Ministry of Agriculture and Irrigation
The Republic of the Union of Myanmar

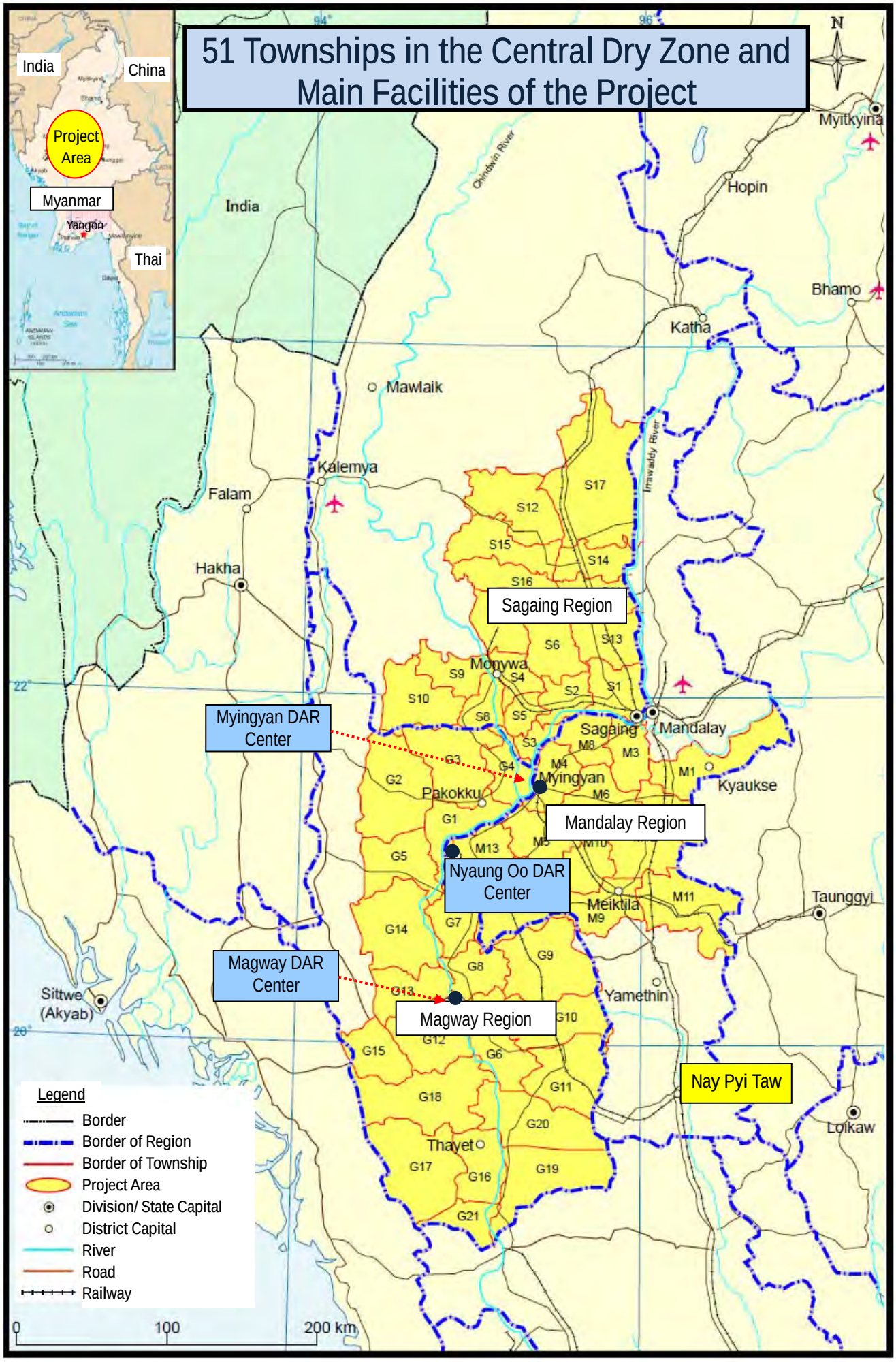
DATA COLLECTION SURVEY ON THE PROJECT FOR DEVELOPMENT OF WATER SAVING AGRICULTURAL TECHNOLOGY IN THE CENTRAL DRY ZONE IN THE REPUBLIC OF THE UNION OF MYANMAR

FINAL REPORT

AUGUST 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SANYU CONSULTANTS INC.


51 Townships in the Central Dry Zone and Main Facilities of the Project
India
China
Project Area
Myanmar
Yangon
Thai
N
Myitkyina
Hopin
Bhamo
Katha
Mawlaik
Kalemya
Falam
Hakha
Sagaing Region
Monywa
Myingyan DAR Center
Sagaing
Mandalay
Kyaukse
Myingyan
Pakokku
Mandalay Region
Nyaung Oo DAR Center
Meiktila
Taunggyi
Magway DAR Center
Magway Region
Yamethin
Sittwe (Akyab)
Nay Pyi Taw
Loikaw
Thayet
Chindwin River
Irrawaddy River
S1
S2
S3
S4
S5
S6
S8
S9
S10
S12
S13
S14
S15
S16
S17
M1
M3
M4
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M8
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G7
G8
G9
G10
G11
G12
G13
G14
G15
G16
G17
G18
G19
G20
G21
Legend
Border
Border of Region
Border of Township
Project Area
Division/ State Capital
District Capital
River
Road
Railway
0
100
200 km

Photos of the Central Dry Zone

Rainfed upland（before rainy season）

Seeding at the beginning of rainy season

Predominant sandy soil (before rainy season）

Indian-made 4 wheel tractor

Plowing by Power tiller

Intercropping with groundnut and pigeon pea

Intercropping with groundnut and maize

Tube-well observed in Central Dry Zone

Hydroponic irrigation (Magway Campus, Yezin Agricultural University ）

Practice of the hydroponic irrigation in a village (Yenangyon)

Practice of micro irrigation in a village (Yenangyon)

Practice of micro irrigation in a village(Yenangyon)

Dragon fruits (Mandalay)

Bean Exchange market (Mandalay)

Oil-extracting factory (Myingyan)

Bean –processing factory (Myingyan)

CONTENTS

APPENDICES

ABBREVIATION

AED	Agricultural Extension Division
AMD	Agriculture Mechanization Department
BAJ	Bridge Asia Japan
CARI	Central Agriculture Research Institute
CARTC	Central Agriculture Research and Training Centre
CBM	Central Bank of Myanmar
CD	Cooperative Department
CID	Cottage Industry Department
CRDI	Credit for Rural Development Institution
CSO	Central Statistical Organization
DAP	Department of Agricultural Planning
DAR	Department of Agricultural Research
DOA	Department of Agriculture
DOF	Department of Fisheries
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GOJ	Government of Japan
GOM	Government of Myanmar
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
ID	Irrigation Department
IMO	Indigenous Micro Organism (In Myanmar, it is called *dochakukin* as in Japanese)
INGO	International Non-Governmental Organization
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
LBVD	Livestock Breeding and Veterinary Department
LFDB	Livestock and Fisheries Development Bank (present Treasure Bank)
LUD	Land Use Division
MADB	Myanmar Agricultural Development Bank
MAPT	Myanmar Agricultural Produce Trading
MAS	Myanmar Agriculture Service (present DOA)
MC	Ministry of Cooperatives
MCSE	Myanmar Cotton and Sericulture Enterprise
MEIS	Myanmar Export and Import Service
MFI	Micro Finance Institution
MFR	Ministry of Finance and Revenue
MFTB	Myanmar Foreign Trade Bank
MICB	Myanmar Investment and Commercial Bank
MJI	Myanmar Jute Industries
MOLF	Ministry of Livestock and Fisheries
MLFDB	Myanmar Livestock and Fisheries Development Bank
MOAI	Ministry of Agriculture and Irrigation
MOF	Ministry of Forestry
MPCE	Myanmar Perennial Crop Enterprise
MRTLC	Myanmar Rice Trading Leading Committee

MRTSC	Myanmar Rice Trading Sub-Committee
MSE	Myanmar Sugarcane Enterprise
NGO	Non-Governmental Organization
NPK	Nitrogen, Phosphate, Potassium
ODA	Official Development Assistance
OISCA	Organization for Industrial, Spiritual and Cultural Advancement-International
PACT	PACT Myanmar
PPD	Plant Protection Division
SD	Seed Division
SLRD	Settlement and Land Records Department
TS	Township (the smallest administrative unit where government institutions are placed)
UMMB	Urea Molasses and Mineral Block
UNDP	United Nations Development Programme
WFP	World Food Programme
WRUD	Water Resources Utilization Department
YAU	Yezin Agriculture University

LOCAL NAME OF FARMLANDS

Le	Paddy field or wet low land which can be used for paddy farming
Yar	Upland
Kaing	Farmlands which appear in the flood land in Ayeyarwady River as the water recedes
Kyun	Farmland which appear on the sandbar in Ayeyarwady River as the water recedes

CONVERSION

1 basket	Paddy	20.9 kg
1 basket	Wheat	32.7 kg
1 basket	Maize (seed)	24.9 kg
1 basket	Sorghum	28.1 kg
1 basket	Sesame	24.5 kg
1 basket	Mustard	26.1 kg
1 basket	Sunflower	14.5 kg
1 basket	Groundnut	11.4 kg
1 basket	Butter Bean	31.3 kg
1 basket	Sultani	31.3 kg
1 basket	Sultapya	31.3 kg
1 basket	Chick Pea	31.3 kg
1 basket	Duffin Bean	31.3 kg
1 basket	Lab Lab Bean	31.3 kg
1 basket	Lima Bean	31.3 kg
1 basket	Pigeon Pea	32.7 kg
1 basket	Black Gram	32.7 kg
1 basket	Green Gram	32.7 kg

1 basket	Bocate	32.7 kg
1 basket	Soybean	32.7 kg
1 basket	Cowpea	32.7 kg
1 basket	Rice Bean	32.7 kg
1 basket	Garden Pea	32.7 kg
1 basket	Lentil	32.7 kg
1 basket	Krishna Mung	32.7 kg
1 basket	Other Pulses	31.7 kg

Fruits and Vegetables

In the Myanmar Agricultural Statistics, Viss and Number are used for fruits, and Viss for vegetables as well. 1 Viss=1.633kg

Others

1 pyi	8 nohzibu
1 basket	16 pyi
1 viss	1.64 kg
1 lb (pound)	0.453 592 kg
1 inch (in.)	2.54 cm
1 feet (ft.)	30.5 cm
1 acre (ac)	0.405 ha
1 hectare (ha)	2.47 ac

CURRENCY（AS OF JULY 2013）

1 US$	=	979.00 Myanmar Kyats
1 US$	=	99.75Japanese yen
1 Kyat	=	0.118 Japanese yen
1 lakh	=	100,000 Kyats

FISCAL YEAR

April 1st to March 31

CHAPTER 1 BACKGROUND AND OBJECTIVES

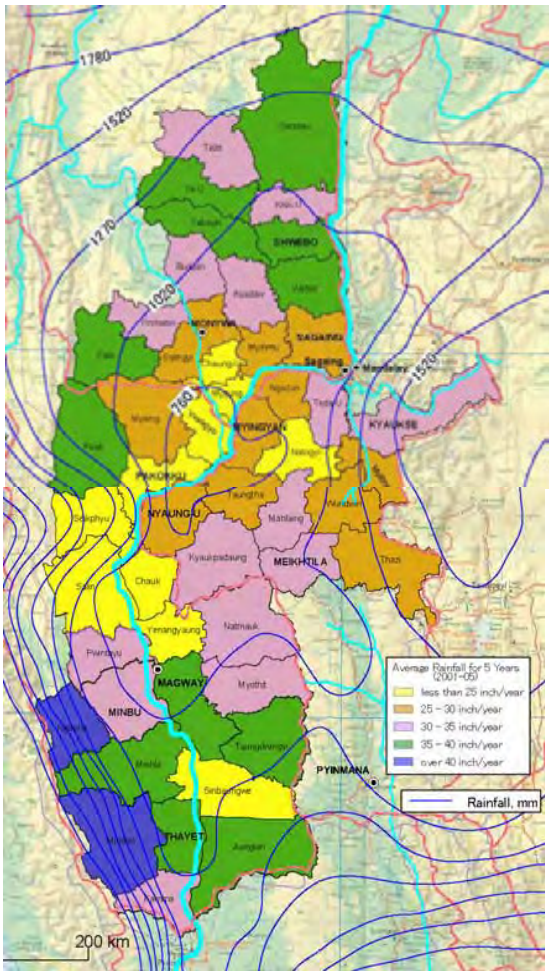
1.1 BACKGROUND

(1) AGRICULTURE IN THE CENTRAL DRY ZONE

Recently the government of Myanmar has been shifting from rice production to crop diversification, though the government still places premium on rice. Consequently, production of pulses, sesame, groundnut and sunflower etc. has a tendency to increase. Especially, the share of pulses in the exporting value of agricultural products occupies 65% in 2010/2011, and 9% in the total exporting value in the same year. The Central Dry Zone (hereinafter called as CDZ) is known as producing area of these pulses and oil crops, which is the objective area of this survey.

However, condition of rainfall is the most serious limiting factor for farming in CDZ. Rainfall in CDZ concentrates from May to October. As shown in the isohyetal map, there exist considerable differences in the annual rainfall even in CDZ. In addition, the predominant sandy soil with low humus content and low water holding capacity is also a limiting factor for agriculture together with small rainfall in CDZ.

The heart-shaped area located at the center of the isohyetal map is the driest area even in CDZ called as the “Heart of Dry Zone”. Myingyan and Nyaung Oo townships except for Magway Township, objective townships of the survey, are involved in the area with annual rainfall of 760mm.



Isohyetal Map on the CDZ

As stated above availability of irrigation water source is the most serious issue for agriculture in CDZ. However, there are difficulties to introduce river water in the hilly area and to develop tube-wells because of deep groundwater level though it differs depending on area conditions. Under these situations, it is necessary to develop water saving agricultural technologies in CDZ.

(2) Implementation of the Development Study (2006-2010)

Under the situation mentioned above, the Government of Myanmar requested official assistance to the Japanese Government. Based on the request, Japan International Cooperation Agency (JICA) dispatched a preliminary study team for the development study in the central dry zone in Myanmar on February 2005, which results in sign of Scope of Work and Minutes of Meeting of the study.

The development study on Sustainable Agricultural and Rural Development for Poverty Reduction Programme in the Central Dry Zone was started on March 2006 and completed on July 2010. Target area of the study was 51 townships in 3 Regions including Sagaing, Magway and Mandalay. In the first and second year of the study, a poverty profile of the target area and action plant to mitigate the

poverty was developed. From the second year, pilot projects had been implemented until fifth year, when the final evaluation was conducted by the study team and counterpart officials. In the sixth year, the action plan for the alleviation of poverty in the central dry zone was finalized based on lessons learned from the pilot project experiences.

(3) Request for the Technical Cooperation Project

In the train of the Development Study, JICA decided to implement technical cooperation project (hereinafter called as the Project) on water saving agriculture in CDZ to develop and extend crops and varieties suitable for CDZ's environment.

Minutes of Meeting and Record of Discussion were signed on February 29, 2012 and December 20, 2012, respectively. Main executing agencies are the Department of Agricultural Research (DAR) and Department of Agriculture (DOA) under the Ministry of Agriculture and Irrigation. The Project will be based at the Agricultural Research Center under DAR located at Nyaung Oo Township in Mandalay Region.

The Project is to commence from 2013 for a period of five (5) years in order to develop proper water saving agricultural technology taking into consideration regional environment and social conditions targeting suitable crops for CDZ's natural conditions. Four long-term experts consisting of chief advisor cum arid area agriculture, integrated pest and disease control, water saving irrigation, and coordinator shall be dispatched.

1.2 Objective of the Survey

Objective of the study is to collect and analyze necessary information on helpful crops and varieties, issues and challenges on traditionally practiced farming methods, and baseline data through farm household survey and so on. The collected and analyzed data and information will be utilized in the forthcoming technical cooperation project under JICA, namely "the Project for Development of Water Saving Agriculture Technology in the CDZ in the Republic of the Union of Myanmar" (hereinafter referred to as "the Project"), which requires necessary information to decide suitable crops and varieties under the environment in the CDZ, and to materialize water saving agricultural technology.

The study shall be composed of the following activities;

(1) Basic Information Survey: data collection on the three townships under the Project,

(2) Farm Household Survey: information collection on agriculture of 240 sample farm households,

(3) Agricultural Production Survey: information collection on agricultural production in the three regions and one city,

(4) Distribution and Marketing Survey: information collection on current condition of distribution and marketing of key crops in the Project area, and their market needs.

(5) Subcontract survey: soil analysis and water quality analysis at DAR.

1.3 Study Area

The following table shows the study area and activities of the study.

Activities and Target Areas

Survey	Target Area	Remarks
1. Basic Information Survey	・Mandalay Region (Nyaung-Oo TS, Myingyan TS) ・Magway Region (Magway TS)	
2. Farm Household Survey	・Mandalay Region (Nyaung-Oo TS, Myingyan TS) ・Magway Region (Magway TS)	Sample household: 240 Farm Households
3. Agricultural Production Survey	・Mandalay Region ・Magway Region ・Sagaing Region ・Nay Pyi Taw city	Regional and field offices of agriculture related ministries particularly DOA.
4. Distribution and Marketing Survey	・Mandalay Region (Nyaung-Oo TS, Myingyan TS) ・Magway Region (Magway TS) ・Mandalay City, and Yangon City	・Local market in TSs ・Market in Mandalay ・Market in Yangon
5. Subcontract survey	・Mandalay Region (Nyaung-Oo TS, Myingyan TS) ・Magway Region (Magway TS)	Soil analysis and water quality analysis at DAR

1.4 Implementing Organization

Counterpart organizations of the study are the Department of Agricultural Research (DAR) and Department of Agriculture (DOA), which are under the Ministry of Agriculture and Irrigation (MOAI) and are also the counterpart organization of the Project. Note that Myanmar Agricultural Service (MAS) which is responsible in providing agricultural extension services to farmers was transferred under the DOA on February 2012.

1.5 First Field Survey

In the First Field Survey, data and information were collected from DOA, DAR (Yezin), WRUD, Nay Pyi Taw Council area and so on in Nay Pyi Taw, capital of Myanmar, and basic information of three townships of Myingyan, Magway, Nyaung Oo and data on agricultural production of three regions of Sagaing, Mandalay, Magway regions, and one city of Nay Pyi Taw city as well. Farm household survey of 240 samples was also conducted. Marketing survey was carried out in two regions of Mandalay and Magway and two cities of Mandalay and Yangon. Major components of the survey are as follows. .

(1) Explanation of the Study to the Agencies Concerned

The Study Team explained the objectives and plan of operation of the Study to JICA Yangon office, DAR, DOA and DAP at the end of April 2013, and asked cooperation for data and information collection at the agencies concerned in Yangon, Nay Pyi taw, region, township and village tract/village levels. The First Field Survey was generally conducted smoothly, and interview survey will be carried out continuously in the Second Field Survey.

(2) Data and Information Collection at the Objective Townships

In order to estimate magnitude of beneficial farmers of the Project in three townships composing Magway, Nyuang U and Myingyan, number of administrative organizations, number of total households and farm households (including landless households), land use, agricultural production and so on were collected mainly from DOA and GAD offices at regional and township levels.

(3) Individual Farm Household Survey

This survey was conducted using six surveyors and they were trained by interviewing farmers practically on the field ay Nay Pyi Taw area. The questionnaire was modified base on the result of trial to facilitate the survey. The actual survey commenced on April 26, 2013 to interview 80 farmers each (total 240 sample farmers) in townships of Nyaung Oo, Myingyan and Magway and was completed on May 10, 2013. Result of the Individual Farm Household Survey is shown in Chapter 6.

(4) Soil and Water Analysis

Simultaneous with data and information survey, is the conduct of soil and water samples (50 samples each) taken at farmlands of objective townships and were analyzed at the DAR laboratory at Yezin on sub-contract basis. The analysis was completed at the end of June 2013. Result of the Soil and Water Analysis is shown in Chapter 8.

(5) Agricultural Production Survey

This survey was conducted in three regions of Mandalay, Magway and Sagaing, and Nay Pyi Taw Council Area to figure out the regional agricultural status. Although regional and state level's agricultural status can be known from Statistical Yearbook etc. the data and information on township level had to ask to township offices of DOA, WRUD, SLRD and LBVD and so on.

(6) Distribution and marketing Survey of Agricultural products

In order to grasp marketing mechanism and needs in market on agricultural products produced in each region, various information on marketing volume, fluctuation of prices and demand for quality such as taste, color, size, and exporting destination countries etc was collected by interviewing local buyers and merchants at local markets of Mandalay, Sagaing and Magway regions

1.6 Second Field Survey

The Second Field Survey was conducted from June 15 to July 12, 2013. Field survey was mainly undertaken on rainfed farms at the beginning of rainy season and supplemental data and information survey at regional and township DOA offices and DAR Farms were carried out. In addition, surveys on processing industries, market and distribution were conducted, and the results of water and soil analysis were also examined.

CHAPTER 2 BASIC INFORMATION ON AGRICULTURE IN MYANMAR

2.1 Administrative Division

As of May in 2013, Myanmar's administration is as shown below. Recently administrative reorganization of township has been conducted. MIMU (Myanmar Information Management Unit) prepared the administrative map as shown in Appendix-6 in order to unify name and boundary of township. Even in the map, MIMU uses "Division" instead of "Region" that is recently used popularly in Myanmar. In this report, "Region" shall be used.

Administrative Division in Myanmar

	Administration Division＊
State/Region	7staes/8Regions*
District	73
Township	330
Sub-Township	84
Village tract	13,623
Village	64,101

Source：GAD, Ministry of Home Affairs, May 2013
Note：*Number of region increased from 7 to 8 as Nay Pyi Taw has jointed into it.

2.2 Available Agriculture Related Statistics

The following statistics are available as of July 2013. However, it is necessary to take note that most of the statistics show are only at the national or regional levels.

（1） Statistical Yearbook 2011, CSO
（2） Myanmar Agricultural Statistics (1997/98-2009/2010), 2011 CSO
（3） Myanmar Agriculture in Brief 2012, MOAI
（4） Talking Figures: Some Statistics in Agriculture of Myanmar and Asia-Pacific Region, 2012 MOAI
（5） Myanmar Agriculture at a Glance, 2012
（6） Livestock and Fisheries Statistics (2008-2009), 2010 CSO
（7） Myanmar Census of Agriculture (2013), SLRD, MOAI

The contents on agriculture in the above-cited statistics are shown in Appendix-1.

The profile on agriculture, livestock and fisheries at the national level can be figured out from (1) to (7) but the regional level data is not shown though it depends on statistics. The Myanmar Agricultural Statistics of (2) is useful as data and information are at regional basis data on annual basis. As to the data and information about district and township levels, it is necessary to get at the Regional, District and Township Offices concerned.

2.3 Mandates of Agencies Concerned

(1) Department of Agriculture (DOA)

1) Production of good quality seed varieties of main crops like rice, seed corn, groundnut, sesame, sunflower, mustard, niger, pulses, culinary crops such as chili, onion, garlic, potato, vegetables

and fruits for economic development of farmers and conduct of training for farmers to produce good quality seed;

2) Organize training on advanced agricultural technologies and cultural practices of above mentioned crops in order to facilitate for application and innovation of these techniques by farmers;
3) Conduct research on scientific cultural practices and development in order to produce good quality and high yielding seeds.

(2) Department of Agricultural Research (DAR)

1) Research development of high yielding crop varieties;
2) Generation of agricultural techniques for maximizing of benefits and sustainable use of natural resource;
3) Dissemination of improved crop varieties and agronomic technologies to farmers; and
4) Development of human resources in agricultural research.

(3) Department of Agricultural Planning (DAP)

1) Assistance in adopting agriculture policies;
2) Formulation of various agricultural plans;
3) Relation with international, regional organizations and governments;
4) Strengthen cooperation and coordination among inter-agencies;
5) Development of agricultural trade and investment;
6) Reporting and compilation of agricultural statistics;
7) Conduct of related surveys;
8) Recommendations for further development of agriculture sector; and
9) Collection and dissemination of wholesale prices of agricultural commodities.

(4) Irrigation Department (ID)

1) Design formulation for new irrigation projects based upon hydrological and geological investigations and topographic survey data;
2) Planning and implementation of new irrigation projects;
3) Operation and maintenance of existing irrigation and drainage systems, flood protection embankments and polders;
4) Seasonal and temporary measures for summer paddy cultivation;
5) Technical assistance to village embankment and village irrigation works for rural development;
6) Installation of micro-hydropower generation plants along the irrigation canals;
7) Providing the on-farm water management development training for farmers' Water User Association; and
8) Conduct of training for capacity building of irrigation staff to enhance irrigation technologies.

(5) Agricultural Mechanization Department (AMD)

1) Land reclamation, land consolidation and land development works;

2) Provision of farm mechanization services for land preparation, harvesting and threshing;
3) Production and distribution of appropriate farm machineries;
4) Research and development on utilization of agricultural machinery
5) Implementation of upland reclamation in hilly regions; and
6) Dissemination of technical know-how on utilization of farm machinery to local farmers and production technologies to private industries.

(6) Settlement and Land records Department (SLRD)
1) Updating land maps and registers;
2) Land surveys and map productions;
3) Collection compilation and issuing timely and reliable crop statistics;
4) Collection and compilation of land use statistics;
5) Land administration and decision on agricultural land disputes; and
6) Conduct of agricultural socioeconomic surveys

(7) Water Resources Utilization Department (WRUD)
1) Supply irrigation water by pumping water from rivers and streams and also utilization of groundwater from feasible potential for boosting crop production;
2) Promote the socioeconomic conditions of the rural population by supplying safe drinking water from both tube wells and piped water supply reticulation systems;
3) Supply crop water as well as drinking water from spring sources by gravity flow system in the mountainous region of the border and remote areas, and examine water quality for drinking and irrigation purposes applying high technology, water analysis methods;
4) Disseminate the knowledge and practice of efficient usage of drip irrigation; and
5) Apply renewable energy, being installed Biomass Gasifier in river water pumping facilities.

(8) Myanmar Agricultural Development Bank (MADB)
1) Provision of seasonal, short, medium and long-term loans to farmers;
2) Collection of repayment of bank loans; and
3) Encouraging farmers to open deposit and saving accounts at MADB

(9) Survey Department (SD)
1) Set-up the plan for surveying, mapping and map reproduction;
2) Cooperation and coordination with international survey organizations;
3) Submission of plans and reports to the authorities concerned;
4) Procurement of necessary materials and equipments;
5) Deputation on internal and international training; and
6) Publication of maps

(10) Yezin Agricultural University (YAU)

1) Produce highly qualifies agriculturists needed for the development of the agriculture sector of the country;
2) Provide adequate technical training on modern methods of agriculture; and
3) Provide sound training to students who wish to engage in scientific farming as a means of livelihood through cooperatives or private enterprises.

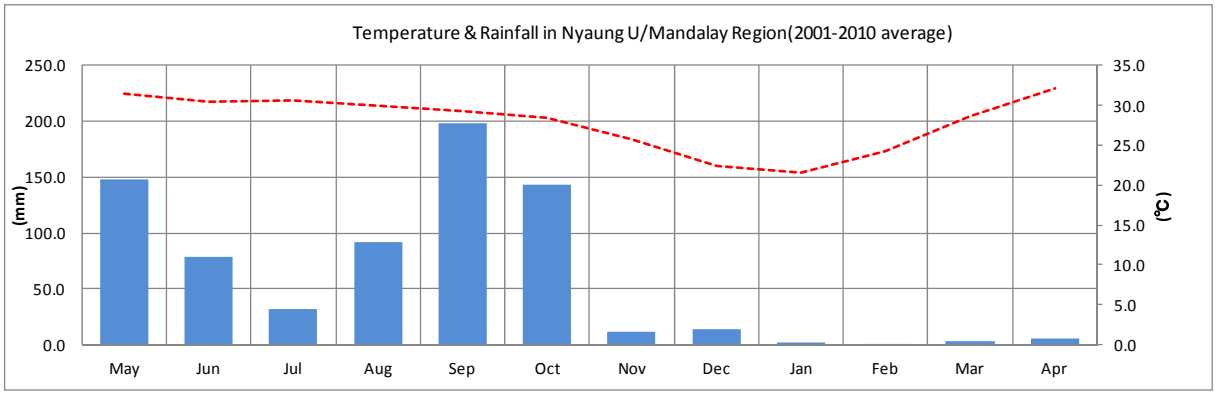
(11) Department of Industrial Crops Development (DOICD)

1) Produce high- yield and qualified seeds for industrial crops such as sugarcane, cotton, jute, rubber, coffee and other industrial crops for increased production;
2) Educate industrial crop farmers with advanced agricultural techniques; and
3) Develop scientific agricultural practices through R&D for the production of seeds for industrial crops with specific characteristics of resistance to pest, diseases and serious weather.

Source of the said is Myanmar Agriculture in Brief 2012.

2.4 Seasonal Zoning

In addition to seasonality such as rainy and dry seasons, seasonal zoning is also used on various agricultural statistics, comprising Pre-monsoon, Monsoon, Post-monsoon, winter and summer. Some crops such as sesame and groundnut, etc. are also named according to seasonal zoning. Monsoon season itself is divided into three periods as shown below. An example of cropping pattern, combined with seasonal zoning in Nyaung Oo township, is presented below.



May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Pre-monsoon		Monsoon		Post-monsoon		Winter			Summer		

Seasonal Zoning in Myanmar

2.5 Category of Farmlands in Myanmar

The four categories of farmlands are shown in the table below.

Category of Farmlands in Myanmar

Farmland	Meaning
Le	Paddy field or wet low land which can be used for paddy farming
Yar	Upland
Kaing	Farmlands which appear in the flood land in Ayeyarwady River as the water recedes
Kyun	Farmland which appear on the sandbar in Ayeyarwady River as the water recedes

2.6 Classification of Farm Household

There is no concrete definition on the classification of farm household by farm size, however, the following classification were identified by the team. At the project area, it was determined that the minimum farm size to feed a family is eight to 10 acres.

Classification of Farm Household

Classification	Farm Size (ac/farm household)
Small scale farm	Less than 2ha≒5.00 ac
Middle scale farm	2.0 to 8 ha ≒5.0 to 20.0 ac
Large scale farm	Above 8 ha≒20.0 ac

Source: Interview survey at ID

2.7 Category of Crops

In Myanmar, crops are classified as shown below. As to vegetables, there are three categories as follows: Culinary crops, Kitchen crops, and Vegetables, different from Japan.

Category of Crops

Category	Crops
Cereal crops	Rice, wheat, maize, sorghum, etc.
Oil seed crops	Sesame, groundnut, mustard, sunflower, Niger, etc.
Pulses	Green gram, black gram (Matpe), lablab bean、pigeon pea, chick pea, soybean, butter bean, sultani, sultapya, etc.
Industrial crops	Cotton, sugarcane, jute, rubber, tobacco, etc.
Vegetables	Cucumber, pumpkin, okra, eggplant, cabbage, etc.
Culinary crops	Potato, onion, garlic, chili, tomato, ginger, spices
Fruits	Mango, tamarind, jujube, banana, citrus, dragon fruit, etc.
Plantation crops	Tea, coffee, coconut, toddy

2.8 English and Local Name of Pulses

Many kinds of pulses are cultivated in CDZ and some of them are unfamiliar to the Japanese. English and local names and botanical name are shown below for comparison.

English and Local Name of Pulses

Pulses		
English Name	Burmese Name	Botanical Name
Black gram	Mat-pe	*Phaseolus mungo*
Green gram	Pedisein	*Phaseolus radiates*

Butter bean	Htaw-but-pe	*Phaseolus lunatus*
Cow pea	Bo-cate-pe	*Vigna catjang*
Sultani	Sultani	*Phaseolus lunatus*
Sultapya	Sultapya	*Phaseolus lunatus*
Soybean	Pe-boke	*Glycine soja*
Chick pea	Ka-la-pe	*Cicer arietinum*
Cow pea	Pe-lun	*Vigna catijang*
Pigeon pea	Pe-sin-ngon	*Cajanus indicus*
Rice bean	Pe-yin	*Phaseolus calcaratus*
Duffin bean	Pe-byu-gale	*Phaseolus lunatus*
Lablab bean	Pe-gyi	*Dlichos lablab*
Garden pea	Sa-daw-pe	*Pisum sativum*
Krishna mung	Pe-nauk	*Phaseolus radiates*
Lentil	Pe-yar-zar	*Lens esculenta*
Kaffir bean	Pe-myit, pe-zaung-yar-	*Psophocarpus tetragonolobus*
Horse bean	Pe-bizat	*Dolichos biflorus*
Goa bean	Pe-sein-sar	*Pachyrhizus angulatus*
Asparagus bean	Pe-daung-she	*Vigna catjang*

English and Local Name of Other Crops

Others		
English name	Burmese name	Botanical name
Groundnut	Mye-pe	*Arachis hypogaea*
Sesame	Hnan	*Sesamum indicum*
Nigar	Pan-hnan	*Guizotia abyssinia*
Jujube	Zee	*Zizyphus jujube*

Source：Talking Figures: Some Statistics in Agriculture in Myanmar and Pacific Region

2.9 Food Consumption in Myanmar

Rice consumption per capita of Burmese could be ranked top in the world. As shown in the following table, people consume 157.8 kg (FAO 2005) per capita per year compared to 60kg/capita/year of Japanese. Moreover, people also consume 15.3 kg/capita/year of pulses, 1.6 times of Japanese, 23kg of meats as well. However, people intake 1,350 Kcal per capita per day from rice and rice products, which is equivalent to 57% of 2,300 Kcal.

Food Consumption in Myanmar

Commodity	Consumption (kg/capita/year)	Major commodity
Rice	157.8	
Pulses	15.3	
Vegetables	73.2	
Cooking oil	9.3	Groundnut oil, sunflower oil and sesame oil

Meats	23.0	Chicken pork and beef
Fish & marine products	26.1	
Milk & milk products	22.3	
Fruits	36.4	
Egg	3.5	

2.10 Data Collection at Local level

Data and information which can be collected at regional, district and township level's DOA is not always available at these offices. In some cases, it is necessary to visit GAD, SLRD, LBVD and hospitals. For example, population, number of farm household, agricultural production, climate condition, number of livestock can be collected in Sagaing and Magway regional and township offices of DOA. However, DOA regional office at Magway and DOA township office at Nyaung Oo and Myingyan do not have these kinds of data in their offices. Consequently JICA Team had to visit GAD and SLRD township offices and hospitals together with their counterpart to collect data that are not available at the regional and township offices. DOA regional, district and township offices at Magway region are deployed in the same compound. Similarly, DOA district and township offices at Nyaung Oo district are located in the same place but the regional office is in Mandalay.

On the other hand, data and information collection and discussion at DAR centers located at Myingyan, Nyaung Oo and Magway were done very successfully.

2.11 Deployment of Agencies Concerned

The offices concerned and Project can be divided into two: the ones which have village / village tract office, and the ones that have no tail-end offices. GAD (General Administration Department) under the Ministry of Home Affairs has offices at the village/village tract level.

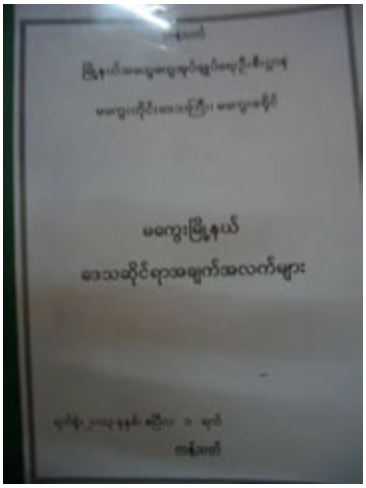
Deployment of Agencies Concerned

	Region	District	Township	Village Tract/Village
Department of Agricultural Research (DAR)	7 centers & 17 satellite stations	-	-	-
Department of Agriculture (DOA)	○(42 seed farms & 55 state farms)	○	○	-
Irrigation Department (ID)	○	○ *	-	-
Water Resource Utilization Department (WRUD)	○	○	-	-
Settlement and Land Records Department (SLRD)	○	○	○	-
General Administration Department (GAD)	○	○	○	○

Source: JICA Study Team
Note. * Only in several districts such as Ayeyarwady region

2.12 General Information at Township and Village Level

GAD (General Administration Department) has offices at the regional, district, township and VT/Village level. This is the only agency with offices at the tail-end of the community. GAD has prepared a booklet titled "Basic Information of Village Tract" (example) covering area, population, village map, economy and society, etc. but is confidential. Contents of the booklet are attached in Appendix-9.

	
Basic information of a Village Tract/Village	Basic Information of a Township

2.13 Agricultural Policies

(1) Five-year Agricultural Plan (2011/2012-2015/2016）

In the Five-Year Agricultural Plan, the following are targeted.

1) Increase of crop yields,
2) Increase of sown area, and
3) Systematic application of quality seeds, chemical fertilizers and agricultural chemicals
4) Education for applying Good Agricultural Practice
5) Execution of agricultural research and development
6) Research and education to develop human resource

As to crops, annual basis targeted sown area, harvesting area, yield and production are set up only for paddy as shown below.

Projection of Paddy Production in the Five-year Agricultural Plan

	2010/2011	Five-year plan				
		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Sown area (1,000 ac)	20,021	19,236	19,315	19,368	19,416	19,463
Harvesting area (1,000 ac)	19,935	19,216	19,315	19,368	19,416	19,463
Yield (Basket/ac)	79.25	75.55	78.31	79.17	79.97	80.87
Production (Basket)	1,579,988	1,490,270	1,512,592	1,533,448	1,552,674	1,574,048

Source：Five-year Plan of Action from 2011/12 to 2015/16

(2) 20-Year Plan (2011/2012-2030/2031）

The 20-Year Agricultural Plan is composed of four units of 5-year plans, and targets only for the first 5-year plan for 2011/2012-2015/2016 are set up about four sub-sectors as shown below.

1) Paddy Production

Numerical Target of Paddy Production

Year	Production (million Basket)
2011/2012	1,540
2012/2013	1,566
2013/2014	1,578
2014/2015	1,595
2015/2016	1,604

2) Irrigation

Numerical Target of Irrigation Development

Year	Dam & Pond (places)	Beneficial Area (million ac)	Irrigation Area (million ac)
2011/2012	415	3,393	5.65
2012/2013	421	3,394	5.72
2013/2014	424	3,352	5.76
2014/2015	433	3,385	5.80
2015/2016	443	3,667	5.82

3) Shifting to Mechanized Agriculture

Numerical Target of Mechanized Agriculture

Year	Tractor（units）	Power Tiller（units）	Plow （million）
2011/2012	11,232	164,054	12.24
2012/2013	11,552	467,972*	12.80
2013/2014	11,838	178,519	13.38
2014/2015	12,140	184,718	13.79
2015/2016	12,468	192,506	14.43

Note: * Number if power tiller in 2012-2013 must be wrong, but is kept in table as original.

4) Draft Cattle and Farming Tools

Numerical Target of Draft Cattle and Farming Tools

Year	Units（1,000）		
	2010/11	2015/16	Annual Increase (%)
Draft cattle	10,316	10,852	1.0
Tractor	11	12	1.8
Power tiller	160	168	1.0
Harvester	2	3	8.4
Thresher	42	45	1.4

5) Development of New Farmlands

Numerical Target of Farmland Development (ac)

Year	Department	Private Sector	Foreign Aid	Total
2011/2012	-			
2012/2013	-			
2013/2014	2,800	5,000	45,000	528,000
2014/2015	2,800	5,000	45,000	528,000
2015/2016	2,800	5,000	45,000	528,000

6) Expansion of Upland

Numerical Target of Upland Development

Year	Targeted Area (ac)
2011/2012	-
2012/2013	-
2013/2014	750
2014/2015	750
2015/2016	750

7) Agricultural Loans

Numerical Target of Agricultural Loans

Year	Amount (million Kyat)
2011/2012	386,225
2012/2013	413,920
2013/2014	433,418
2014/2015	464,753
2015/2016	496,786

8) Agricultural Investment

Numerical Target of Agricultural Investment

Year	Total (million Kyat)	US$
2011/2012	186,692	14,633
2012/2013	522,039	61,765
2013/2014	306,788	22,116
2014/2015	194,487	32,164
2015/2016	117,781	30,812

9) Quality Seeds Distribution

Numerical Target of Quality Seeds Distribution

Crop	Unit	2010/2011	2015/2016	Annual Increase (%)
Paddy	Basket	121,517	181,100	8.3
Wheat	Basket	287	400	7.1
Pulses	Basket	2992	13,660	35.5
Groundnut	Basket	120	450	30.3
Sesame	Basket	484	2,550	30.4
Sunflower	Basket	394	3,000	50.1

10) Fertilizer Distribution

Numerical Target of Fertilizer Distribution

	Unit	2010/2011	2015/2016	Annual Increase (%)
Fertilizers	ton	299	1,790	43.0

CHAPTER 3 INFORMATION ON AGRICULTURE IN THE CDZ

3.1 Overview of CDZ

(1) Number of Township in CDZ

CDZ is located at the central part of Myanmar and covers three regions of Sagaing, Mandalay and Magway but all the area of these regions is not defined as CDZ. In the Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Programme in the Central Dry Zone by JICA, CDZ covers 54 townships when the study started but finally it was reduced to 51 townships at the first steering committee because Nay Pyi Taw, the new capital of Myanmar, covers the three townships of Tatkon, Yamethin, and Pyawbwe. It should be noted that basically most data used in this report covers all townships of each Region. When we use 51 township level data, it is clearly stated in the sentence.

Administrative Division of CDZ

Region	Mandalay	Sagaing	Magway	Total
District	4/7	3/8	4/5	11/20
Township	13/31	17/37	21/25	51/93

Note. Denominators mean the total in each region

(2) Area and Population

The total acreage of CDZ is estimated at 75,169 sq.km. This is equivalent to 11% of the state area of 677,000 sq. km and also mostly equal to 90% of Hokkaido Island (83,450 sq.km) of Japan. The total population of the 51 townships is estimated at 12.26 million according to the said Development Study by JICA, and occupies 18% of the total population of the country. Population density is 131 persons per sq.km, which is higher than 79 person per sq.km of the national average.

(3) Number of Farm household by farm Size

According to the data collected at the DOA in Nay Pyi Taw, the total number of farm household in the three regions is 1.89 million, and 58.1% of which have farm size with less than 5 ac. Assuming that minimum farm size to feed a family is 10 ac, the number of farmers with less than 5 ac account for 85.3 %. However, this data is different from the one collected from the regional offices of DOA/SLRD.

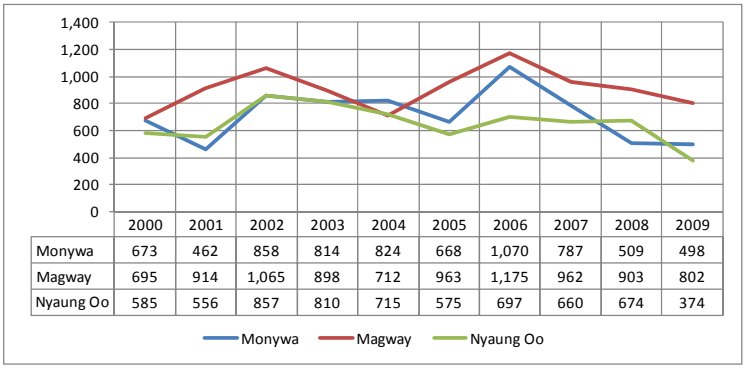
Number of Farm Household by Farm Size (regional basis)

Region	Less than 5ac		5 to 10 ac		10 to 20 ac		20 to 50 ac		Above 50 ac		Total	
	No. of Farm Household	Acreage (ac)	No. of Farm Household	Acreage (ac)	No. of Farm Household	Acreage (ac)	No. of Farm Household	Acreage (ac)	No. of Farm Household	Acreage (ac)	No. of Farm Household	Acreage (ac)
Sagaing	354,398	1,027,740	218,699	1,619,360	96,897	1,453,482	29,805	938,006	2,455	319,383	702,254	5,357,971
Magway	458,935	1,130,443	132,089	925,558	52,594	745,148	10,843	294,262	328	126,145	654,789	3,221,556
Mandalay	288,903	762,168	166,269	1,188,121	66,517	936,569	19,438	511,706	258	75,607	541,385	3,474,171
Total	1,102,236	2,920,351	517,057	3,733,039	216,008	3,135,199	60,086	1,743,974	3,041	521,135	1,898,428	12,053,698
Proportion (%)	58.1	24.2	27.2	31.0	11.4	26.0	3.2	14.5	0.2	4.3	100.0	100.0

Source. DOA HQ, Nay Pyi Taw

(4) Climatic Characteristics of CDZ

The hardness of climatic condition, especially annual rainfall, is the most serious limiting factor for agriculture in CDZ. Normally rainfall occurs from May to October. The condition of precipitation varies considerably depending on regions as shown in the graphs. Climatic data in the Nyaung Oo station shows the lowest



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Monywa	673	462	858	814	824	668	1,070	787	509	498
Magway	695	914	1,065	898	712	963	1,175	962	903	802
Nyaung Oo	585	556	857	810	715	575	697	660	674	374

Climatic Characteristics of CDZ

annual rainfall among the three areas.

Moreover, fluctuation of the annual rainfall is the factor, which makes agricultural production unstable in CDZ in which about 70% is occupied by rainfed upland.

(5) Soil Condition

The "Soil Types and Soil Characteristics of Myanmar", soil type and its acreage in three regions is as shown in the table. Yellow brown soil accounts for 28.3%, followed by 17.8% of Red brown forest soil. These soils are classified as "Fair" in "Soil Types and Soil Characteristics of Myanmar", which is different from the results by FAO as described below. In fact, it is often observed that in CDZ that the soils in rainfed uplands are prone to erode by strong rainfall and wind, and the soils contain less humus and not fertile.

Soil Condition in the 3 Regions

Sr. No.	Soil Type	Acreage (ac)	Share (%)
1	Alluvial soils	206,105	0.5
2	Meadow & meadow alluvial soils	3,071,727	7.0
3	Meadow carbonate soils	256,756	0.6
4	Red brown forest soils	7,781,713	17.8
5	Yellow brown forest soils	12,325,560	28.3
6	Yellow brown dry forest & indaing soils	2,133,848	4.9
7	Light forest soils	4,411,755	10.1
8	Catena of Savanna soils on slopes & compact soils on depressions	4,549,738	10.4
9	Chin hill complex soils	616,910	1.4
10	Northern hill complex soils	2,782,423	6.4
11	Turfy primitive soils	564,864	1.3
12	Compact soils	1,203,405	2.8
13	Red earth & yellow earths	398,918	0.9
14	Mountainous red forest soils	847,700	1.9
15	Popa complex soils	149,594	0.3
16	Primitive crushed stone soils	457,702	1.0
17	Alphic complex soils	515,265	1.2
18	Water body	1,332,260	3.1
	Total	43,606,243	100.0

Source: Soil Types and Soil Characteristics of Myanmar, MOAI

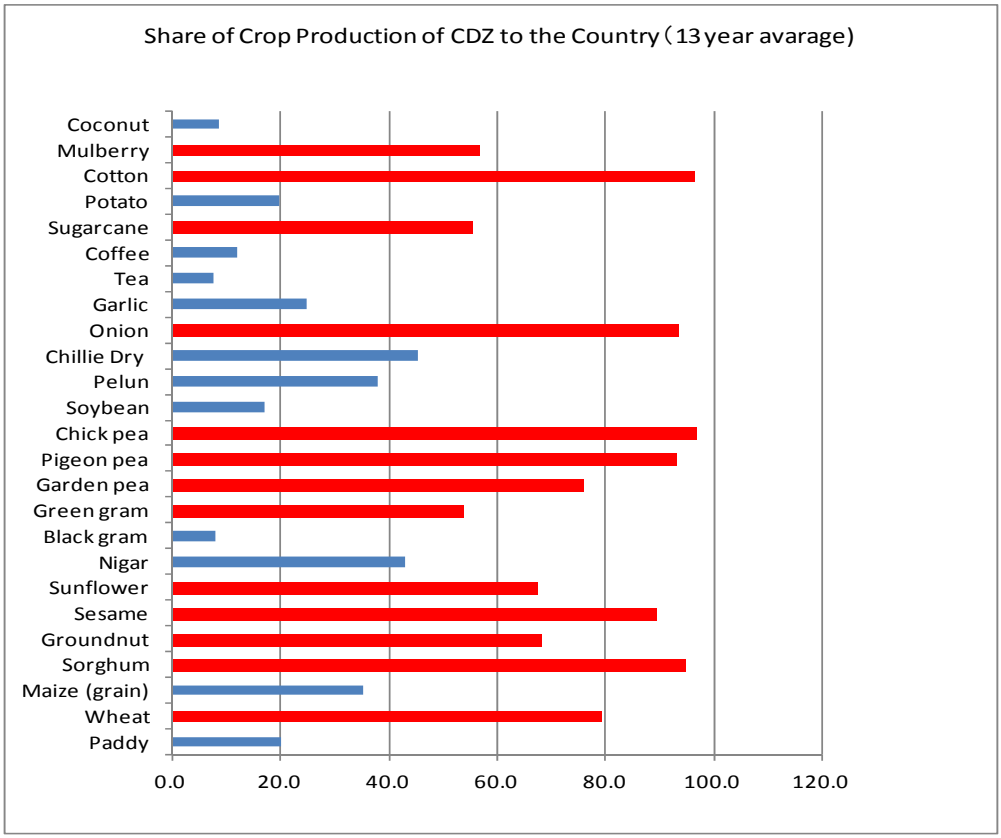
As mentioned above, FAO conducted soil survey in Kyaukpadaung, Magway and Chaunh Oo township in 1996. According to the results, the soil types in these three townships are classified as sandy soil (including gravel soil), sandy loam, and clayey soil though they are different depending on land form. The report also indicates that the soils in these three townships have characteristics of 1) low fertility, 2) low humus contents, 3) low water holding capacity, and 4) high evaporation. Generally, the soils contain potash and all the crops except for leguminous crops need input of Nitrogen in all type of soils. It also reports that hard pan is formulated nearly in all type of soils. Similarly, FAO report indicates that soil erosion occurs in CDZ by strong rainfall and strong wind, especially in the upland with 5 to 15% slope in Kyaukpadang and, Chaung Oo township, and higher erosion of the surface soil in Magway township.

Sandy soil（Nyaung Oo）

Gully erosion on a Sesame farm (July 2013)

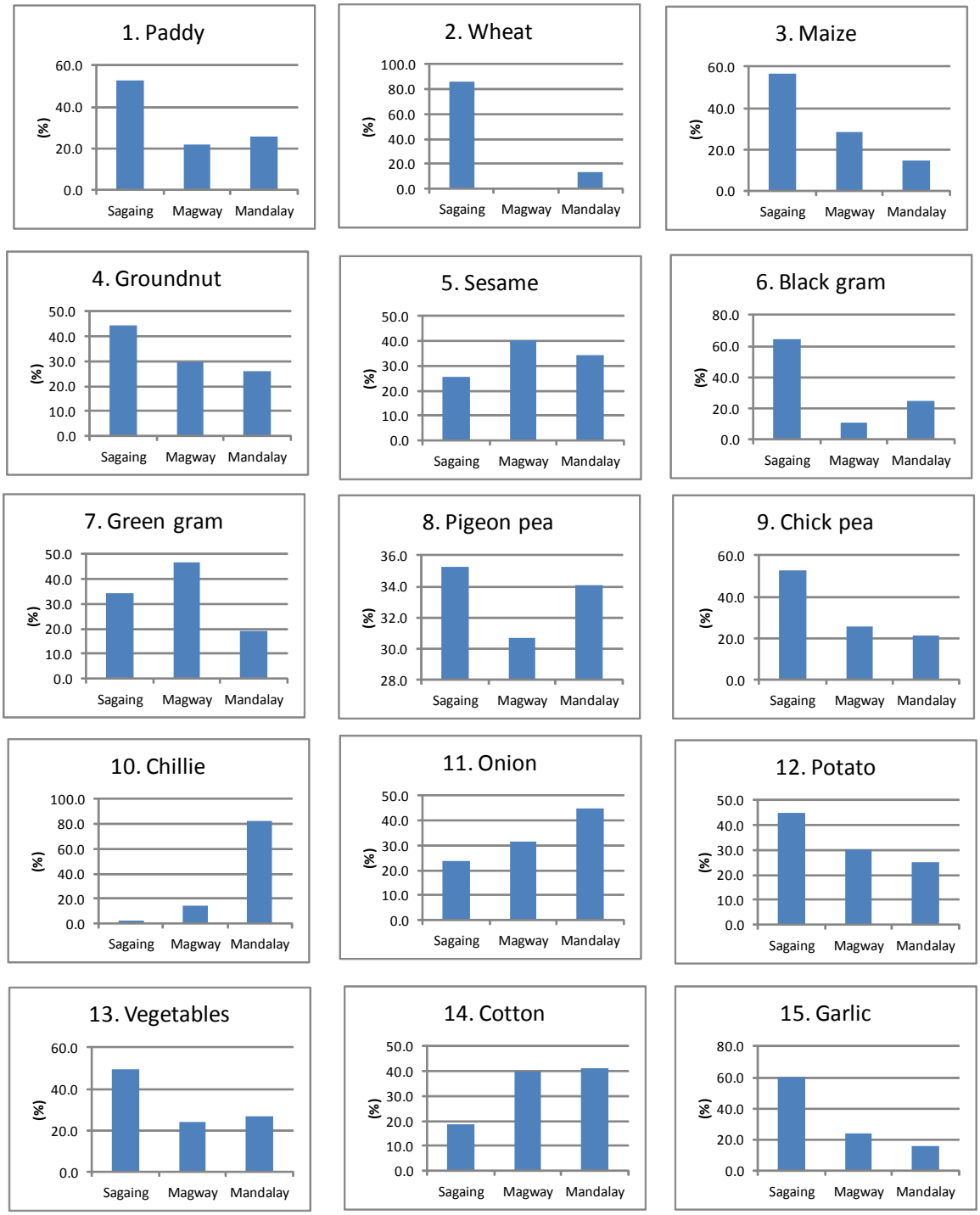
(6) Crop production

Despite its disadvantageous conditions of small precipitation and aridity, CDZ occupies decisive position in agricultural production in the country. The graph shows the share of crops by three regions of Mandalay, Magway and Sagaing in CDZ. The crops with red color are the ones with higher share in particular. It is a fact that CDZ has higher share in pulses and oil crops, in addition to wheat, sorghum, onion and cotton. Even paddy which is the crop produced mainly in the wet land different from arid CDZ, the produce is 20.2% of paddy of the country.



Recently, Myanmar government has been shifting to diversification of agriculture although still emphasizing rice production in its policy. Along with the policy, sown area with pulses, sesame and sunflower have been expanding. Especially, the share of pulses in 2011 was 65% of the total amount of agricultural export. The area occupying important position in pulses and oil crop in the country is CDZ and it can be said that CDZ can be considered as possible model area for agricultural diversification now that the government is likely to promote crop diversification.

The following graphs as presented below shows the share of production of major crops in the three regions based on the average of for the span of 13 years. Sagaing region is producing area of many crops as compared to Magway and Mandalay regions.



Share of Crop Production in the 3 Regions

(7) Profitability of Crops

Information on the profitability of crops was taken from the DOA in nay Pyi Taw is shown below. Profitability in value per acre of potato and onion is exceptionally high as compared to other crops, followed by groundnut and summer paddy.

On the other hand, the crops with higher profitability in percentage are onion, soybean, winter sesame and Nigar. Each regional office of DOA also examines crop profitability independently, however, the result of cost and return is different from each other because of different input on different land conditions. The detailed quantity of agricultural materials used and unit prices are not shown.

Though farm household want to increase farm income by cultivating high profitability crops, climatic and soil conditions have compelled them to cultivate groundnut, sesame and pigeon pea, etc. under the rainfed condition.

Crop Profitability

	Crop	Production Cost (Kyat/ac)	Yield /ac	Cost (Kyat/unit)	Unit Price (Kyat/Unit)	Gross Income (Kyat/ac)	Net Profit (Kyat/ac)	Ratio of Net Profit (%)
Monsoon crops	Paddy	204,250	73	2,732	4000	292,000	87,750	30.1
	Monsoon rice (nursery)	303,500	100	3,035	4,000	400,000	96,500	24.1
	Monsoon rice (transplanting)	246,500	80	3,081	4,000	320,000	73,500	23.0
	Monsoon rice (broadcasting)	108,000	50	2,160	4,000	200,000	92,000	46.0
	Summer rice (diret seeding)	159,000	60	2,650	4,000	240,000	81,000	33.8
	Maize	220,000	58	3,793	6,000	348,000	128,000	36.8
	Wheat	203,000	40	5,075	7,000	280,000	77,000	27.5
	Groundnut	134,400	7	19,200	23,000	161,000	26,600	16.5
	Sesame	171,500	35.00	4,400	8,000	280,000	108,500	38.8
	Sunflower	161,600	14.28	11,317	16,278	232,450	70,850	30.5
	Green gram	142,700	13.05	10,935	15,893	207,404	64,704	31.2
	Pigeon pea	140,650	16.16	8,704	16,625	268,660	128,010	47.6
	Soybean	127,800	14.97	8,537	13,000	194,610	66,810	34.3
	Black gram	113,200	15.82	7,155	14,000	221,480	108,280	48.9
	Chilli (dry)	320,500	180	1,781	2,300	414,000	93,500	22.6
	Onion	709,500	2800	253	400	1,120,000	410,500	36.7
	Potato	605,000	3500	173	400	1,400,000	795,000	56.8
Winter crops	Paddy							
	Summer paddy (nursery)	275,700	121.00	2,331	4,000	484,000	208,300	43.0
	Summer paddy (transplanting)	241,500	90.00	2,705	4,000	360,000	118,500	32.9
	Summer paddy (broadcasting)	187,750	75.00	2,526	3,636	272,700	84,950	31.2
	Summer paddy (direct seeding)	201,500	85.00	2,368	3,638	309,230	107,730	34.8
	Winter maize	218,000	55.26	4,047	6,700	370,242	152,242	41.1
	Groundnut	258,200	65.00	3,972	7,500	487,500	229,300	47.0
	Sesame (winter)	140,960	12.00	11,747	25,000	300,000	159,040	53.0
	Sunflower	169,660	30.00	5,655	9,500	285,000	115,340	40.5
	Niger	82,200	10.00	8,220	17,000	170,000	87,800	51.6
	Summer Sesame	184,000	15.00	12,267	20,000	300,000	116,000	38.7
	Green gram	143,600	14.38	9,986	17,000	244,460	100,860	41.3
	Chick pea	141,100	14.55	9,698	18,000	261,900	120,800	46.1
	Soybean	126,950	15.08	8,418	18,000	271,440	144,490	53.2
	Cow pea	116,500	13.10	8,893	16,000	209,600	93,100	44.4
	Blck gram	143,600	15.63	9,187	16,500	257,895	114,295	44.3

Source. DOA, Nay Pyi Taw

(8) Irrigation Area

The ratio of irrigation area of 51 townships in CDZ was 11% on the average according to the Development Study conducted by JICA from 2006 to 2010. The latest irrigation ratios of three regions are shown in the table below. Compared to 17.1 % (2009/10) in the country, the ratio of Sagaing region is highest at 21.6%, and lowest among three regions.

Irrigation Area of Three Regions

	2009/10				
	Net Area Sown (1,000ac)	Irrigated Area (1,000ac)	Multiple Crop Irrigated Area (1,000ac)	Percentage of Irrigated Area	Percentage of Multiple Crop Irrigated Area
	(1)	(2)	(3)	(4)=(2)/(1)	(5)=(3)/(2)
Sagaing	5,252	1,133	580	21.6	51.2
Magway	3,181	453	204	14.2	45.0
Mandalay	3,653	656	298	17.9	45.2
Union	33,716	5,755	1,532	17.1	26.6

Source. Myanmar Agricultural Statistics, (1997/98-2009/10), 2011 CSO

Kind of crops and cropping intensity in rainfed area and irrigated area where water is available by ID or

WRUD's irrigation projects are varied. Paddy is predominantly cultivated in irrigated areas. As shown in the following table, it is common for three regions that paddy is the major irrigated area.

Irrigated area by Crops in Tree Regions

2009/10												
Region	Total Irrigated Area	Paddy	Wheat	Maize	Groundnut	Sesame	Pulses	Sugarcane	Other Food Crops	Cotton	Jute	Other Non-food Crops
Sagaing	1,740.07	1,381.58	65.71	8.77	27.88	40.74	84.95	1.97	125.46	0.52	-	2.49
Magway	667.20	518.63	0.45	2.74	6.37	25.71	35.95	0.01	70.99	0.05	-	6.30
Mandalay	959.80	677.58	6.58	10.68	0.93	75.89	31.27	0.03	123.60	26.21	-	7.04
Union	7,337.02	5,545.69	84.37	103.87	66.57	184.48	260.68	25.93	968.20	26.90	6.85	63.48

Source. Myanmar Agricultural Statistics, CSO

(9) Agricultural Loans

As to the options for agricultural loans in rural areas, there are the institutional loans of MADB (Myanmar Agricultural Development Bank) and LFDB (Livestock and Fisheries Development bank), NGO's micro-finance such as done by PACT, private lender and borrowing from relatives. The institutional loans have lower interest rate. However, it is generally difficult for farmers to borrow money because it requires mortgage and takes time for processing application, and also because loan ceiling is small. Also, institutional loans cannot be provided to landless households.

On the other hand, both farmers and landless people have no capacity to save money to cope with some situations such as disease, education, accident etc. It is common practice for farmers to borrow money or in kind to procure agricultural materials such as seeds and fertilizers. Thus, it is considered that borrowing money is a common practice in rural area.

As compared to the institutional loans, interest rate of private loans is higher. If borrower has mortgage such as gold and others, the rate becomes low at 3% and 5 to 10% or more in case of without mortgage. However, there are many borrowers of the private loans probably because of "easiness" for farmers and landless people if compared with institutional loans. Agricultural production in CDZ is unstable due to relying on erratic and small rainfall. Therefore, there are some farmers who borrow money repeatedly and finally lose their cultivation right. Under the condition that institutional loans are not easier to use for general borrowers, it may be said that private loans with higher interest rates may be considered as a necessary evil in rural area.

Under the situation, micro finance operation by NGOs and others bring loans with lower interest rate and without mortgage for rural people taking into consideration household economy. For example, PACT in cooperation with UNDP has been operating MFP (Micro-Finance Program) since 1997 covering 26 townships in Ayeyarwady Delta region, CDZ and Shan state for the purpose of providing micro-credit targeting small farmers, livestock farmers and traders to improve their living standard. The short-term loan with 3% interest rate for one year is provided to group-basis comprising 5 beneficiaries per group, and 4 to 10 groups formulate one center to have trainings from the PACT.

OISCA has also been providing micro-finance project since 2008 covering Yesagyo Township for the purpose of agriculture, livestock and landless people. The service for landless people is to support their small scale business such as incense stick-making, and retail shop. The period of loan for agriculture is one crop season, 6 to 9 months for livestock, and one year for landless people. The interest rate for agriculture and livestock is 2.5% per month and 2.0 % for landless people under the condition of organizing borrower's group but without mortgage. The loan for landless people is basically copy of the method of Grameen Bank of Bangladesh and asks repayment with 25 times and participation in one training every two

weeks. Repayment is 100% because OISCA has carried out various agriculture-related activities in the area for long time and village chairmen who work for solving problems know OISCA's activities.

(10) Agricultural Extension Services

The organizational chart of DOA who is responsible for agricultural extension services in the related townships is shown in Appendix-14. Township DOA office is tail-end organization for extension services deployed under regional and district offices of DOA. Extensionists are responsible for technical advice, crop situation and distribution of quality seeds etc. As 930 contact farmers are assigned in Myingyan Township, each township has contact farmers to extend agricultural technologies to individual farmers in rural community through them. Village chairman often works as contact farmer voluntarily, and there is no limitation in term. DAR also assigns contact farmers and some are also contact farmer nominated by DOA. However, number of contact farmer nominated by DOA is more than the one by DAR according to field survey.

The number of extensionists and number of villages can be compiled as shown below. Averaged number of villages per extensionist is largest in Magway Township at 14.4, and followed by 10.0 of Nyaung Oo township. Transportation means of extensionist are motorcycle in many cases. Formerly, they used bicycles, line buses and/or walk. Recently motorcycle is commonly used but the number of motorcycles is observed to be inadequate to meet the demand.

Annual budget of DOA in three townships differ as shown below. DOA in Nyaung Oo Township having 22 extensionists is allocated the largest budget among the related three township offices.

Overview of Extension Service of DOA

	Myingyan TS	Nyaung Oo TS	Magway TS
No. of extensionist	36	22	15
No. of village	186	219	216
Village per extensionist	5.2	10.0	14.4
Budget (million Kyat) 2012/2013	38.3	65.0	34.0

Source: Calculation based on the data of DOA township offices

3.2 Irrigation Methods Observed in Uplands in CDZ

(1) Irrigation Source Development

In the rainfed upland where t no irrigation source is developed by ID and WRUD, available water source will be tube-well with groundwater. Number of tube-well itself is not so many but it is commonly used in CDZ to irrigate crops. However, development of tube-well is dependent on the financial capacity of farmers also in addition to depth of groundwater level. In the hilly area ranging from Nyaung Oo to Magway, groundwater level is generally deeper than other areas and this will require digging of about 300m or more, therefore tube-well cannot be found so often.

On the contrary, there are some places where tube-well can be dug by manual because of shallow groundwater level, and shallow tube-well is observed even at backyard of farm household in these areas. At the farmlands on river terrace, so called as Kaing, tube-wells are dug by hands with small investment. A tube-well with 30 to 40m and can be dug in 2 to 4 days and about Kyat 100, 000. This fact tells that there is considerable difference in possibility of groundwater development depending on regional conditions even in CDZ where rainfed uplands are dominant. In some villages located in the place with shallow

groundwater level, treadle pumps are observed for cultivating vegetables in the backyard.

Tube-wells Observed in Uplands in CDZ

		
Tube-well on rainfed upland	Tube-well digging by manual	Mechanical digging of Tube-well

(2) Water-saving Technologies

Torres des homes, Italian NGO, demonstrates water-saving agricultural technology at the Magway Campus of YAU (Yezin Agriculture University), which uses rice husk charcoal and PET (Polyethylene terephthalate) bottle of mineral water as materials in drip irrigation and micro-irrigation systems. These technologies have already been applied and operated by organized community people in 20 villages in Yenanchaung Township and 33 villages in Natmauk Townships.

Hydroponic Technology demonstrated in Magway Campus of YAU

Survey date	May 9, 2013
Place	Magway campus of YAU
Village Tract	-
Township	Magway
Region	Magway
Location	Magway city
Interviewees	Professor /Dr. Mi Mi Aung, U Kyaw Min Tun
Information about water-saving technologies：	
Facility	The hydroponic irrigation system has acreage of about 5 x 4 m. Irrigation stored in a plastic tank at about 1.5m height and irrigates the series of PET bottle by gravity. Water source is from water supply. Micro-irrigation system is also demonstrated in the same area using plastic pipe + micro-pipe and plastic buckets.
Costs	The total cost is estimated at Kyat 750,000 (Kyat700,000 + Kyat 50,000 (pump)). If digging tube-well, more investment is required.
Irrigation methods	Drip of irrigation water flows into two holes on the surface of PET bottle filled with rice husk charcoal PET, where plants such as lettuce and others are planted (photo). 12 hrs irrigation, 12 hrs no irrigation. The facility itself is covered by meshed plastic curtain to avoid strong sunshine. Micro-irrigation system is also applied for cucumber planted in a plastic buckets with 40cm diameter to irrigate by pipe with 1.5cm diameter and 1.0

	mm plastic pipe. Irrigation is sequential different from the drip irrigation (photo).
Crops irrigated	Lettuce, tomato, cucumber, chili, eggplant and mustard
Findings	The hydroponic irrigation system is a water-saving irrigation technology using rice husk charcoal. Demonstration in YAU is operating since 2012 under cooperation with Tdh, Italian NGO, and practically running in 16 villages according to YAU's Magway Campus. This system is characterized with combination of PET bottle and rice husk charcoal for drip irrigation. Another one is micro-irrigation system using main pipe and micro-pipe for water-saving. These two technologies are applied for cash crops such as tomato, lettuce and others, and considered applicable for a limited area to grow cash crops with higher profitability. Though it is simple facility, some investment for tube-well + pump, water tank and meshed curtain will be necessary. Compost making is also demonstrated using EM brought from Japan. It will be applicable to improve water holding capacity of sandy soils in CDZ.

		
Hydroponic irrigation system	Emitter and PET bottles	Cultivation bed of PETbottles（Lettuce）
		
Irrigation by micro-pipe for Okra	Micro-irrigation for cucumber	Micro-irrigation and multing for eggplant
		
Compost making using EM		

Tdh (Terres des hommes), Italian NGO, Yenaungyon Township

Survey date	May 22, 2013
Place	Tds Office in Yenanchaung TS
Village name visited	San Kan Gyi, Ma Gyi KanTownship, Magway Region
Location of the village	Yenanchaung Township (1.5hrs from Magway)
Interviewees	Daw Khin Khin Aye, Area coordinator of Tdh
Activity of Tdh：	
Tdh, Italian NGO has been supporting in the sub-sector of education, livelihood improvement, water supply, and medical and sanitary affairs in Myanmar since 2005. Water-saving agriculture is one of components of the livelihood improvement, targeting improvement of living standard and provision of new technology on water-saving agriculture. In Yenachaung office of Tdh, 11 staff are deployed to operate project and to support community people in 20 villages in Yenanchaung township and 33 village in Natmauk township.. These villages are so called remote villages and approach is difficult especially in rainy season. The reasons for selecting these villages are shortage of fresh vegetables to intake vitamin in dry season due to no irrigation system in their villages, and improvement of standard of living by cultivating cash crops. Water-saving technologies comprising hydroponic and micro-irrigation system for demonstration is in the Magway campus of YAU in Magway.	
Information about water-saving technologies： JICA Team visited San Kan Gyi village in Ma Gyi Kan township 1.5 hrs away from Yenanchaung Township.	
Facility and irrigation methods	1. Hydroponic irrigation using Rice Husk Charcoal & PET bottle. The facility of about 6 x 3 m is larger than that of Magway Campus of YAU. Rainwater collected from the roof of a temple nearby flows into concrete tank with 110,000 gallon (photo), and is pumped up to plastic tank with height of about 1.5m, and irrigates crops on 96 rows (48x2) by gravity (photo). At the tail end of the system, used water is collected and reused. Organic cultivation is done. 2. Micro-Irrigation Another water saving technology operated nearby is micro-irrigation using plastic bucket with 40cm diameter planted with carrots and other crops, pipes with 1.5 cm diameter and 1.0mm pipe connected with water tank. This system is not drip irrigation but sequential irrigation through 1.0mm pipe to eggplant and other crops (photo). A rainwater tank with 11,000 gallon can irrigate hydroponic and micro-irrigation systems for 8 months. Irrigation is done from 6 am to 6 pm. . Two systems mentioned above are managed by community group under guidance of Tdh, and get income though it is not much. There is a pond in the village but no water as of end of May 2013. Also there is a tube-well for domestic use constructed in 1983 with 400 to 800 feet depth of groundwater. Because of deep groundwater level, villagers could not dig the tube-well for drinking.
Costs	1. Example in Yenanchaung TS

	Rainwater tank(11,000gallon) Kyat 3.5~4.0 million Water-saving irrigation system(6 x 3m) Kyat 1.1 million 2. Example in Natmauk TS Rainwater tank(11,000gallon) Kyat 2.8~3.0 million Water-saving irrigation system(6 x 3m) Kyat 1.0 million
Crops irrigated	Hydroponic technology：Mustard, Watercress, Amaranthus, Roselle Micro-irrigation：Eggplant, carrot, tomato
Findings	The agriculture in the village fully relies on rainfall. For the water-saving irrigation, they use rainwater from the roof of a temple nearby and store in a concrete tank. Though these technologies will be applicable for a limited area, it is remarkable from view point of rain water harvesting for cash crops. The hydroponic technology also uses rice husk charcoal. It is characterized as a drip irrigation system combined with PET bottle, rice husk charcoal and drip irrigation system by gravity. However, rice husk is procured from distant village. Another is micro-irrigation system using main pipe and micro-pipe by gravity. Both systems are used for intensive cropping of leafy vegetables and carrot etc, and applicable for a limited area. Though they are simple facilities, it also requires investment for tube-well, water tank, and meshed plastic curtain if applied practically on field. The system can be practiced using rainwater collected from the roof of houses and temples but the applicable area will be limited in both cases.

Rainwater harvesting from a temple's roof

Cultivation bed with PETbottles

Water tank (2units)

Micro-irrigation system

Micro-irrigation with plactic bucket

Micro-irrigation for carrot

In addition to the above, a traditional water-saving technology using unglazed pot is observed, which is applied for Mango nursery and pumpkin placed or buried nearby plant's roots to give a small amount of water seeping from pot. Similarly to this technology, PET bottle with small hole is also used to irrigate Mango nursery.

Traditional Water-saving Technologies in the CDZ

		
Irrigation by a unglazed pots for Mango nurseries (Nyaung Oo)	Water-saving Irrigation using unglazed pot for pumpkin	Mongo trees irrigated by PET bottle when planting

(3) Water Harvesting

In CDZ, it sometimes happens that strong rainfall occur during the rainy season. As the rain is very important for agriculture especially in rainfed areas, people store rainwater in farm ponds, water jar, and pits dug on lower part of farmland. In the village where is supported by Tdh, Italian NGO, rainwater collected from temple's roof is stored in a concrete tank to irrigate water-saving irrigation systems.

Water Harvesting in the CDZ

		
Farm pond (before rainy season)	Collection & storage of rainwater	Water harvesting by pits on farmlands

3.3 Other Countermeasures against Aridity

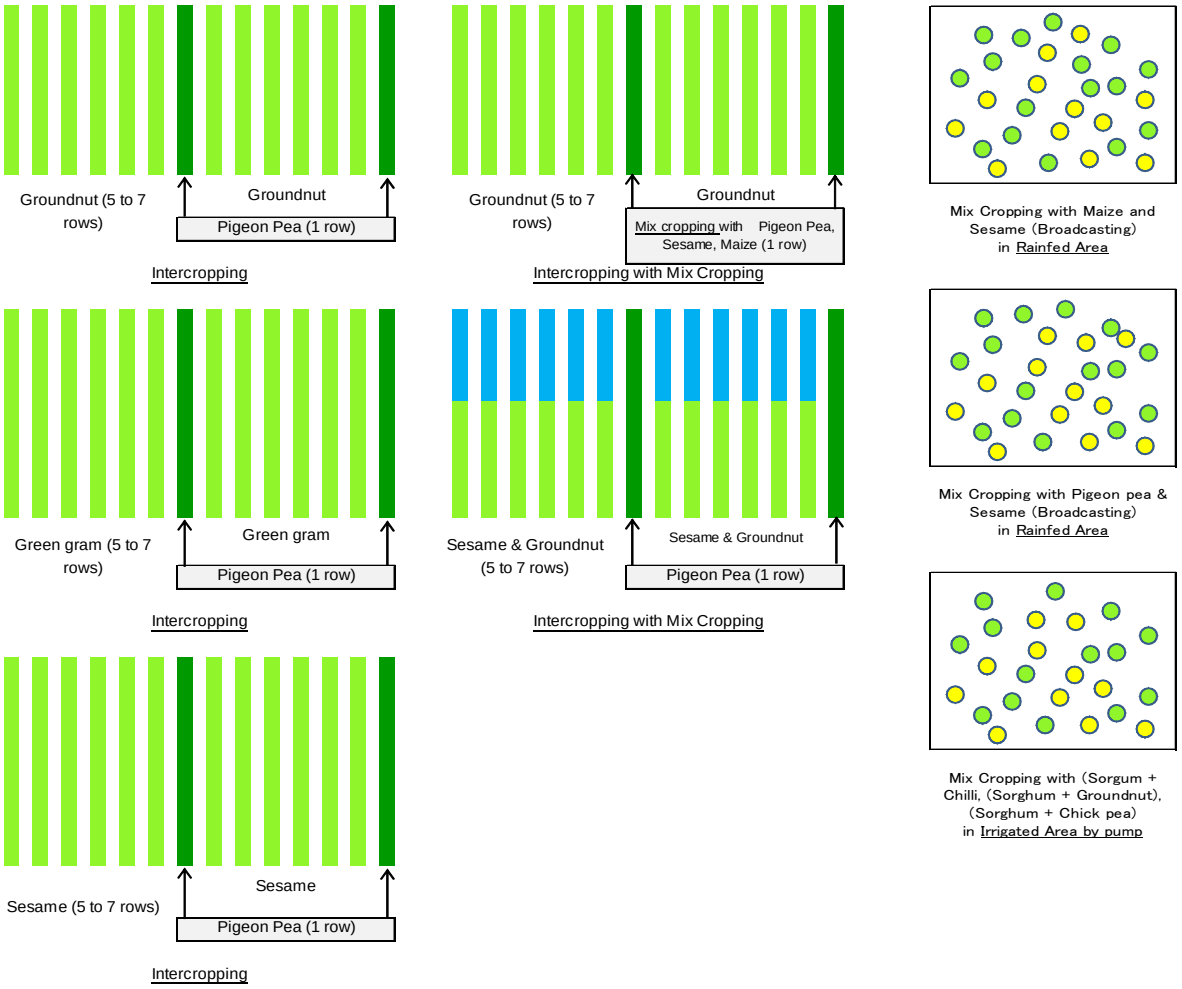
(1) Inter-cropping and Mixed Cropping

In CDZ, it is not always certain that the amount of rain necessary for crops falls steadily for each year. . Under the situation, individual farmers have practiced inter cropping and mixed cropping traditionally based on their experience about climatic condition, especially pattern of rainfalls by judging suitable timing of plowing and seeding observing soil moisture, which can be said their wisdom as a survival agricultural practices under the scarce rainfall and sandy soils. The idea of inter and mixed cropping systems is based on the consideration that even though one crop may be damaged, other crops will survive to generate income. Sesame, Pigeon Pea, Maize, and Groundnut are representative crops for intercropping and mixed cropping in general, and sesame is considered to be a gambling crop among farmers, which may bring higher income if rainfall is suitable but is also prone to be damaged depending on rainfall condition

according to farmers.

Under these conditions, pigeon pea is considered to be the highest drought tolerant crop. Though green gram is damaged if rain does not fall for about 15 to 20 days, pigeon pea can survive for 100 days without rainfall according to DAR. Therefore, pigeon pea is a core crop for inter cropping system in CDZ, which can be seen often in arid hilly area as close as index crop of dry areas. However, pigeon pea is not consumed in the country but exported to India, Singapore and Malaysia. Exportation of pigeon pea to India is reduced if Indian production is good.

The following figures show the patterns of inter and mixed cropping observed in Myingyan and Nyaung Oo. There are some cases that inter and mixed cropping is done on the same farm plot. As compared to Myingyan Township where various type of intercropping can be seen, intercropping of sesame and pigeon pea is practiced in Nyaung Oo according to DOA. Nyaung Oo in Magway township, intercropping is not commonly practiced, only mono-culture of groundnut or sesame.



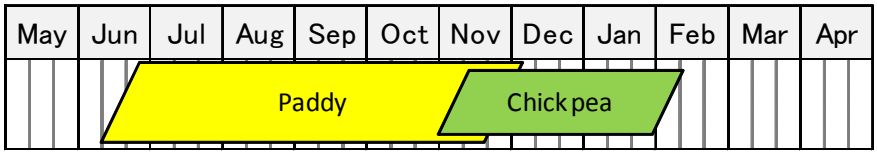
Typical Inter-cropping and Mixed Cropping Patterns in CDZ

Inter-cropping Cropping Patterns in CDZ

	
Intercropping of groundnut and pigeon pea	Farm plots of intercropping and monoculture of sesame

(2) Relay Cropping

Relay cropping is also practiced to make use of remaining soil moisture by sowing one crop before harvesting one crop and show below is a typical example of the relay cropping of paddy and chick pea on the same farm plot.



Relay Cropping in CDZ

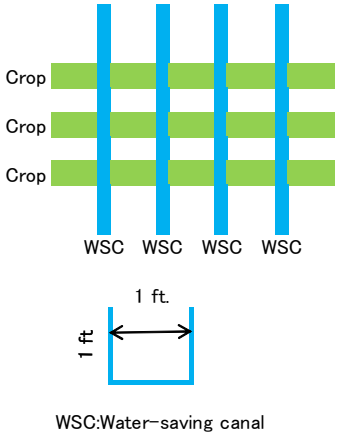
(3) Application of Crop Varieties having Different Growing Period

For example, there are three varieties in sesame, black, white and brown which have different growing period, 85 to 90 days for black sesame and white sesame, and 65 days for brown sesame. If rainy season in May comes earlier, farmer chooses black sesame having higher price. However if the rain comes late, they choose brown sesame having shorter growing period but lower unit price than black sesame. Thus, farmers are able to cope with unpredictable erratic rainfall in CDZ.

Among three sesame varieties, brown has the lowest unit price. According to a farmer in Magway Township, the farm-gate price of black sesame is Kyat 45,000/basket Kyat 40,000/basket for white sesame and kyat 35,000/basket for brown sesame. Therefore, when sowing brown sesame, maize or other crops are usually cultivated to supplement income.

(4) Water-saving Canal

As of May 2013, DAR is still testing water-saving canal (WSC) technology in Magway and Myingyan Centers in order to increase soil moisture of sandy soil. As seen in the figure, WSC with 1 x 1 foot is made across crop rows, and DAR explains soil moisture by making WSC on farm plots compared to the farm without WSC. However, when JICA Team visited Magway Center again on July 2013, practice of this idea has not stopped because once rain comes WSC is destroyed and they have to always re-build. WSC requires more labor and is not acceptable to the farmers.



WSC:Water-saving canal

(5) Compost

Compost is input popularly in CDZ to increase water holding capacity of the soils. In Japan, 20 tons of compost per hectare is said to be standard but compared to Japanese standard, it is observed that quantity of compost input is very low as shown table below. One of the reasons for the low volume is the limited quantity of manure that can be collected due to small population of cattle. It is important to input more compost and organic fertilizers to improve water holding capacity of soils in CDZ. YAU in Magway campus demonstrates Bokashi making using EM.


Compost

Example of Compost input in Nyaung Oo Township

	Crops	Compost input(ton/ha)
1	Groundnut (runner)	4
2	Groundnut	-
3	Early sesame	10
4	Green gram	9
5	Sorghum	10
6	Pigeon pea	-
7	Early sesame-late sesame	16
8	Early sesame + Pigeon pea	12
9	Early sesame + Pigeon pea-Horse gram	2
10	Early sesame + Pigeon pea-late sesame +Horse gram	17
11	Green gram + Pigeon pea	13

Source: DAR, Yezin

(6) Application of Drought Tolerant Varieties of Crops

Farmers use various kinds of crop varieties in response to land and climatic conditions. They choose suitable varieties, which may not always be varieties that DAR recommends, including varieties of groundnut and pigeon pea distributed by ACIAR (Australian Center for International Agricultural Research) in CDZ.

Application of Drought Tolerant Varieties of Crops

Crop	At Village Survey	At DAR
Groundnut	SP121, Kyaung Gong (LV), Japan 1, Toontarni, Vietnam white, Sinpadaytha 11, Sinpadaytha 6, Pin Htaung	Sinpadatha 6, Sinpadatha 7, Sinpadatha 11
Sesame	Kanchi, Malthila, Aung Ban (LV), Zonephyu, Manager,	Sinyadana 2, Sinyadana 4, Sinyadana 10
Green gram	Local variety, Kyauksein	Yezin 11, Yezin 12
Pigeon pea	Yezin, Monywa Shwedinga, Tha Htay Kan, Nyaung Oo Shwedinga, Kyaukpadaung Shwedinga,	Yezin 5, Yezin 6, Yezin 7
Paddy	Manawthukha, Pwintphu Thukha, Ayerwady Thar,	Sinthukha, Earmin, Manawhari, Sinethwelatt, Hmawbi 2 Pawsanhmwe, Immayebaw, Sinweyin, Yadanatoe, Shwemanaw, Lonethwehmwe
Onion	Shwe Phalar,	
Chick pea	Yezin 4, V2	
Watermelon	855(from Taiwan)	

Tomato	909(from Taiwan), Seed from Shan State	
Tobacco	Local variety,	

(7) Cultivation of Crops with Less Water Requirement

There are some farmers cultivating crops with less water requirement to cope with scarce and unstable rainfall condition in CDZ such as dragon fruit, a kind of cactus, and mushroom observed in the field survey. Both crops require only small water for growing, especially the area with dragon fruit has been increasing as compared with the period of Development Study by JICA in 2006 to 2010 as seen in Nyaung Oo, nay Pyi taw and Kyaukpadaung. Today, dragon fruit is one of drought tolerant crop popularly planted in CDZ.

Dragon fruit

Mushroom at backyard

(8) Windbreak

In the DAR Center in Magway, windbreak tested to prevent wind erosion is by using leguminous tree planted around farm plots. Interval is about 30 ft. Soil moisture rate becomes higher by planting windbreak compared with other plots without windbreak according to the DAR Magway. A farm level, windbreak can be seen sometimes and its young leaves are cooked for soup and salad.

Windbreak

(9) Mulching

Practice of mulching is not observed in CDZ. Only the farms cultivating cash crops such as tomato, mango, and watermelon apply in the limited area. Rice straw which is popularly used in Japan for mulching is available only in areas along Ayeyarwady River in the irrigated area in Sagaing region. Instead of rice straw, toddy leaves and crop residues are used in CDZ though in limited cases. Plastic sheet for mulching is still expensive for average farmers.

Mulching for Mango nursery by toddy leaves

Mulching by crop residue

3.4 Crop and Irrigation

Many kinds of crops are cultivated in CDZ and are planted based on the availability of irrigation, drought tolerance, suitability for upland or lowland as shown in the table below. Farmers choose crops taking into consideration land condition, rainfall and irrigation conditions, etc. However, they choose in common paddy if water is available.

Characteristics of Crops

Crops	Irrigation is indispensable	Possible relying on rainfed without irrigation	Suitable for lowland	Suitable for upland
Monsoon paddy	◎	×	◎	×
Summer paddy	◎	×	◎	×
Pigeon pea	×	○	×	◎
Maize	×	○	×	○
Sesame (summer)	○	×	○	○
Sesame (monsoon)	×	○	×	○
Groundnut (monsoon)	×	○	×	○
Groundnut (winter)	×	○	×	○
Green gram (monsoon)	×	○	×	○
Green gram (winter)	×	○	×	○
Black gram (winter only)	×	○	○	○
Sorghum (monsoon)	×	○	×	○
Chick pea (winter only)	×	○	○	○
Sunflower (monsoon)	×	○	○	○
Sunflower (winter)	×	○	○	○
Cotton (pre-monsoon)	○	○	○	○
Cotton (monsoon)	○	○	○	○
Cotton (post-monsoon)	○	○	○	○
Onion (monsoon)	○	○	×	○
Onion (winter)	○	×	○	○
Potato (winter)	×	○	×	○
Tomato (monsoon)	×	○	○	○
Tomato (winter)	○	×	○	○
Tomato (summer)	○	×	○	○
Vegetables (all season)	○	×	○	○

Source: Interview survey at DOA Mandalay Regional Office

3.5 Variety Selection by farmers

A survey on the basis/factors for selecting crop variety was carried out in CDZ. Result of survey shows that farmers would consider crop yield, drought tolerance, growing period, etc as priority though varies depending on crops. For example, farmers give priority to color (black variety has higher price), size, growing period when choosing varieties. As for groundnut, priority is given to yield, and color and size are not determining factor with high priority. Farmers always consider how to get higher farm income by choosing varieties with higher price and suitable crop varieties to cope with scarce and fluctuating rainfall. These varieties selected by farmers are not always the same as DOA's promoted varieties, since amount of DOA's recommended varieties are not enough and not accessible for most farmers.

Factors on Crop Variety Selection

(1) Groundnut

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Yield
SP121,	2	-	3	-	4	-	1
Kyaung Gong (LV),	-	1	-	-	-	-	-
Japan 1,	-	-	3	1	4	5	2
Toontarni,	2	-	3	-	4	5	1
V Vietnam white,	-	-	1	-	2	-	3
Sinpadaytha 11,	4	-	2	-	3	-	1
Sinpadaytha 6,	1	-	-	-	-	-	-
Sinpadatha 7,	-	-	2	-	3	-	1
Pin Htaung	3	-	1	-	-	-	2

(2) Sesame

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Root depth	Yield
Kanchi,	1	-	-	-	-	-	-	-
Malthila,	-	-	1	-	-	-	-	-
Aung Ban (LV),	-	-	1	-		-	-	-
Zonephyu,	-	-	-	-	-	-	2	1
Manager,	-	-	-	-	-	-	2	1
Sinyadana 2,	-	-	-	-	2	1	-	-
Sinyadana 4	-	-	-	-	2	1	-	-
, Sinyadana 10,	-	-	-	-	-	1	-	-

(3) Green gram

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Root depth	Yield
Kyauksein	-	2	-	-	-	-	-	1
Yezin 11,	-	1	3	-	4	-	-	2
Yezin 12,	-	1	-	-	-	3	-	2

(4) Pigeon pea

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Root depth (feet)	Yield
Yezin,	-	-	-	-	-	-	-	-
Monywa Shwedinga,	-	-	-	-	3	2	-	1
Tha Htay Kan,	-	-	-	-	3	2	-	1
Nyaung Oo Shwedinga,	-	-	-	-	3	2	-	1
Kyaukpadaung Shwedinga,	-	-	-	-	-	-	-	-
Yezin 5,	-	-	-	-	2	3	-	1
Yezin 6,	1	-	-	-	3	2	-	-
Yezin 7	-	-	-	-	2	3	-	1

(5) Chick pea

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Root depth	Yield
Yezin 4	4	-	1	-	3	2	-	-
V2	-	-	1	-	3	2	-	-

(6) Onion

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Root depth	Yield
Shwe Phalar,	-	-	-	-	3	2	-	1

(7) Paddy

	Drought tolerance	Tolerance to pest /diseases	Growing period	Good taste	Size	Color	Root depth (feet)	Yield
Manawthukha,	-	-	3	2	-	-	-	1
Pwintphu Thukha,	-	-	-	-	-	-	-	-
Ayerwady Thar,	-	-	-	-		-	-	-
Sinthukha,	-	2	3	4	-	-	-	1
Earmin,	-	-	-	1	-	-	-	-
Manawhari,	3	-	2	1	-	-	-	-
Sinethwelatt,	-	-	-	-	-	-	-	-
Hmawbi 2	-	-	2	1	-	-	-	-
Pawsanhmwe,	-	-	3	1	-	-	-	2
Immayebaw,	-	-	3	1	-	-	-	2
Sinweyin,	-	-	2	1	-	-	-	-
Yadanatoe,	-	1	2	3	-	-	-	-
Shwemanaw,	-	-	1	2	-	-	-	-
Lonethwehmwe,	-	-	4	1	2	-	-	3

CHAPTER 4 BASIC INFORMATION SURVEY

Information about administration such as population, number of household, and others at township level are shown in the booklets titled "Basic Information of the Township" prepared by GAD under Ministry of Home Affairs (refer to Appendix-9), which is stipulated as a Confidential Document. As for detailed information about agriculture, data and information are available at township DOA and SLRD. Livestock data is also available in township LBVD as well. However, there are some gaps and missing data depending on the related offices, for example sown area, harvested are, production and climatic data, etc.

4.1 Myingyan Township

4.1.1 General Administration

(1) Administrative Division

Myingyan Township belongs to Mandalay Region composed of the following administrative division. One village tract is composed of 2.8 villages on the average. The distance from Mandalay, regional capital, is 156.8km (98miles).

Administrative Division of Myingyan TS

Village Tract	Ward	Village
66	19	186

(2) Budget of the Township DOA and Organizational Structure

The organization chart is shown in Appendix-14. Annual budget of the township DOA office is allocated at Kyat 38.3 million in 2012/13.

(3) Village Map

Township map is shown in Appendix-10.

(4) Population

1) Population and Population Density

The population as of May 2013 is estimated at 270,985, of which 70.8% is in rural area and 29.2% in urban area. Population density of the township is 279 persons/㎢, which is bigger than 117/㎢ (2010) of average in three regions in CDZ.

Population in Myingyan TS

Urban	Rural	Total
79,215	191,770	270,985
29.2%	70.8%	100.0%

Source: GAD Township office, 2013

2) Races

The following table shows the race composition in urban area of the township. According to the data, 98% is occupied by Bamar with some ethnic minorities.

Races in Myingyan TS

Kachin	Kayah	Kayin	Chin	Bamar	Mon	Rakhine	Shan	Others	Total
2	0	8	17	77,240	6	36	19	1,708	79,216
0%	0%	0.01%	0.02%	97.73%	0.01%	0.05%	0.02%	2.16%	100.0%

3) Population by Sex

Female population accounts for 52.6% of the total population as shown below.

Population by Sex in Myingyan TS

Male	Female	Total
128,405	147,580	270,985
47.4%	52.6%	100.0%

4) Economically Active Population

The economically active population above 18 years old is estimated at 67%.

Economically Active Population in Myingyan TS

Economically Active Population above 18 yrs	Ratio to the total
181,839	67%

5) Population Working in the Agricultural Sector

Of the population above 18 years old, 69% is working in the agricultural sector which is the basic industry of the township.

Population Working in the Agricultural Sector

Population working in the Agricultural Sector	Ratio to the population above 18 yrs
186,144	69%

(5) Number of Household and Average Family Members

The total household in the township is 55,094, of which 65% is farm households who were given cultivation rights from the government, and the remaining 35% is so called landless households consisting of casual labor working in agriculture and construction, officers and carpenters. The average family member is 4.92/family.

Number of Household and Family Member in Myingyan TS

Farm Households	Landless Households		Others	Total	Average (persons/family)
	Non-farm	Casual labor			
35,774	19,320		0	55,094	4.92
65%	35%		0%	100.0%	

(6) Wage of Farm Labor and Non-Farm Labor

As of May 2013, wage of farm labor is Kyat 2,500/day/capita, and Kyat 3,000 day/capita for non-agriculture labor. As compared with the rate of Kyat 700 for female and Kyat 1,000 for male in the period of the Development Study by JICA from 2006 to 2010, the wage has increased at about three times.

4.1.2 Agricultural Profile of the Township

(1) Acreage by Land Type

The following table shows the acreage of the township by land type. Net sown area accounts for 68% of the total township area.

Acreage by Land Type in Myingyan TS (ac)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
241,598	0	1,739	164,970	1,027	1,027	18,777	54,058

(2) Cultivable Area

The breakdown of the cultivable area of the township is as follows. Yar (upland) accounts for 74.4 % of the total cultivable area and 14.8 % by paddy. Kaing is farmland on river terrace and Kyun is the one on sandbank in a river.

Cultivable Area in Myingyan TS (ac)

Total Cultivated	Total Paddy	Total Yar Land *	Total Kaing *	Total Kyun *	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
164,970	24,386	122,768	0	0	17,816
100%	14.78%	74.42%	0.00%	0.00%	10.80%

(3) Irrigated Area

The ratio of irrigated area to the total cultivable area in the township is only 13.8% following to the one in Nyaung Oo Township. Main water source for irrigation is river. Irrigation water charge is Kyat 9,000/ac/year for paddy and Kyat 3,000/ac/year for field crops.

Irrigated Area in Myingyan TS

Paddy(ac)	Upland(ac)	Total(ac)	Ratio (%)
1,529	21,200	22,729	13.8

(4) Crops

The top five cereal, oil and pulses crops based on sown area in 2011/2012 in Myingyan is shown in the table below. The township is characterized as upland farming area centering on sesame production. Paddy farming is done mainly in the areas of 5,336 acres along Ayeyarwady River.

Crop Production in Myngyan TS

Ranking	Crop	Sown area (ac)	Harvested area (ac)	Production (basket)
1	Sesame	51,711	51,711	276,627
2	Pigeon pea	25,711	25,711	319,017
3	Sunflower	17,919	17,919	456,218
4	Groundnut	16,022	16,022	800,299
5	Chick pea	15,788	15,788	204,139

Similarly, vegetable and fruits in 2011/2012 are as follows.

Vegetable and Fruits Production in Myingyan TS

Ranking	Crop	Sown area (ac)	Harvested area (ac)	Production (viss)
1	Onion	14,907	14,907	527,068
2	Vegetables	6,335	6,335	9,418,564
3	Chili	1,689	1,689	191,539
4	Toddy	1,579	998	NA

Source: DOA TS Office, Myingyan

(5) Number of Farm Household by Farm Size

The farm household with less than 5 acres accounts for 92.7% of the total. The average farm size is calculated at 4.61 acres per farm household (164,970ac /38,240farm = 4.61ac/farm). It is said that in Myanmar the minimum farm size necessary to feed a family is 8 to 10 acres but farm size on the average in the township is nearly one half.

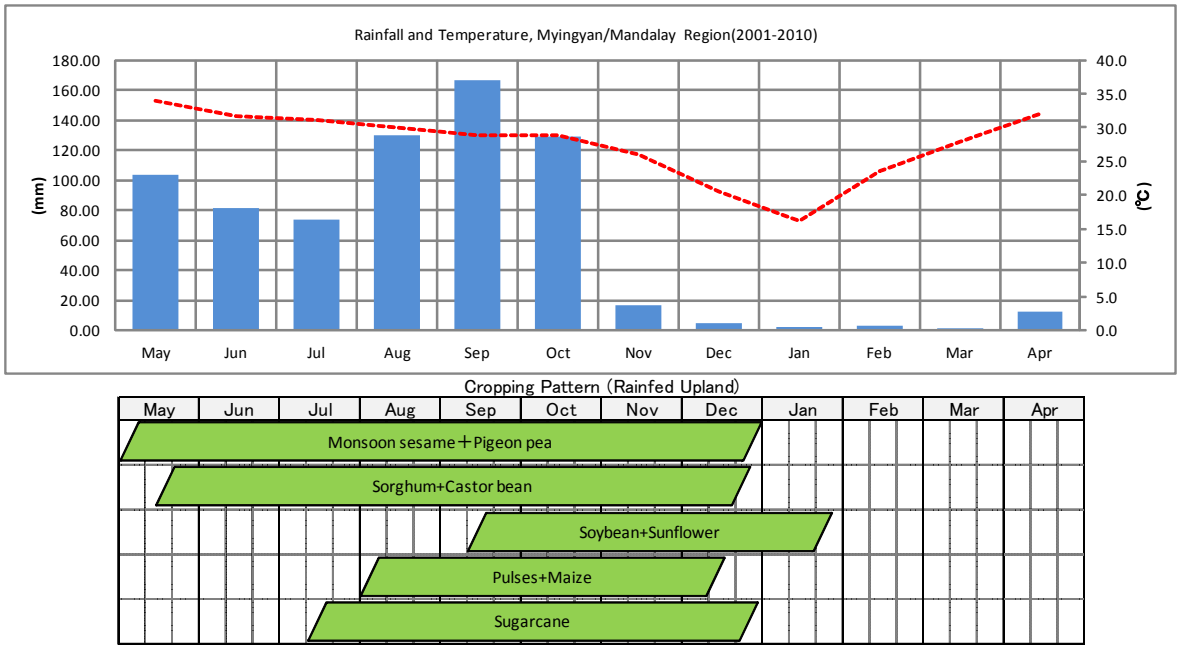
Number of Farm Household by Farm Size

Less than 5 ac	5-10 ac	10-20 ac	Above20 ac	Total
24,058	9,091	2,214	411	35,774
67.3%	25.4%	6.2%	1.1%	100.0%

Source: SLRD TS Office, Myingyan

(6) Cropping Pattern and Climate

The relationship between climate conditions and cropping pattern in Myingyan Township can be illustrated as shown in the figure below. Farming practices starts from the beginning of May when rainfall comes. Dry spell occurs from June to July that precipitation reduces temporarily even in rainy season. In the places where groundwater can be developed for tube-well, onions and so on are cultivated. CSO's data on Statistical yearbook was used.



Cropping Pattern and Climate in Myingyan TS

(7) Livestock

In Myyingyan Township, livestock centering on cattle and buffaloes necessary for farm practices are raised as shown in the table below. Buffaloes are raised in the limited area where water is available.

Livestock in Myingyan TS

Cattle/buffaloes	Goats/sheep	pigs	Chicken	Ducks
109,177	52,975	29,787	558,369	-

(8) Land Classification

Land in the township is classified as follows based on the data collected in the period of the Development Study in 2006 to 2010. Fertile Alluvial soils accounts for 13,000 acres and 34,000 acres by hilly area. However, recently this classification is not used according to the DOA township office.

Land Classification in Myingyan TS (1,000 ac)

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
2	130	-	18	16	-	-	-	-	-

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

Similarly to the land classification mentioned above, acreage by soil type in Myingyan based on the data collected in the period of the Development Study in 2006 to 2010 is shown below. In Myingyan Township, data on soil type could not be collected though soil map and acreage on regional level were collected.

Soil Type in Myingyan TS (1,000 ac)

Acreage by Soil Type (unit:Acre)									
Meadow Alluvial Soils (Gleysol)	Meadow Carbonate Soils (Gleysol)	Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Compact Soils (Vertisol)	Turfy Primitive Soils (Lithosol)	Primitive Crushed Stones Soils	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other	Total
-	-	174	8	-	4	-	10	2	198

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

Catena of savanna soil composed of sandy loam and clayey soil and occupying almost all of the cultivable area is classified good/fair with pH 7.5 to 8.5, according to “Soil Type and Characteristics of Myanmar” (DOA), and suitable for paddy, cotton, vegetables, sugarcane, groundnut, sesame and pulses.

(10) Crop Varieties being promoted by DOA in Myingyan

The following varieties that the township DOA has been promoting recently are as follows;

Crop Varieties being promoted by DOA in Myingyan TS

Crops	Varieties
Monsoon paddy	Ayeyamin, Shwebo Paw San
Groundnut	Sin Pada Thar
Green gram	Yezin-11
Chick pea	Yezin-6, Yezin-8
Pigeon pea	Monywa Shwedinga

(11) Agricultural Disasters

Drought often occurs with high frequency once every three years as compared to the damage by insect and rat that occurs once every 15 years.

(12) Issues on Agriculture

Among the agricultural issues to be solved in the township, water-related ones are most serious according to the township DOA. In addition poor soil and inadequate agricultural loans are also issues in the township.

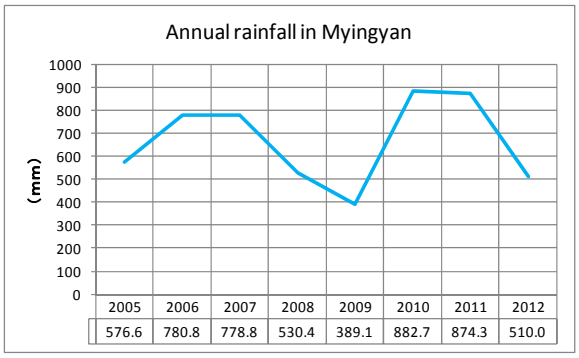
Issues on Agriculture in Myingyan TS

Agricultural Issues in Myingyan Township
Water shortage, drought, unstable rainfall, soil erosion by rainfall, lack of draft cattle, inadequate service on agricultural loan

4.1.3 Climatic Conditions

(1) Precipitation

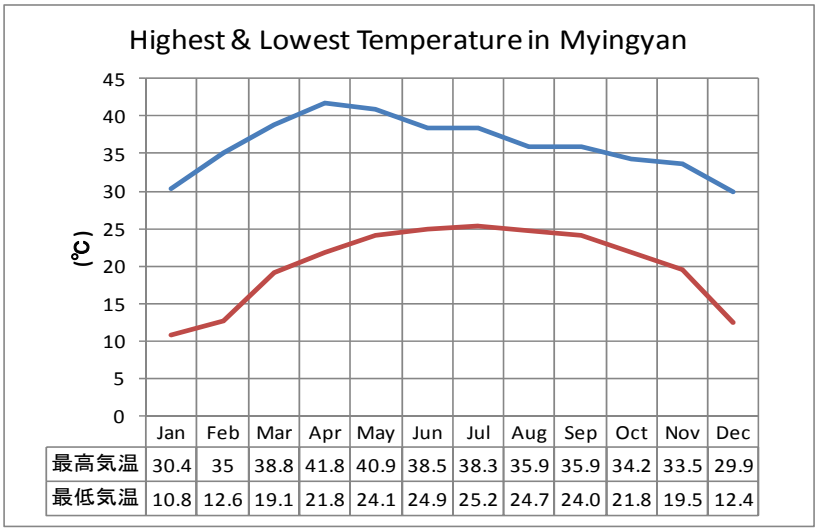
The graph shows fluctuation of annual rainfall in the township from 2005 to 2012. It is know that the rainfall in 2009 was extremely scarce. However, farmers have practices farming under these severe conditions. It can be said that annual rainfall has affected farmer's living standard.



Source: DOA, Myingyan Township

(2) Highest and Lowest temperatures

The highest temperatures occur on April, and lowest in January at 10.8℃. Difference between highest and lowest temperature is largest also in January.



Source: DOA, Myingyan Township

4.1.4 Other Information

(1) Main Markets

There are three local markets in the township which are managed by municipality. In these markets, cereals, pulses, vegetable, fruits are dealt along with daily commodities.

Main Market in Myingyan TS

Name	Location	Managing Body	Public/private
Aye Mya Thida	Center of the city	Municipality	Public
San Pa	South of the city	Municipality	Public
Myoma	Center of the city	Municipality	Public

(2) Donors

It was confirmed that there were two donors that worked in the township as indicated below. IDEA provided storage of rainwater and micro-credit by PACT.

Activities of Donors in Myinyan TS

Name	Sector	Period
IDEA	Rain storage	2011
PACT Myanmar	Micro credit	2012

(3) Schools

The existing schools in the township cover from primary to high school as indicated below.

Schools in Myingyan TS

Type	Places	Students	Teachers
Primary school	178	22,255	567
Secondary school	9	12,916	1,154
High school	5	3,873	157

(4) Hospital

The following medical facilities exist in the township.

Hospitals in Myngyan TS

Above 100 beds	Other hospitals	Clinic	Health center	Child care	Drug store
3	0	33	8	1	12

(5) Electrification

Data on electrification in the township was not available.

4.2 Nyuang Oo Township

Information about administration such as population, number of household etc at township level are shown on the booklets titled “Basic Information of the Township” prepared by GAD under Ministry of Home Affairs (refer to Appendix-9), though is stipulated as a Confidential Document. As for detailed information about agriculture, data and information are available at township DOA and SLRD, while livestock data is also available in township LBVD as well. However, there are some gaps and missing data depending on the related offices, for example sown area, harvested are, production and climatic data, etc.

4.2.1 General Administration

(1) Administrative Division

Nyaung Oo Township is located at the central part of Mandalay Region composed of the following administrative division. One village tract is composed of 3.0 villages on the average. The distance from Mandalay, regional capital, is 220.8km (138miles)..

Administrative Division of Nyaung Oo TS

Village Tract	Ward	Village
74	17	219

(2) Budget and Organization of DOA Office

Annual budget allocated for the DOA township office for 2012/2013 is Kyat 65.0, which is largest in the related three townships. Organizational chart is shown in Appendix-14.

(3) Village map of the Township

Village map of Nyaung Oo Township is shown in Appendix-14.

(4) Population

1) Population and Population Density

As of may 2013, population in the township is 188,301, of which 78.6% in rural area and 21.4% in urban area. Population density is estimated at 127 persons/km^2, which is higher than 117 persons / km^2 of three region's average.

Population in Nyaung Oo TS

Urban	Rural	Total
40,330	147,971	188,301
21.4%	78.6%	100.0%

Source: GAD TS Office, 2013

2) Races

Most of population in the township is occupied by Bamar race as shown below with small number of ethnic minority like Shan race.

Races in Nyaung Oo TS

Kachin	Kayah	Kayin	Chin	Bamar	Mon	Rakhine	Shan	Others	Total
0	0	0	0	188,269	0	0	32	0	188,301
0%	0%	0%	0%	99.98%	0%	0%	0.02%	0%	100.0%

3) Population by Sex

Female population accounts for 53.9% in the township.

Population by Sex in Nyaung Oo TS

Male	Female	Total
86,826	101,475	188,301
46.1%	53.9%	100.0%

4) Economically Active Population

Economically active population above 18 years is 67% in the township.

Economically Active Population in Nyaung Oo TS

Economically Active Population above 18 yrs	Ratio to the total Population
129,951	69%

5) Population Working in Agricultural Sector

Agricultural sector is the basic industry also in Nyaung Township in which 59% of the population above 18 years is working in the agricultural sector.

Population Working in Agricultural Sector

Population working in agricultural sector	Ratio to the economically active population
110,933	59%

(5) Number of Household and Average Family Members

Total household of the township is estimated at 37,732, of which 73% is farmers who have cultivation rights given by the government. The remaining 27% is landless households consisting of casual labor for farm and non-farm. The average family members are 4.99 per family.

Number of Household and Average Family Members in Nyaung Oo TS

Farm Household	Landless		Others	Total Households	Average family members/family
	Non-farm	Causal labor			
27,391	10,341		0	37,732	4.99
73%	27%		0%	100.0%	

(6) Wage rate of Farm and Non-farm Labor

As of May 2013, wage rate in the township is Kyat 1,500/day/capita for farm labor, and Kyat 2,500/day/capita for non-farm labor, which are slightly lower than that of Myingyan Township. However the rate has increased at about 1.5 times as compared to the period of the Development Study by JICA in 2006 to 2010. The current wage of Kyat 1,500 per day is income level by which they can buy 2.1 to 1.1kg of white rice based on current rice prices as of May 2003 are Kyat 700/kg to Kyat 1,700/kg.

4.2.2 Agricultural Profile

(1) Acreage by Land type

Acreage by land type in the township is as shown below. Net sown area occupies 58.6% of the total area of the township.

Acreage by Land Type in Nyaung Oo TS (ac)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
280,622	4,588	7,378	164,478	0	66,936	37,242	0

(2) Cultivable Area

Cultivable area in the township is summarized below.. Yar land (upland) accounts for 95.4% and only 0.16% for paddy field, which means that the township is typical one of arid area in CDZ. Kyun is river terrace and Kaing means farmland on sandbank in a river but not exists in this township.

Cultivable Area in Nyaung Oo TS (ac)

Total Cultivated	Total Paddy	Total Yar Land *	Total Kaing *	Total Kyun *	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
164,478	256	156,875	0	7,142	205
100%	0.16%	95.38%	0.00%	4.34%	0.12%

(3) Irrigated Area

The ratio of irrigated area to cultivable area is only 18% in this township but it is the highest among the three township concerned, and also higher than 17.1% (2009/10) of the country. The main water source for irrigation is river water.

Irrigated Area in Nyaung Oo TS

Paddy (ac)	Upland (ac)	Total (ac)	Irrigated ratio (%)
3,184	26,428	29,612	18.0

Irrigation fee per acre per year is Kyat 6,000 for paddy and Kyat 3,000 for upland, and Kyat 9,000 in case of the summer paddy.

(4) Crops

The top five acreages in 2011/2012 by cereal crops, oil crops and pulses in Nyaung Oo Township are presented below as follows. The township is characterized as upland area with groundnut as major crop.

Crop Production in Nyaung Oo TS

Rank	Crop	Sown area(ac)	Harvested area (ac)	Production(basket)
1	Groundnut	74,098	74,098	2,416,041
2	Sesame	46,308	46,173	241,367
3	Pigeon pea	30,079	30,079	391,691
4	Green gram	29,401	29,401	367,398
5	Sorghum	11,068	11,068	151,168

The table below shows the acreages of vegetables and fruits in 2011-2012. Small area for these crops implies that the township do not have sufficient irrigation water though the ratio of irrigated area is 18% as mentioned above.

Vegetable and Fruits Production in Nyaung Oo TS

Rank	Crop	Sown area(ac)	Harvested area (ac)	Production(viss)
1	Vegetables	2,038	2,038	1,448,960
2	Toddy	2,765	2,053	6,026,850
3	Onion	636	636	2,864,000
4	Chili	514	514	102,800

Source: DOA TS Office, Nyaung Oo

(5) Number of Farm Household by Farm Size

Number of farm household by farm size is shown in the table below. Farm household with less than 10 acres accounts for 72.8% of the total. , The average farm size in the township is estimated at 6.00 acres per farm (164,478ac /27,391farm=6.00 ac/farm).

Number of Farm Household by Farm Size in Nyaung Oo TS

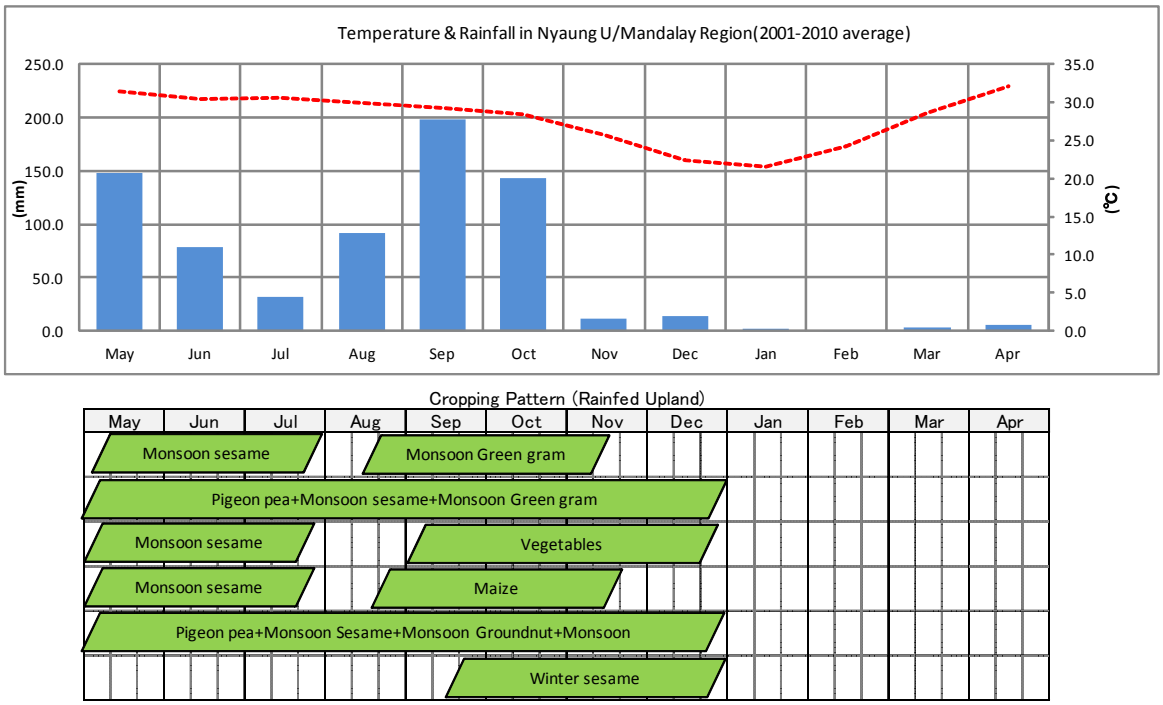
Less than 5 ac	5-10 ac	10-20 ac	Above 20 ac	Total
13,967	6,700	5,563	2,156	28,386
49.2%	23.6%	19.6%	7.6%	100.0%

Source) SLRD TS Office, Nyaung Oo

Note. The number of farm household of 28,386 does not accord with the total farm household of 27,391.

(6) Cropping Pattern and Climate

The relationship between climate conditions and cropping pattern in Nyaung Oo Township can be illustrated as shown in the figure below. Farming practices starts from the beginning of May when rainfall comes. Dry spell occurs from June to July when precipitation reduces drastically compared to other two townships even in rainy season. CSO's data on Statistical yearbook was used to illustrate the figure.



Cropping Pattern and Climate in Nyaung Oo TS

(7) Number of Livestock

Number of livestock in Nyaung Oo is shown in the Table below. Following cattle and water buffalo necessary for plowing, many goats are raised which is suitable in dry area (next to 120,600 of goats in Magway Township). This may be based on the reason that income from raising goats/sheep complements unstable income from crop cultivation under the condition of limited rainfall as compared to other Townships.

Number of Livestock in Nyaung Oo TS

Cattle	Buffaloes	Goats/sheep	Pigs	Chicken	Duck
98,051	192	90,550	20,355	575,638	459-

(8) Land Classification

According to the DOA, this type of land classification is no longer used, but the data collected during "The Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Program in the Central Dry Zone (CDZ) of the Union of Myanmar" are shown below. Type IV means "Foot-plain" which is hilly terrain with undulation. Thus, the Township is located in the land with hardships in terms of land classification.

Land Classification in Nyaung Oo TS (1,000 ac)

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
15	70	-	100	38	-	-	-	-	-

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

(9) Soil Type

The same as land classification, data on area by soil type in Nyaung Oo Township was collected during the said study are shown below. During the Study, soil maps and area data were only available at DOA offices at regional level but not at Township level.

Coil Type in Nyaung Oo TS (1,000ac)

Acreage by Soil Type (unit:Acre)									
Meadow Alluvial Soils (Gleysol)	Meadow Carbonate Soils (Gleysol)	Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Compact Soils (Vertisol)	Turfy Primitive Soils (Lithosol)	Primitive Crushed Stones Soils	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other	Total
57	197	1,504	607	173	353	403	531	107	3,932

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

"Catena of Savanna soil" which occupies most of cultivated land is categorized as "good/fair ("fair" better than "good")" and consists of clay soil and sandy loam with PH 7.5-8.5, according to "Soil Type and Characteristics of Myanmar" (DOA). This kind of soil is suitable for rice, cotton, vegetables, sugar cane, peanut, sesame and legumes.

(10) Crops Recommended in Nyaung Oo Township

The DOA in Nyaung Oo Township recommends the following crops:

Crops Recommended in Nyaung Oo Township

Crop	Promoting Varieties
Monsoon paddy	Sin Thu Kha, Manwa Thu Kha
Summer paddy	Manaw Thu Kha,

Pigeon pea	Khwe Chan Shwedinga, Monywar Shwedinga
Green gram	Yezin-11, Yezin-14
Groundnut	Kyaung Kon, Magway-11, Myanmar Pin Pyant
Sesame	Malthila, Red sesame
Chick pea	Karachi, ICCV-2

(11) Agricultural Disaster

Drought is reported to occur once in every two years. This frequency is higher than that of Myingyan Township, and it shows severe condition of limited rainfall in this Township.

(12) Constraints in Agriculture

The following issues are pointed out by Township DOA as constraining factor in agriculture. Issues related to water are raised also in this Township which shows seriousness of water shortage. Also, soil with low fertility and insufficient agricultural financing services are pointed out.

Constraints in Agriculture in Nyaung Oo TS

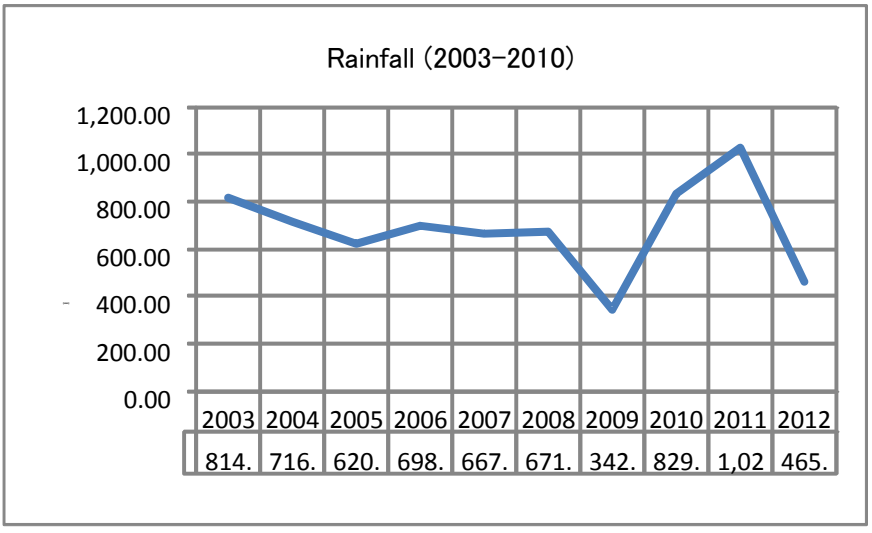
Issues on Agriculture
Lack in irrigation water, drought, unstable rainfall, low farm-gate price of crops, inadequate agricultural loans

4.2.3 Climate Condition

(1) Rainfall

Rainfall data from 2003 to 2012 collected at the Township DOA Office show that rainfall occurrences vary by year as shown in the Figure below, which shows the instability of rainfall in this township. The data shows that 2009 was the year of drought with rainfall amount equivalent to half of 10 year average (684.89mm). Also in year 2012, it was below the average. Such condition of unstable rainfall can be the reason of unstable farming income as it depends heavily on rain water, widening the income gaps (between the income of farmers who can avail tube-well and other farmers.)

Rainfall Pattern in Nyaung Oo TS



Source: DOA Nyaung Oo Township Office

(2) Highest and Lowest Temperature

The DOA of Nyaung Oo Township does not maintain data on the highest and lowest temperature.

4.2.4 Other information

(1) Major market

There are two markets in Nyaung Oo Township as indicated below. Both are public markets operated and maintained by the local authority. At these markets, not only grains, legumes, vegetable and fruits, but also daily commodities are sold.

Major Market in Nyaung Oo TS

Name	Location	Managing body	Public/private
Mani Si Thu	Center of the city	Municipality	Public
Tax free market	Center of the city	Municipality	Public

(2) Donor

The activities of the some donors are confirmed in Nyaung Oo Township. KOIKA is executing reforestation and environmental projects, while PACT Myanmar is implementing microcredit programs.

Activities of Donors in Nyaung Oo TS

Name	Sector	Period
KOICA	Environment (forestry)	-
PACT Myanmar	Micro-finance	-

(3) Educational Facilities

Schools are available in the Township, from primary school to high school. At primary school, one teacher takes care of 27 pupils on the average, while 38 students in middle school.

Educational Facilities in Nyaung Oo TS

Type	Places	Student	Teacher
Primary school	114	22,735	834
Secondary school	4	13,424	356
High school	5	4,213	124

(4) Medical Facilities

Medical facilities in the Township are as follows:

Medical Facilities in Nyaung Oo TS

Hospital with 100 beds	Other Hospital	Clinic	Rural health Center	Child care	Pharmacy
1	1	5	35	2	5~10

(5) Electrification

Electrification rate of the Township by type is indicated in the table below. The rate is 12.4% in urban area, however only 0.41% in rural area.

Electrification Rate of Nyaung Oo TS

Type	Electrification (%)	Beneficial Houses
Urban	12.36	7,117
Rural	0.41	235
Total	12.77	7,352

4.3 Magway Township

4.3.1 General Administration

(1) Administrative Division

Magway Township is located at the center of Magway Region. Administrative structure consists of divisions indicated below. One Village Tact consists of 3.5 Villages on the average.

Administrative Division of Magway TS

VT	Ward	Village
61	15	216

(2) Organization and Budget of Township DOA

Organizational chart of DOA in Magway Township is shown in Appendix-14. Annual budget of Township DOA Office is 34.0 Million Kyat in FY 2012/2013, which is the smallest among 3 Townships. Annual budget of Nyaung Oo Township DOA is 65.0 Million Kyat.

(3) Village Location Map within the Township

Village location map within the Township is shown in Appendix-10.

(4) Population

1) Population and Population Density

Population of the Township is 278,978 as of May 2013. About 72% reside in rural area, while 28% reside in urban area. Population density is 158 people/sq.km, which is higher than 117 people/sq.km, which is average of the three (3) Regions in the CDZ.

Population and Population Density in Magway TS

Urban Population	Rural Population	Total
78,162 人	200,816 人	278,978 人
28.0%	72.0%	100.0%

Source : GAD TS Office, 2013

2) Population by Ethnic Group

Population by ethnic group, though data is limited in urban area, is shown in the table below. The data shows 95.4% of urban population is Barmar. Though the population is limited, more than 7 ethnic groups such as Shan, Kachin are mixed in the area.

Population by Ethnic Group in Magway TS

Kachin	Kayah	Kayin	Chin	Bamar	Mon	Rakhine	Shan	Others	Total
97	80	204	180	74,572	60	313	190	2,466	78,162
0.12%	0.10%	0.26%	0.23%	95.41%	0.08%	0.40%	0.24%	3.15%	100.0%

3) Population by Sex

Women account for 52.2 percent of the total population.

Population by Sex in Magway TS

Male	Female	Total
133, 484	145,502	278,986
47.8%	52.2%	100.0%

Note : Total number does not match with total population

4) Population by Economic Activities

Labor force or economically active population over the age of 18 is 73%.

Economically Active Population in Magway TS

Economically Active Population above 18 yrs	% to the total population
202,747	72.7%

5) Labor Force in Agricultural Sector

More than half, 54% of the labor forces over the age of 18 are in agricultural sector. This means, major industry also in this township is agriculture.

Labor Force in Agricultural Sector in Magway TS

Population Working in Agriculture	% to the Total Population
140,629	50.4%

(5) Number of Household and Average Number of Person per Household

Total numbers of household are 53,787. Among them, 78% are “farmers” with right to cultivate given from the Government. The remaining, (22%) are the so-called “landless household” such as workers (agriculture, construction, etc), non-agricultural public servant, carpenters, etc.

Number of Household and Average Number of Person per Household in Magway TS

Farm Household	Landless Household		Others	Total Household	Averaged family members
	Non-farm	Casual labor			
41,727	12,060		0	53,787	5.19
78%	22%		0%	100.0%	

(6) Agricultural and Non-Agricultural Wage

Agricultural wage in Magway Township as of May 2013 is 1,500 Kyat/day per person, while non-agricultural wage is 2,000 Kyat/day per person, which is comparatively higher than agricultural wage. Considering the standard wage at the time of “The Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Program in the Central Dry Zone (CDZ) of the Union of Myanmar” from 2006 to 2010 were 700 Kyat for women and 1,000 Kyat for men. The present wage has reached 1.5 times higher than during the 2006-2010 periods. Since market price of rice as of May 2013 is in the range from 700 Kyat/kg for ordinal variety to 1,700 Kyat/kg for branded variety, only 1.1 to 2.1 kg of rice is affordable at dairy wage of 1,500 Kyat.

4.3.2 Agricultural Situation

(1) Area by Land Type

In Magway Township, area by land type is as shown below. Net sown area occupies 46% of total township area.

Land Type in Magway TS

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
436,623	5,600	0	201,175	0	1,978	174	227,696

(2) Cultivated Area

Details of cultivated area are shown in the Table below. Yar land occupies 95.3% of total cultivated area, while paddy occupies only 2.1%. This means, the Township is characterized as rain fed cultivation dominant area except paddy along Ayeyarwady River. “Kyun” and “Kaing” means cultivated land in river sandbar and in riverbed.

Cultivated Area in Magway TS (ac)

Total Cultivated	Total Paddy	Total Yar Land *	Total Kaing *	Total Kyun *	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
201,175	4,237	191,764	5,168	0	6
100%	2.11%	95.32%	2.57%	0.00%	0.00%

(3) Irrigated Area

Percentage of irrigated area against total cultivated land reaches only 4.5%, the lowest figure in three Townships it is much lower than 17.1% of national average (as of Oct. 2009). Irrigated area is concentrated in paddy. Irrigation water charge is 9,000 Kyat/ac/year for paddy, and 3,000 Kyat/ac/year for field crops.

Irrigated Area in Magway TS

Paddy(ac)	Upland(ac)	Total(ac)	Ration of Irrigated Area (%)
9,084	0	9,084	4.5

5 top crops grain, oil crops and legumes planted in Magway Township (2011-1012) are as shown in the table below. Thus, this Township can be said as a Township of field farming agriculture represented by Groundnut production.

Crop Production in Magway TS

Rank	Crop	Sown Area (ac)	Harvested Area (ac)	Production (basket)
1	Sesame	181,081	180,748	2,676,201
2	Green gram	64,930	64,930	1,044,860
3	Groundnut	54,087	54,087	3,714,691
4	Pigeon pea	33,750	33,750	568,687
5	Sunflower	15,831	15,831	386,736

Situation of vegetables and fruits (2011-2012) are shown in table below.

Vegetable and Fruits Production in Magway TS

Rank	Crop	Sown Area (ac)	Harvested Area (ac)	Production (viss)
1	Vegetables	2,956	2,956	10,868,241
2	Onion	2,054	2,054	13,191,873
3	Toddy	1,610	814	260,480
4	Chili	284	284	156,839
5	Potato	201	201	1,126,605

Source : DOA TS Office, Magway

(2) Number of Farming Household by Size

Farm household with farmland between 8 to 10 ac., which is said to be a requirement to maintain farming, occupies 78.1%. An average farmland per household is 201,175ac. / 41,727 households = 4.82 ac. per household.

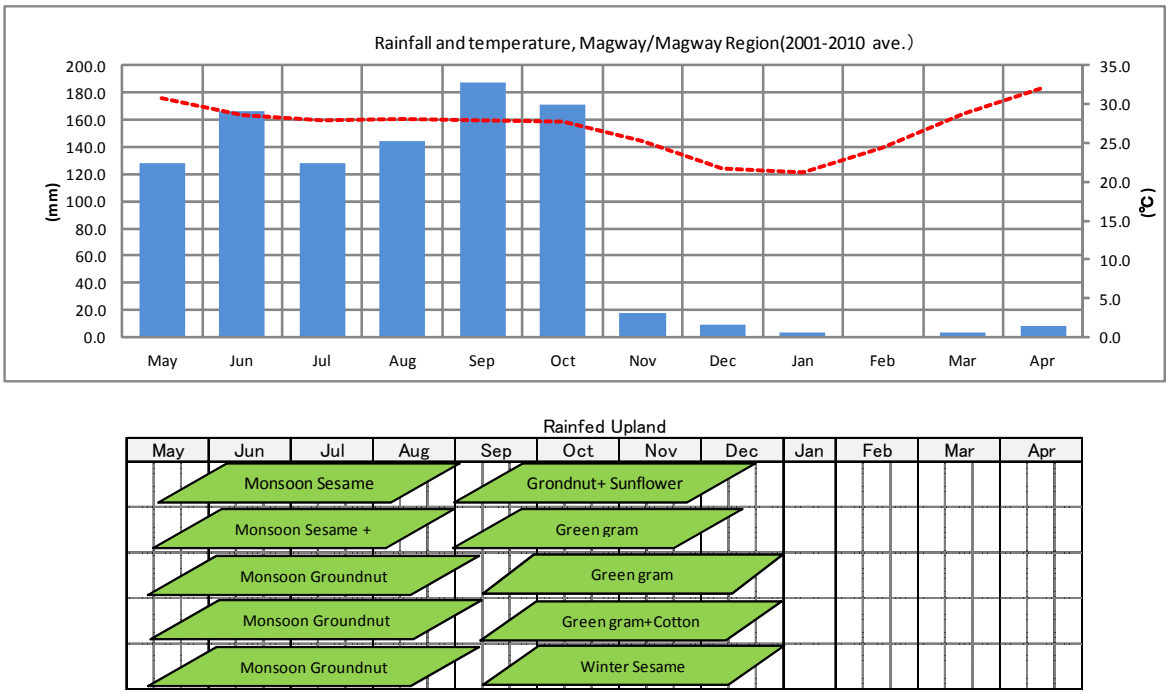
Number of Farming Household by Size in Magway TS

Less than 5 ac	5-10 ac	10-20 ac	Above 20 ac	Total
14,015	7,484	4,845	1,193	27,537
50.9%	27.2%	17.6%	4.3%	100.0%

Source : SLTD TS Office, Nyaung Oo
Note: Sum of detail household number (27,537) does not match with total number of household (41,727).

(3) Cropping Pattern and Climate

Table below shows relation between climate (rainfall amount and temperature) at rainfed field in Magway Township with its cropping pattern. Planting of crops starts in May when rainy season starts. Comparatively not as obvious as in Nyaung Oo, but phenomenon called dry spell occurs also in Magway. Climate data are quoted from Statistical Yearbook 2011 CSO.



Cropping Pattern and Climate in Magway TS

(4) Number of Livestock

Number of livestock in Magway Township is as shown in Table below. Together with cattle and water buffalo necessary for plowing, many goats are raised which is suitable in dry area (120,600 which is the largest number among three Townships). Same as in Nyaung Oo, this may be based on the reason that income of raising goats/sheep is complementing unstable crop income under limited rainfall amount.

Number of Livestock in Magway TS

Cattle	Buffaloes	Goats/sheep	Pigs	Chicken	Ducl
148,909	698	120,600	71,288	2,152,294	4,273

(5) Land Classification

Though the classification of land in this manner is no longer used according to DOA, data collected during "The Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Program in the Central Dry Zone (CDZ) of the Union of Myanmar" are shown below. Type IV, dominant in this Township, means "Foot plain" which is hilly terrain with undulation. Thus, except the farmland along Ayeyarwady River, the Township is located in the land with hardships in terms of land classification.

Land Classification in Magway TS (1,000 ac)

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
-	5	4	192	-	-	-	-	-	-

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

(6) Soil Type

The same as land classification, data on area by soil type in Magway Township as collected during "The Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Program in the Central Dry Zone (CDZ) of the Union of Myanmar, 2006-2010" are shown below. During the present Study, soil maps and area data were available at the regional level but not at the Township level at DOA Office.

Soil Type of Magway TS (1,000 ac)

Acreage by Soil Type (unit:Acre)									
Meadow Alluvial Soils (Gleysol)	Meadow Carbonate Soils (Gleysol)	Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Compact Soils (Vertisol)	Turfy Primitive Soils (Lithosol)	Primitive Crushed Stones Soils	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other	Total
67	2	133	-	-	170	12	-	52	436

Source. JICA Report on Poveety Reduction for CDZ, MAS (former)

Cultivated land mainly consists of Primitive Crushed Stones Soil and Catena of savanna soil. The former is suitable for pasture in hilly area and categorized as "fair (better than good), though it may require soil conservation. The later is categorized as "good/fair" and consists of sandy loam and clay soil of PH 7.5-8.5, according to "Soil Type and Characteristics of Myanmar" (DOA), and suitable for rice, cotton, vegetables, sugar cane, peanut, sesame and legumes. Catena of savanna soil is better as it is suitable for many crops.

(7) Crops Recommended in Magway Township

DOA in Magway Township recommends the following crops.

Crops Recommended in Magway Township

Crop	Promoting Varieties
Pigeon pea	Shwedinga, Nga San
Groundnut	Toontani, Sin-11, Magway-11
Sesame	Ba Pan, Shwe Ta Saak
Green gram	Yezin-1, Yezin-4, Yezin-11
Black gram	Yezin-3
Cotton	Chi Myin Shay War, War Gyi
Chick pea	Karachi

(8) Agricultural Disaster

Drought is reported to occur almost every year. However, according to DOA, it does not bring severe damage to agriculture.

(9) Constraints in Agriculture

The following issues are pointed out by Township DOA as constraining factor in agriculture. Issues related to water are pointed out also in this Township. Also, runoff of soil, low fertility of soil and insufficient agricultural financing services are pointed out.

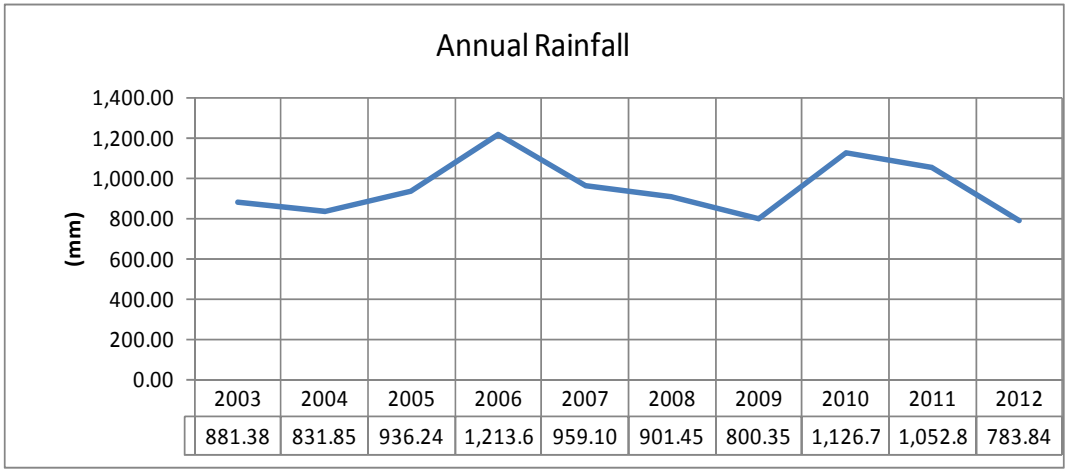
Agricultural Issues in Magway TS

Agricultural Issues
Lack in irrigation water, soil erosion, poor soil, low farm-gate prices, expensive agricultural chemicals, inadequate agricultural loans

4.3.3 Climate Condition

(1) Rainfall

Rainfall data of 10 years from 2003 to 2012 collected at Township DOA shows that it has been varied by year as shown in the following Figure, which shows unstable rainfall amount. The data shows that 10 year average is 948.7 mm, however, actual rainfall exceeded this average in only 4 years. It is judged that in the farming village located at inland of Ayeyarwady River; such condition of unstable rainfall can be the reason to generate unstable farming income.



Source : DOA Magway Township Office

(3) Highest and Lowest Temperature

DOA of Magway Township does not maintain data on the highest and lowest temperature.

4.3.4 Other information

(1) Major Market

There are three markets in Magway Township as indicated below. All are public markets operated and maintained by the local authority. At these markets, not only grains, legumes, vegetable and fruits, but also daily commodities are sold.

Major Market in Magway TS

Name	Location	Managing Body	Public/private
Myo Ma	Center of the city	Municipality	Public
Kan Thar	Center of the city	Municipality	Public
Yanpal	Northern part of the city	Municipality	Public

(2) Donor

The following three donors confirmed their activities (present and past) in Magway Township. PACT Myanmar's microcredit program covers also this Township.

Donors' Activity in Magway TS

Name	Sector	Period
CESVI	Livelihood improvement	-
PACT Myanmar	Micro finance	-
WFP	NA	NA

(3) Educational Facilities

Schools are available in the Township, from primary to High school. At primary school, one teacher takes care of 24 pupils on the average, while 34 students in middle school.

Educational Facilities in Magway TS

Type	Places	Student	Teacher
Primary school	172	19,111	788
Secondary school	10	6,480	188
High school	7	8,535	419

(4) Medical Facilities

Medical facilities in the Township are as follows:

Medical Facilities in Magway TS

Hospital with 100 beds	Other Hospitals	Clinic	Rural Health Center	Child care	Pharmacy
2	3	NA	49	1	NA

(5) Electrification

Data on electrification rate of the Township was not available.

CHAPTER 5 AGRICULTURAL PRODUCTION SURVEY

5.1 Mandalay Region

(1) Production of Major Crops

The five (5) top grain crops, oil crops and legumes planted in Mandalay Region (defined herein as entire Region) are as shown in the table below. Rice production is mainly practiced in irrigated area in Kyaukse.

Major Crops in Mandalay Region

Rank	Crop	Sown Area (ac)	Harvested Area (ac)	Production (bkt)
1	Sesame	1,174,168	1,174,033	6,986,948
2	Monsoon paddy	620,061	618,390	483,697
3	Pigeon pea	490,246	489,835	6530,948
4	Groundnut	342,334	342,249	15,148,126
5	Chick pea	213,134	213,134	3100,297

Situation of vegetables (2011-2012) is shown in table below. Mandalay is a major production area of Chili.

Major Vegetable in Mandalay Region

Rank	Crop	Sown Area (ac)	Harvested Area (ac)	Production (viss)
1	Chili	121,012	119,566	20,692,297
2	Onion	71,831	71,637	21,779,020
3	Tomato	51,824	51,824	102,129,811
4	Potato	1,984	1,984	5,130,456
5	Carrot	862	862	1,609,796

Source : DOA Regional Office, Mandalay

(2)Number of Farming Household by Size

Farm household with farmland less than 10 ac., which is said to be a requirement to maintain farming, occupies 85.1%. An average farmland per household is 3,317,508 ac. / 606,595 households = 5.47 ac. per household.

Number of Farming Household by Size in Mandalay Region

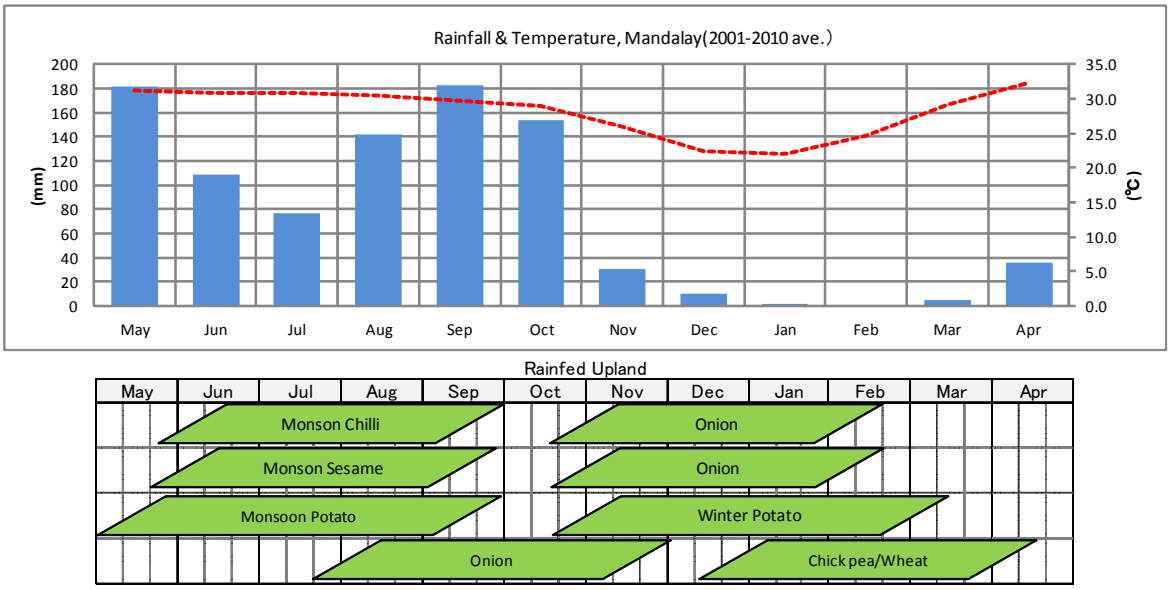
Less than5 ac	5-10 ac	10-20 ac	Above 20 ac	Total
333,180	183,318	702,39	19,858	606,595
54.9%	30.2%	11.6%	3.3%	100.0%

Source : DOA Regional Office, Mandalay

(3) Cropping Pattern and Climate

Table below shows relation between climate (rainfall amount and temperature) at rainfed field in Mandalay Region with its cropping pattern. Planting of crops starts in May when rainy season starts. In July, dry spell starts, reduction of rainfall amount during rainy season occurs, which makes rainfall amount in July less than half of that of May.

Common in rainfed farming in any Township; farmers decide timing of plowing/seeding by judging the condition of frequency and amount of rainfall and condition of soil moisture when rainy season starts, as per their experiences in the past. When dry spell prolongs, plants lose moisture and withered by lack of rainfall necessary for early stage of growing. Thus, timing of plowing/seeding is important, however, it is difficult to do this by just plowing by cow which is still common practice. No crop planting is done over dry season where underground water resources are not available. Climate data are lifted from the Statistical Yearbook 2011 CSO.



Cropping Pattern and Climate in Mandalay Region

(4) Land Use

A bigger area of 66.3% is cultivated in the uplands. . With the existence of irrigated area, paddy occupies 27.6%.

Land Use in Mandalay Region (ac)

Total Cultivable Area	Paddy	Upland	Kaing	Kyun	Others
3,317,508	916,828	2200780	169,064	0	30,836
100.0%	27.6%	66.3%	5.1%	0%	0.9%

Source : DOA Regional Office, Mandalay

(5) Access to Water Recourses

Irrigated area against cultivated area is 21.7%. Though not high, it is however higher than 20% in Sagaing Region and 17.9% in Magway. 88% of irrigated areas are planted to paddy, the priority crop in irrigated areas.

Access to Water Resources in Mandalay Region

Paddy (ac)	Upland (ac)	Total (ac)	Ratio of Irrigated Area (%)
635,112	84,181	719,293	21.7

(6) Soil Condition

Soil type of Mandalay Region is as indicated in the table below, and “good” is dominant in weak acidity, alkalinity and fertility. Result of soil analysis sampled during the first field survey will be made available in next study.

Soil Condition in Mandalay Region

	Land form	Soil Depth*	Texture	Soil pH	Class	Suitable crops	Acreage (1,000ac)
Meadow Alluvial Soils (Gleysol)	Plain	Thick	Silty clay, Clay	6.0-8.0	Fair	Rice, Veg., Pulses, Cotton, Sesame, Maize, Sugarcene	114
Meadow Carbonate Soils (Gleysol)	Plain	Thick	Clay loam, Clay	7.5-8.5	Fair	Chilli, Pelses, Sorghum, Rice, Cotton	394
Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Hill & Slope	Med	Sandy loam, Clay loam	6.5	Fair	Forest, Orchard	1,062
Light Forest Soils (Nitosol)	Hill & Slope	Med	Sandy loam, Clay loam	6.5	Fair	Forest, Orchard	806
Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Undurating upland plain	Thick	Sandy loam, Clay	7.5-8.5	Good	Rice, Veg., Pulses, Cotton, Sorgum, Sugarcene	3,008
Compact Soils (Vertisol)	Plain	Thick	Clay	7.5-8.5	Fair	Rice, Veg., Pulses, Cotton, Sorgum, Sugarcene	1,214
Turfy Primitive Soils (Lithosol)	Hill & Slope					Forest	346
Primitive Crushed Stones Soils	Hilly	Med	Loam, Clay			Pasture	706
Others							214

Source : “The Development Study on Sustainable Agricultural and Rural Development for Poverty Reduction Program in the Central Dry Zone (CDZ) of the Union of Myanmar”’2006-2010

(7) Farming Technology

Due to the existence of irrigated area and Mandalay as large place of consumptions, it may be said that intensive agriculture is being practiced as compared to the other two (2) Regions. Plowing is mainly by animals (cow/water buffalo), and use of tractor in some part. Based on information at Regional Office, water saving irrigation is not being practiced.

(8) Varieties of Crops Planted

The three (3) top varieties for each crop in Mandalay Region are as follows:

Varieties of Crops Planted in Mandalay Region

Crop	1	2	3
Monsoon paddy	Manawthuka	Ayeramin	Shwethwe Yin
Summer paddy	Manawthuka	Shwethwe Yin	Sin Thu Kha
Pigeon pea	Shwedinga	Nga San Pac	Yezin-3
Maize	Yezin-4	CP888	
Sesame	Sin-4	Yoe Seinn	Kanshi
Groundnut	SP121	Magway-10	Sin-6, 7, 11
Green Gram	Yezin-5	Yezin-1	Yezin-4
Sorghum			
Chickpea	Yezin-3	Karachi	Yezin-4
Sunflower	Sin Shwe Kyar-2	Sin Shwe Kyar-3	
Soybean			
Black gram			
***			
Onion	Shwe Phalar		

(9) DOA Seed Farm and DAR Research Farm

In Mandalay Region, there are Seed Farms under DOA, State Farms, Crop Research Centers and Satellite Farms under DAR.

Seed Farm of DOA

No.	Farm name	State/Region	Township	Total Acreage (ac)	Cultivating Area (ac)	Not Cultivating Area (ac)	Crops
1	Sink Kaing	Mandalay	Sinkkaing	98.51	88.11	10.40	Monsoon rice+summer rice
2	Mandalay	Mandalay	Mandalay	35.30	32.00	3.30	Monsoon rice+summer rice
3	Ma Hlaing	Mandalay	Ma Hlaing	251.09	207.64	43.45	Sesame, sunflower, pulses
4	Chaung Magyi	Mandalay	Pyaw Bwe	250.00	199.00	51.00	Rice, green gram, sunflower
5	Kyat Mauk Taung	Mandalay	Kyaunk Pa Daung	100.00	95.00	5.00	Rice, green gram, sunflower
6	Saik Htain	Mandalay	Kyaunk Pa Daung	115.68	80.00	35.68	Groundnut, sesame, pulses

Source. DOA, Nay Pyi Taw

State Farm of DOA

No.	State/Region	Township	Name of Farm	Acreage (ac)	Cultivable Acreage	Net Sown Area (ac)	Crops
1	Mandalay	Mandalay	Nan Shoe	4.34	2.00	1.50	Mango, Coconut
2		Myitthar	Mya Nadi	1,116.98	290.00	260.00	Mango
3		Pyin Oo Lwin	Yone Win	9.65	5.65	6.50	Lychee, Dragon fruit, Strawberry, Flower
4		Pyin Oo Lwin	Doe Kwin	45.00	25.00	8.71	Damson, Avocado, Dragon fruit, Castor, Lettuce
5		Pyin Oo Lwin	Thatkant	364.64	320.00	56.00	Damson, Lychee, Avocado, Asparagus, Cabbage
6		Pyin Oo Lwin	Kyun Dine	127.66	90.00	30.50	Damson, Hazel nut, Ginger, Chesnut
7		Pyin Oo Lwin	Pway Taung	70.00	67.00	65.50	Damson, Pear, Asparagus, Carrot, Avocado, Jackfruit, Dragon fruit, Castor, Maize
8		Tharzi	Indinethar	2,500.00	1,850.00	561.00	Mango, Jujube, Green gram, Pigeon pea, Maize, Sunflower
9		Tharzi	Hlaingtat (1)	272.72	238.48	66.00	Mango, Jujube, Dragon fruit
10		Tharzi	Hlaingtat (2)	490.00	280.00	187.00	Mango, Jetropha, Jujube, Green gram
11		Tharzi	Pyi Nyaung	500.00	324.50	51.75	Citrus, Orange, Jujube, Pinapple, Mango, Papaya, Pigeon pea
12		Kyaukpadaung	Sepauk	179.85	141.57	117.98	Grape, Mango, Dragon fruit, Guava, Jujube, Tamarind, Jackfruit, Tea
13		Patheingyi	Htonebo	228.00	200.00	198.00	Mango, Lychee, Pomelo, Dragon fruit
14		Meikhtila	Meikhtila	36.00	30.03	30.03	Mango, Jujube, Dragon fruit, Citrus, Grape
15		Nyuang Oo	Nyaung Oo	184.31	143.57	143.57	Mango, Citrus, Dragon fruit, Damson, Jujube
16		Kyaukpadaung	Poppa	32.73	27.00	27.00	Dragon fruit, Lychee, Graprfuit, Tamarind, Makadaemia, Guava, Mango, Jackfruit, Star fruit
17		Tharzi	Yeasatcha	30.00	24.50	28.50	Green gram, Sunflower, Jetropha, Mango

Source. DOA, Nay Pyi Taw

Number of Crop Research Center and Satellite Farms under DAR

	Crop Research Center	Satellite Farm
Mandalay region	2 **	5 *

*: Kyaukse, Myingyan, Tatkon, Sebin, Kyauktada

**: Nyaung Oo, Myithar

DAR Satellite Farms and their Mandate Crops

	Satellite Farms	Region/State	Mandate Crops
1	Kyaukse	Mandalay	Rice, chickpea, sunflower
2	Kyauktada	Mandalay	Rice, groundnut
3	Myingyan	Mandalay	Pigeon pea, sorghum, chick pea, groundnut
4	Tatkon	Mandalay	Maize, sunflower, groundnut, chick pea, green gram
5	Sebin	Mandalay	Rice, sunflower, maize, green gram, pigeon pea

5.2 Magway Region

(1) Production of Major Crops

The five (5) top grains, oil crops and legumes planted in Magway Region (defined herein as entire Region) in 2011-2012 are as shown in the table below. Rice production is mainly practiced in irrigated area in Kyaukse.

Major Crops in Magway Region

Rank	Crop	Sown Area(ac)	Harvested Area (ac)	Production(bakt)
1	Sesame	1368,684	1,366,955	151,050
2	Monsoon paddy	893,271	885,766	74,191,760
3	Green gram	696,361	696,314	1,102,057
4	Sunflower	517,769	517,755	142,627
5	Pigeon pea	437,017	436,449	7,699,219

Situation of vegetables (2011-2012) are shown in table below in the same manner.

Vegetable Production in Magway Region

Rank	Crop	Sown Area (ac)	Harvested Area (ac)	Production (viss)
1	Onion	49,162	49,082	29,145,480
2	Chili	25,928	28,828	7,802,233
3	Potato	5,258	5,258	30,509,689

Source : DOA Regional Office, Mandalay

(2) Number of Farm Households by Farm Size

The farm household with less than 10 ac account for 90.3% of the total. The average farm size is estimated at 4.54 ac per farm.

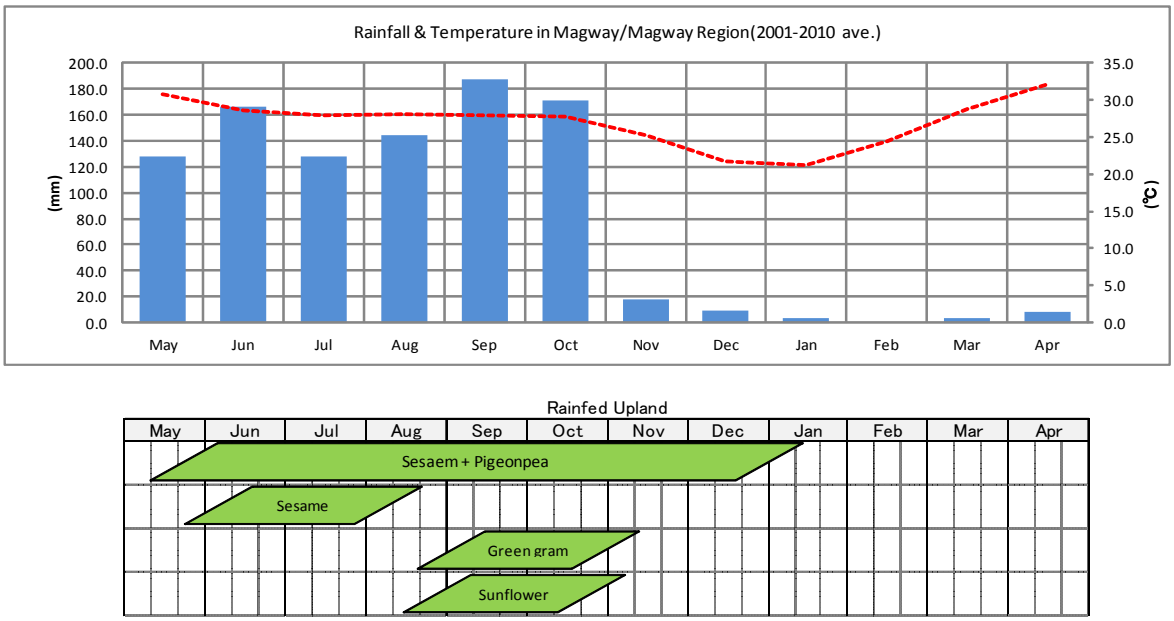
Number of farm households by Farm Size in Magway Region

Less than 5 ac	5-10 ac	10-20 ac	Above 20 ac	Total
458,935	132,089	52,594	11,171	654,789
70.1%	20.2%	8.0%	1.7%	100.0%

Source: DOA Regional Office, Magway

(3) Cropping Pattern and Climate

Cropping patterns of rainfed upland and climate condition is illustrated in the figure below. In the rainfed area, farming practices start from the beginning of May when the worst rain comes, and harvested during middle December. In the area without tube-well, cropping during the dry season is not observed. CSO's climate data was used to prepare the figure.



Cropping Pattern and Climate in Magway Region

(4) Land Utilization

Out of the total cultivable area, 72.7% is upland. There is irrigated area along the Ayeyarwady River where paddy farming is practiced accounting to 19.6%.

Land Utilization in Magway Region (ac)

Total Cultivable Area	Paddy	Upland	Kaing	Kyun	Others
2,975,276	582,576	2,164,466	210,350	0	17,844
100.0%	19.6%	72.7%	7.1%	0%	0.6%

Source: DOA Regional Office, Magway

(5) Accessibility to Water Sources

The ratio of irrigated area to total cultivable area is estimated at 17.9%, which is lowest compared to 20% of Sagaing Region and 21.7% of Mandalay Region. Of the total irrigated area, paddy field accounts for 94%, implying that rice production is also given top priority in the region.

Irrigated Area in Magway Region

Paddy(ac)	Upland(ac)	Total(ac)	Ratio of Irrigated Area (%)
499,569	32,019	531,588	17.9

(6) Soil Condition

The soil composition in Magway Region ranges from weak acid to alkarine, and soil fertility is mostly good. Stony soil is also observed in the area of 1,899,000 ac.

Soil Condition in Magway Region

	Land form	Soil Depth*	Texture	Soil pH	Class	Suitable crops	Acreage (1,000 ac)
Meadow Alluvial Soils (Gleysol)	Plain	Thick	Silty clay, Clay	6.0-8.0	Fair	Rice, Veg., Pulses, Cotton, Sesame, Maize, Sugarcene	485
Meadow Carbonate Soils (Gleysol)	Plain	Thick	Clay loam, Clay	7.5-8.5	Fair	Chilli, Pelses, Sorghum, Rice, Cotton	647
Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Hill & Slope	Med	Sandy loam, Clay loam	6.5	Fair	Forest, Orchard	1,422
Light Forest Soils (Nitosol)	Hill & Slope	Med	Sandy loam, Clay loam	6.5	Fair	Forest, Orchard	677
Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Undurating upland plain	Thick	Sandy loam, Clay	7.5-8.5	Good	Rice, Veg., Pulses, Cotton, Sorgum, Sugarcene	2,144
Compact Soils (Vertisol)	Plain	Thick	Clay	7.5-8.5	Fair	Rice, Veg., Pulses, Cotton, Sorgum, Sugarcene	92
Turfy Primitive Soils (Lithosol)	Hill & Slope						736
Primitive Crushed Stones Soils	Hilly	Med	Loam, Clay			Pasture	1,819
Othres							465

Source: JICA's Development Study in 2006 -2010

(7) Agricultural Technologies

Draft cattle are predominantly used in every farm in the upland. In some part of the area along the Ayeyarwady River, 4-wheel tractor and power tiller are used for paddy farming. In Magway Campus of YAU, hydroponic and micro-irrigation system are tested and demonstrated and operated and managed in cooperation with Tdh, Italian NGO, and these water-saving technologies are practically operated in the selected villages in Yenangyaung and Natmauk Townships.

(8) Crop Variety

The following table shows that top-3 varieties of crop planted in Magway Region.

Crop Variety in Magway Region

Crop	1	2	3
Monsoon paddy	Yadanartoe	Manawthuka	Sinthuka
Summer paddy	Yadanartoe	Sinthuka	
Pigeon pea	Shwedinga		
Maize	Suwun-3		
Sesame	Ya Thae Kyaw	Shweta Soak	Samonnet
Groundnut	Yezin-1	Yezin-4	Yezin-5
Green Gram			
Sorghum			
Chickpea			
Sunflower	Sin Shwe Kyar-2	Than Palar	
Soybean			
Black gram	Moe Nyo Gyi		

Source: DOA Regional Office, Magway

(9) DOA's Seed Farm and DAR's Crop Research Center

In Magway Region, DOA has one Seed Farm and one State Farm, while DAR has two Crop Research Centers. The former produces improved seeds, and the latter is for adaptability test of crops in the CDZ.

DOA Seed Farm

No.	Farm name	State/Region	Township	Total Acreage (ac)	Cultivating Area (ac)	Not Cultivating Area (ac)	Crops
1	Pwint Phyu	Magway	Pwint Phyu	135.47	124.77	10.70	Monsoon rice

Source. DOA, Nay Pyi Taw

DOA State Farm

No.	State/Region	Township	Name of Farm	Acreage (ac)	Cultivable Acreage	Net Sown Area (ac)	Crops
1	Magway	Nga Phoe	Netyekan	250.00	200.00	13.10	Castor, Tea, Avocado, Hazel nut, Orange

Source. DOA, Nay Pyi Taw

DAR has two Crop Research Centers in Konpontaung TS and Magway TS each. There is no Satellite Farm in Magway.

Crop Research Center and Satellite Farm in Magway Region

	Crop Research Center	Satellite Farm
Magway region	2 ***	-

***: Konpontaung, Magway

5.3 Sagaing Region

(1) Production of Major Crops

The following table shows the top five (5) crop including cereals, oil crops and pulses and beans in Sagaing Region. It should be noted that the "Sagaing" includes not only the CDZ area, but also other areas including irrigated area for paddy.

Major Crops in Sagaing Region

Order	Crops	Planted Area (ac)	Harvested Area (ac)
1	Monson paddy	1,780,848	1,775,597
2	Sesame	983,067	983,032
3	Groundnut	703,878	703,878
4	Pigeon pea	548,206	548,206
5	Green gram	543,423	543,423

Likewise, top-3 vegetables are shown in the table below (2011-12).

Vegetable Production in Sagaing Region

Order	Crops	Planted Area (ac)	Harvested Area (ac)	Production (viss)
1	Onion	31,467	31,467	13,465,660
2	Potato	7,546	7,546	3,242,008
3	Chili	4,306	4,306	1,264,735

Source: DOA Regional Office, Sagaing

(2) Number of Farm Household by Land Holding Size

91.1% of farmers hold less than 10 ac, which is the minimum scale to keep family life in the CDZ. Average land holding size is 4.66ac/HH (=4,582,592ac /983,657HH).

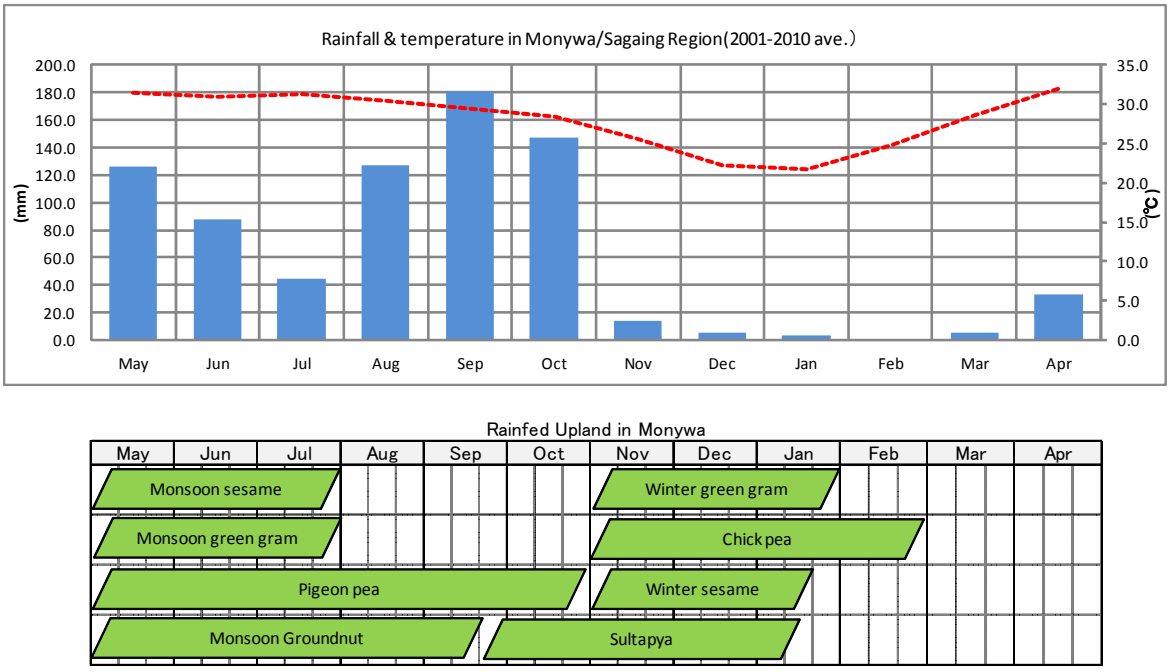
Number of Farm Household by Land Holding Size in Sagaing Region

Below 5 ac	5-10 ac	More Than 10 ac	Total
710,837	184,515	88,305	983,657
72.3%	18.8%	9.0%	100.0%

Source: DOA Regional Office, Sagaing

(3) Cropping Pattern and Climate

The following diagram shows cropping pattern and climate condition (monthly rainfall and temperature) under rainfed condition in Sagaing Region. Planting starts in May when monsoon starts, and Dry Spell is observed in July. Data on climate condition is lifted from the Statistical Yearbook 2011 published by CSO.



Cropping Pattern and Climate in Sagaing Region

(4) Land Use

53.1% of cultivated area is dry field (Yar), and 37% is paddy field including irrigated area. Among three Regions in the CDZ, Sagaing is superior to agricultural production.

Land Use in Sagaing Region

Total Cultivated Area	Paddy Field (Le)	Dry Land (Yar)	Riverbank (Kaing)	Towhead (Kyun)	Others
4,582,592	1,693,358	2,435,184	337,795	0	116,255
100.0%	37.0%	53.1%	7.4%	0%	2.5%

Source: DOA Regional Office, Sagaing

(5) Access to Water Resources

Irrigated area account for 20% of total cultivated area, and the figure is close to 21.7% in Mandalay. Paddy field account for 89.7% of irrigated area and the figure is also close to that of Mandalay (88%). The figure indicates that paddy is considered as important crop in the irrigated area.

Irrigated Area in Sagaing Region

Paddy Field (ac)	Dry Land (ac)	Total (ac)	Irrigated Area (%)
821,153	94,339	915,492	20.0

(6) Soil Condition

Topography in Sagaing Region varies from plain to hilly area, where soil condition also varies from acescence to alkalinity, and soil fertility is dominant in "good". This condition allows farmers to grow rice, pulses and beans, and vegetables.

Soil Condition in Sagaing Region

	Land form	Soil Depth*	Texture	Soil pH	Class	Suitable crops	Acreage (1,000 ac)
Meadow Alluvial Soils (Gleysol)	Plain	Thick	Silty clay, Clay	6.0-8.0	Fair	Rice, Veg., Pulses, Cotton, Sesame, Maize, Sugarcene	113
Meadow Carbonate Soils (Gleysol)	Plain	Thick	Clay loam, Clay	7.5-8.5	Fair	Chilli, Pulses, Sorghum, Rice, Cotton	687
Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Hill & Slope	Med	Sandy loam, Clay loam	6.5	Fair	Forest, Orchard	22
Light Forest Soils (Nitosol)	Hill & Slope	Med	Sandy loam, Clay loam	6.5	Fair	Forest, Orchard	433
Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Undurating upland plain	Thick	Sandy loam, Clay	7.5-8.5	Good	Rice, Veg., Pulses, Cotton, Sorgum, Sugarcene	1,733
Compact Soils (Vertisol)	Plain	Thick	Clay	7.5-8.5	Fair	Rice, Veg., Pulses, Cotton, Sorgum, Sugarcene	925
Turfy Primitive Soils (Lithosol)	Hill & Slope						80
Primitive Crushed Stones Soils	Hilly	Med	Loam, Clay			Pasture	207
Others							3,177

Source : "The Development Study on Suitable Agricultural and Rural Development for Poverty Reduction Programme in the Central Dry Zone of the Union of Myanmar: 2006-2010"

(7) Farming Technology

20% of cultivated area is irrigated area where paddy is dominant but pulses and beans, cotton and other crops are also planted. Tube-well irrigation for mostly fruit tree is also observed in some area in dry land. Watermelon, cucumber and tomato are grown under irrigation condition with intensive farming. For land cultivation, animal use is the most common, but tractor is introduced in some area. According to Regional Office of DOA, water saving irrigation is not practiced in this area. In upland area including Ayadaw TS, drought tolerant crops such as Pigeon Pea is planted to cope against dry condition.

(8) Crop Variety

Annual rainfall is different between South and North in Sagaing Region. In Southern area, annual rainfall is 700 to 800mm, whereas in Northern part of the Region, annual rainfall is 1,000 to 1,300mm. Also, 20% of cultivated land is irrigated area in this Region. The following table shows top-3 crop variety grown in Sagaing Region.

Crop Variety in Sagaing Region

Crop	1	2	3
Monsoon paddy	Shwe Bo San	Ayeraming	Sin akri-3
Summer paddy	IR-744	Shwe Thwe Yin	Sin New Yin
Pigeon pea	Monywa Shwe dinga	Kywe Chan Shwedinga	Nga San (red)
Maize	CP888	Shwe Wah-3	
Sesame	Sinpadanar-3	Yoe Sain	Shat Kalay
Groundnut	SP121	Sinpadanar-11	Magway-10
Green Gram	Yezin-11	Yezin-14	
Sorghum	Shweni	Waithar Li	
Chickpea	Yezin-8	Yezin-6	Yezin-3
Sunflower	Sin Shwekyar-3	Yezin-1	Sinshwekyar-2
Soybean	Yezin-4	Local variety	
Black gram			
***			
Onion	Shwe Phalar		

Source: DOA Regional Office, Sagaing

(9) DOA's Seed Farm and DAR's Satellite Farm

There are seven (7) Seed Farms under DOA in Sagaing Region, but no Satellite Farm exists. DAR has two Satellite Farms, but no Crop Research Center in this Region, where crop adaptabilities for Rice, Chick Pea and Pigeon Pea are tested and studied.

DOA Seed Farm

No.	Farm name	State/Region	Township	Total Acreage (ac)	Cultivating Area (ac)	Not Cultivating Area (ac)	Crops
1	Kaye Mon	Sagaing	Monywar	306.00	248.00	58.00	Pigeon pea, sesame sunflower
2	Chi Par	Sagaing	Shwebo	82.00	72.00	10.00	Monsoon rice, summar rice
3	Gway Kone	Sagaing	Khin Oo	53.26	40.00	13.26	Monsoon rice, summar rice
4	Kantbalu	Sagaing	Kantbalu	400.00	334.00	66.00	Maize, pigeon pea, green gram
5	Maye Mon	Sagaing	Kantbalu	1,314.45	800.00	514.45	Maize, soybean, pulses
6	Wattoe 1	Sagaing	Tantse	1,862.00	1,640.00	222.00	Maize, groundnut, pulses
7	Wattoe 2	Sagaing	Tantse	1,863.00	600.00	1,263.00	Maize, groundnut, pulses

Source. DOA, Nay Pyi Taw

DAR Satellite Farm

	Satellite Farms	Region/State	Mandate Crops
1	Pangon	Sagaing	Rice , wheat, chickpea
2	Zaloke	Sagaing	Wheat, chickpea, pigeon pea, rice

5.4 Nay Pyi Taw

(1) Production of Major Crops

Nay Pyi Taw Council Area locates Southern part of the Study Area, and rich in rainfall with record of 1,000 to 1,200mm per annum, quite different from typical dry area such as Nayung Oo. Irrigated area account for 28.3%, the highest figure among four Regions surveyed. In recent year, land consolidation for mechanical farming is introduced in this area. Top-5 planted crops in 2011-2012 including cereals, pulses and beans, and oil crops, are shown in table below. Paddy is mainly grown in irrigated area in Kyaukse.

Major Crops in Sagaing Region

Order	Crops	Planted Area (ac)	Harvested Area (ac)	Production (bakt)
1	Monsoon paddy	163,206	168,109	13,962,863
2	Black gram	67,778	67,767	130,221
3	Green gram	67,402	67,402	1,107,375
4	Sesame	59,005	59,005	480,546
5	Groundnut	46,853	46,853	2,348,934

Top-5 planted vegetables in 2011-2012 are also shown in table below.

Vegetable production in Saganig Region

Order	Crops	Planted Area (ac)	Harvested Area (ac)	Production (viss)
1	Chili	5,055	5,055	1,109,271
2	Potato	1,783	1,783	9,892,000
3	Onion	1,491	1,491	4,520,340

Source: DOA Regional Office, Sagaing

(2) Number of Farm Household by Land Holding Size

95.2% of farmers hold less than 10 acre, which is the minimum scale to keep family life in the CDZ. Average land holding size is 5.28 ac/HH (=277,400ac /52,509HH).

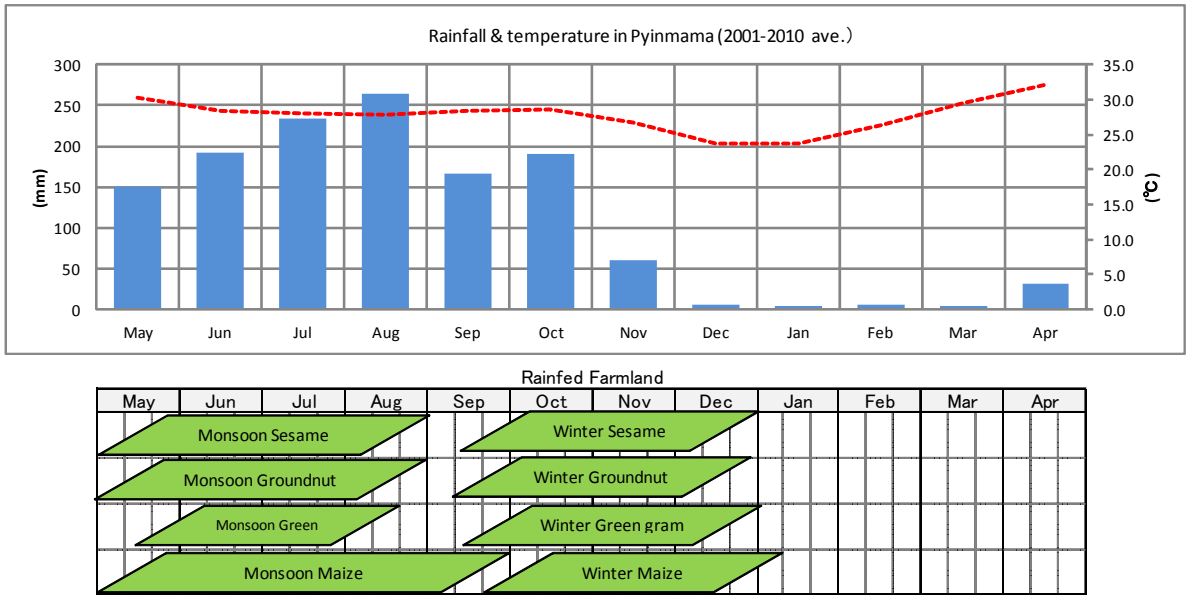
Number of Farm Household by Land Holding Size in Sagaing Region

Below 5 ac	5-10 ac	More Than 10 ac	Total	Below 5 ac
40,426	9,578	2,165	340	52,509
77.0%	18.2%	4.1%	0.6%	100.0%

Source: DOA Nay Pyi Taw Council Area, Nay Pyi Taw

(3) Cropping Pattern and Climate

The following diagram shows cropping pattern and climate condition (monthly rainfall and temperature) in Pyinmana, which is close to Ney Pyi Taw. The data shows that this area has more rainfall, and has different rainfall pattern from the Regions in CDZ. Data on climate condition is taken from the Statistical Yearbook 2011 published by CSO.



Cropping Pattern and Climate in Sagaing Region

(4) Land Use

Different from other three Regions, paddy field is dominant in the area, which makes up 58% of cultivated land.

Land Use in Sagaing Region

Total Cultivated Area	Paddy Field (Le)	Dry Land (Yar)	Riverbank (Kaing)	Towhead (Kyun)	Others
277,400	160,634	115,259	0	0	1,507
100.0%	58.0%	41.5%	0%	0%	0.5%

Source: DOA Council Area Office, Nay Pyi Taw

(5) Access to Water Resources

Irrigate area makes up 28.3% of cultivated land, and the figure is the highest among four regions studied. Paddy field account for 88% of irrigated area, and paddy is considered as important crop in the irrigated area.

Irrigated Area in Sagaing Region

Paddy Field (ac)	Dry Land (ac)	Total (ac)	Irrigated Area (%)
78,623	0	78,623	28.3

Source: DOA Council Area Office, Nay Pyi Taw

(6) Farming Technology

In irrigated area, cultivator and tractor are introduced in addition to traditional animal force. Irrigation Department (ID) implements land consolidation project for mechanical farming in this area. According to DOA office in the Council Area, water saving irrigation is not introduced in this area.

(7) Crop Variety

The following table shows top-3 crop variety grown in Ney Pyi Taw.

Crop Variety in Sagaing Region

Crop	1	2	3
Monsoon paddy	Manawthuka	Sin Thu Kha	Pearl Thwe
Summer paddy	Shwe Thwe Yin	Manau Thuka	
Pigeon pea	Shwedinga		
Maize	CP-888	8	
Sesame	Sinyadanar-3	Red sesame	25/160
Groundnut	SP-121	Sinpaddaythar-7	
Green Gram	Yezin-5	Yezin-9	
Black gram	LBG-17	Yezin-3	
Chickpea	ICCV-2	Yezin-4	
Sunflower	Sinshwekyar-3	Yezin hybrid-1	
Lablab bean	Shwe Yinmar	Shwe Kyun	

(8) DOA's Seed Farm and DAR's Crop Research Center

Neither State Farm of DOA nor Crop Research Center of DAR exists in Nay Pyi Taw Council Area.

CHAPTER 6 INDIVIDUAL FARM HOUSEHOLD SURVEY

6.1 General

Farm household survey was carried out in townships of Myingyan, Magway and Nyaung Oo for 240 farmers, 20 farmers each in the 12 villages. Contents of the questionnaire composed of basic information of each farmer, agricultural technologies, and others. Questionnaire was used for the conduct of the survey where farmers were interviewed by hired interviewers in the following villages shown below, which were selected in cooperation with DOA township offices. Out of 240 farmers, 70 farmers are the contact farmers.

Sample Villages of Individual Farm Household Survey

	Sample Villages				Sample farmers	Contact farmers
	Name	Township	District	Region		
1	Shwe Twin	Nyaung Oo	Mandalay	Mandalay	20	2
2	Thant Sin Kyal	Nyaung Oo	Mandalay	Mandalay	20	7
3	Taung Ba	Nyaung Oo	Mandalay	Mandalay	20	7
4	Tett Ma	Nyaung Oo	Mandalay	Mandalay	20	3
5	Ba lone	Myingyan	Myingyan	Mandalay	20	7
6	Chay Say	Myingyan	Myingyan	Mandalay	20	9
7	Nyaung Pin	Myingyan	Myingyan	Mandalay	20	5
8	Zee Pin Tan	Myingyan	Myingyan	Mandalay	20	6
9	Sai Kya	Magway	Magway	Magway	20	6
10	Shar Pin Hla	Magway	Magway	Magway	20	7
11	Kone Gyi	Magway	Magway	Magway	20	6
12	Nyaung Kan	Magway	Magway	Magway	20	5
Total					240	70

6.2 Basic Information on Farmers

(1) Family Members

The average family members of farm households are calculated at 5.15 persons, of which 2.51 persons are engaged in agricultural production. Most of the head of households are male-headed but three are female-headed households.

(2) Farm Size and Cultivation Right

The averaged farm size of the 240 samples is estimated at 15.4 ac, comprising 14.4 ac of upland and 1.0ac of paddy field, and 99 % of them hold the cultivation right.

Farm Size and Cultivation Right

Village	Ave. farm size (ac)	Upland(ac)	Paddy(ac)	Cultivation right (%)
Shwe Twin	9.2	6.6	2.6	85%
Thant Sin Kyal	17.2	16.9	0.3	100%
Taung Ba	16.0	16.0	0.0	100%
Tett Ma	11.1	11.1	0.0	100%
Ba lone	16.8	10.5	6.3	100%
Chay Say	19.6	19.6	0.0	100%
Nyaung Pan	13.2	11.7	1.5	100%
Zee Pin Kan	15.8	15.4	0.4	100%
Sai Kya	18.9	18.3	0.6	100%
Shar Pin Hla	15.3	15.0	0.3	100%
Kone Gyi	13.5	13.5	0.0	100%
Nyaung Kan	18.1	18.1	0.0	100%
Average	15.4	14.4	1.0	99%

(3) Income Sources of Farmers

Some 94.2 % of the sample farmers are dependent on agriculture, with many farmers having additional sources of income sources such as remittance, construction work and salary from the government.

Income Source of Farmers

Agriculture	Farm work	Transp-ortation	Const. work	Livestock	Teacher	Official	Retail	Middle-eman	Carpe-nter	Rem-ittance	Others
94.2%	3.3%	0.8%	7.9%	4.2%	4.6%	7.1%	0.8%	0.8%	5.0%	10.4%	2.5%

(4) Annual Incomes

The averaged annual household income of the samples is estimated at Kyat 3.62 million per household, of which 88.4 % is from agricultural production as shown below.

Average Annual Household Income

Agriculture	Farm work	Transp-ortation	Const. work	Livestock	Teacher	Official	Retail	Middle-eman	Carpe-nter	Rem-ittance	Others
88.4%	0.6%	0.2%	2.3%	0.5%	0.7%	2.3%	0.1%	0.1%	1.5%	3.0%	0.3%

(5) Livestock

Out of 240 respondents, 221 farms raise cattle/buffaloes, with six farmers also raising chicken in addition. The average number of cattle/buffaloes necessary for farm practices is 3.3 head per farm. A pair of cattle/buffaloes is used for ploughing, harrowing and inter-cultivation. At present, agricultural mechanization is not yet common among the sample farms.

(6) Status of Self-sufficiency of Foods

The self-sufficiency of rice, beans and cooking oil are as shown below. However, considering that most of upland farmers do not produce paddy (cannot produce); the information about the self-sufficiency of rice is an open question. The reason for higher rate for cooking oil will be due to marketing oil crops such as sesame and groundnut at about 50% and keeping them at 50% for home consumption

Self-sufficiency of Basic Foods

Months on self-sufficiency	Rice	Pulses	Cooking oils
3 months	1	-	-
6 months	3	30	8
7months		-	1
8 months	-	2	-
10 months	1	-	
12 months	234	208	231

6.3 Information about Agricultural Technologies

(1) Cropping Patterns

The representative cropping patterns in three villages are shown below. Farm production on upland starts r during the onset of the first rain on May as seen on the patterns. There is dry spell between the first rain and second one. If period of the dry spell becomes longer, crops with lower drought tolerance will wither and die eventually depending on rainfall condition. Therefore, farmers in CDZ have coped with the dry spell and scarce rainfall by introducing drought-tolerant pigeon pea as intercrop. The growing period of pigeon pea is about seven months.

Cropping Pattern (Shwe Twin Village, Nyaung U Township)

Crop	Variety	May	June	July	August	September	October	November	December	January	February	March	April
Monsoon rice													
Pigeon pea													
Maize													
Groundnut													
Green Gram													
Onion													

Cropping Pattern (Thant Sin Kyal Village, Nyaung U Township)

Crop	Variety	May	June	July	August	September	October	November	December	January	February	March	April
Pigeon pea													
Sesame													
Groundnut													

Cropping Pattern (Taung Ba village)

Crop	Variety	May	June	July	August	September	October	November	December	January	February	March	April
Pigeon pea													
Sesame													
Groundnut													
Green Gram													

Cropping Patterns

(2) Traditional Cultivation Methods

Intercropping is the most popular countermeasure against scarce rainfall and drought in CDZ. As seen in the table, various combinations of crops such as Green gram + Groundnut, Groundnut +Pigeon pea, Pigeon pea + Sesame, Pigeon pea + sorghum are practiced on farm, and pigeon pea with higher drought tolerance is included in most cases. Out of 240 samples, 161 farmers (67%) are practicing intercropping for the purpose of "for more income". Intercropping is the countermeasure used to avoid risk of drought damage.

On the contrary, only 0.8 % of farmers (2 households) practices mixed cropping such as Maize+ Pigeon pea + Groundnut etc, and only one farmer has to rely on cropping of Pigeon pea + sunflower. In lowland, paddy + chick pea is popular.

Inter-cropping Method in the Study Area

Township	Village	Intercropping Crops
Nyaung U	Shwe Twin	Green gram + Groundnut
		Groundnut + Pigeon pea
	Thant Sin Kyal	Green gram + Pigeon pea
		Sesame + Pigeon pea
		Groundnut + Pigeon pea
	Taung Ba	Pigeon pea + Sesame
	Tett Ma	Pigeon pea + Sesame
		Pigeon pea + Groundnut
Myingyan	Ba Lone	Groundnut + Pigeon pea
		Chick pea + Sunflower
		Pigeon pea + Sesame
	Chay Say	Pigeon pea + Green gram
		Pigeon pea + Cotton
		Pigeon pea + Sesame
		Pigeon pea + Maize
		Maize + Cotton
		Pigeon pea + Groundnut
	Nyaung Pan	Pigeon pea + Sesame
		Pigeon pea + Sorghum
		Pigeon pea + Groundnut
	Zee Pin Kan	Pigeon pea + Groundnut
Magway	Sai Kya	Pigeon pea + Groundnut
	Shar Pin Hla	Green gram + Sesame
		Pigeon pea + Sorghum
	Kone Gyi	Green gram + Sesame
		Pigeon pea + Sorghum
		Groundnut + Sesame
	Nyaung Kan	Groundnut + Sesame

The rate of farms that practice rotational cropping is 59 farms (24.6%) of the total samples. The reasons for the rotational cropping are 1) to maintain soil fertility, 2) to cope with small farm size and so on. There are two patterns for the rotational cropping of 2-year rotation and 3-year one. In the latter case, groundnut in the first year, green gram in the 2nd year and sesame in the 3rd year is introduced systematically.

The reason why farmers develop the traditional cultivation method is farmers' lessons learned from trial and error process beyond generations under the rugged environments in CDZ, in addition to DAR's efforts.

(3) Renewal of Seeds

The results on the question on renewal of seeds of paddy, oil crops, pulses, fodder crops and vegetables are

as follows. It can be said that frequency of seed renewal for oil crops and pulses, main crops in CDZ, is very low due to higher rate for continuous use of seeds produced in their farms.

Frequency of Seed Renewal

Frequency	Paddy	Oil crops	Pulses	Forage	Vegetables
Never	8	172	199	34	0
Every year	10	23	16	2	0
Every 2 years	10	13	15	1	0
Every 3 years	13	12	10	0	0

(4) Constraints in the Agricultural Production

Many farmers raise issues about disease and insect damage along with issues on irrigation and rainfall conditions, implying that irrigation is the bottle neck of CDZ agriculture.

Constraints in the Agricultural Production

	Pest & insect	Expensive fertilizer	Drought	Flood	Erratic rainfall	Lack of money	Poor soil	Lack in cattle	Water shortage	Soil erosion
No.	190	77	162	6	166	49	22	4	78	3

For most farmers, farm inputs including fertilizers and pesticides are expensive. Following table shows current market price of fertilizers and pesticides for reference.

Market Price of Fertilizer and Pesticides

Summar Paddy			Monsoon Paddy		
Inpout	Unit	Price	Inpout	Unit	Price
Urea	50kg	22,887kyat	Urea	50kg	21,558kyat
TSP	50kg	18,289kyat	TSP	50kg	17,728kyat
Compound Fertilizer	50kg	17,094kyat	Compound Fertilizer	50kg	17,940kyat
Compost	1cart	2,408kyat	Compost	1cart	2,735kyat
Insecticide	1L or 1kg	10,448kyat	Insecticide	1L or 1kg	9,871kyat
Fungicide	1L or 1kg	9,160kyat	Fungicide	1L or 1kg	15,000kyat
Herbicide	1L or 1kg	10,814kyat	Herbicide	1L or 1kg	11,049kyat

Srouce: MarketveySurvey (August 2013)

(5) Damages and Countermeasures

Damages by type are shown below in which insect and pest damages are much more than that of drought. Farmers have coped with insect/pest damages by spraying agricultural chemicals but they have no countermeasures against scarce rainfall and drought.

Causes of Damage on Agricultural Production

	Pest & insect	Drought	Flood	Erratic rainfall	Soil erosion	Others
No.	191	169	6	96	2	0

(6) Irrigation Facilities

Among 12 villages surveyed only 40 farmers (16.7%) in two villages are equipped with systematic irrigation facilities implemented by ID. Water source for irrigation is river water in most cases. The total irrigated are of the beneficiaries are 191.0 ac, consisting of 116.5 ac for paddy and 74.5 ac for upland, which imply that objective crop for irrigation is paddy.

Irrigation Facilities

Irrigated farmers	40 farms (16.7%)	
Irrigated area	Upland：74.5 ac	Paddy：116.5 ac

(7) Management of irrigation Facilities and Water Charge

The beneficiaries of irrigation project by ID pay imposed water charge for the operation and maintenance of irrigation facilities by ID. The water charge is varied depending on village from Kyat 1,950 to Kyat 3,000/ac/year. No mutual work to manage irrigation facilities by beneficiaries is done.

There are some farmers who own tube-well dug by their investment, for which any legal permission from the governmental offices is not necessary according to farmers. Tube-well is managed individually, and there are some tube-well owners who serve irrigation water to other farmers around his tube-well by collecting water fee.

(8) Utilization of Irrigation facilities

In the two villages where irrigation water is available by ID projects, irrigation service cannot be used year round but only for rainy season according to beneficial farmers.

(9) Irrigation Methods

Gravity irrigation is dominantly done through main, feeder and tail-end canals in the irrigated villages. Inundated irrigation in paddy field, and cash crops by furrow irrigation method is used. Tube-wells on river side farms irrigate sesame, groundnut and others by furrow irrigation. Similarly tube-wells on rainfed upland irrigate onion, tomato, watermelon fruits such as citrus and mango, though their acreages are limited.

(10) Irrigated Crops (top five crops)

Paddy farming is given priority in irrigation areas, followed by groundnut and onion. However, 10 villages among 12 sample villages have no irrigation water by ID or WRUD. Most of villages in CDZ rely on rainfall.

(11) Water-saving Technologies and Countermeasures for Soil Erosion

There was no reply to the questions on the water-saving technologies, which will imply that securing water is given top priority than water-saving because they are in the places where irrigation water itself is difficult to get.

As to countermeasures against soil erosion caused by rainfall in sandy soil areas, four farmers apply contour farming and three farmers do compost.

(12) Crop Varieties

The top varieties by crops predominantly used in their farms are shown below.

Crop Varieties

Crops	Varieties (Top 3)		
	1	2	3
Monsoon paddy	Manawthuka	Pearl Thwe	
Summer paddy	Manawthuka	Pearl Thwe	
Pigeon pea	Thetgyi	Thetyin	Shwedinga
Maize	CP		

Sesame	Khanshi	Black	Red
Groundnut	Tontarni	Kyaung Kone	Vietnam
Chick pea	B2		
Green gram	Zotkalay	Yezin-6	
Cotton	Ngwe Chi-6		
Onion	Kyaw Min	Shwephalar	

As to reasons for selecting their preferable varieties, farmers give top priority on “marketability” except for paddy and cotton, followed by “taste”, “maturity”, “drought tolerance”, which will imply that farmers choose suitable varieties in conformity to fluctuating annual rainfall along with taking into consideration market demand and evaluation. As gleamed from their replies, it is estimated that “yield” is slightly considered in their prioritization.

Determinants of Variety Selection

Crop	Variety	Eating quality	Market-ability	Early maturity	Drought tolerant	Disease tolerant	High yield	No choice
Paddy	Manawthuka	38	36	1	2	3	1	1
	Pearl Thwe	19	20	–	–	–	–	–
Pigeon pea	Thetgyi	68	80	40	45	1	–	2
	Thetyin	92	132	78	103	12	1	6
Maize	CP	13	30	15	18	–	1	–
Sesame	Kanshi	86	105	73	22	1	–	2
	Black	49	64	39	37	2	–	–
	Red	71	83	63	32	6	–	–
Groundnut	Tontarni	152	171	134	133	1	4	1
	Vietnam	9	17	14	9	1	3	–
	Kyaung Kone	76	93	40	75	3	2	6
Green gram	Zotkalay	56	64	53	12	–	1	3
	Yezin-6	6	17	1	7	2	3	2
Sorghum	Kalar	40	48	19	30	21	2	4
Chick pea	B2	24	25	9	11	12	–	–
Onion	Kyaw Min	19	20	1	1	–	–	–
	Shwephalar	19	19	1	18	–	–	–
Tobacco	Burma	5	18	14	14	2	–	1
Cotton	Ngwechi-6	–	10	16	19	5	–	–

(13) Sown Area by Crop

The sown area of sample 240 farms can be ranked in the table below. Sesame, Groundnut, Pigeon pea is the top three crops. Although the ranking of crops in the sown area is varied depending on conditions of irrigation, soil, land slope, etc. of villager’s determination factor is availability of irrigation, which is considered to be a factor for decision of crops affecting farm income and crop yields too.

Sown Area by Crop

	Paddy	Pigeon pea	Sesame	Maize	Groundnut	Green gram	Sorghum	Chick pea	Onion	Potato	Tomato	Tobacco	Cotton
Sown area (ac)	106.3	464.6	1,425.0	180.5	1,206.0	391.0	182.0	70.0	59.0	0.0	0.0	70.0	106.0
Ranking	7	3	1	6	2	4	5	9	10	–	–	9	8

(14) Harvested Area

The ratio of harvested area to the sown area of 12 sample villages in 2011/2012 is estimated at 83.3 %. Most of farmers reply to be highest at 100% but lowest at 10% in small farms. This fact implies that harvesting is affecting seriously depending on farm conditions of slope and soil characteristics etc.

(15) Procurement of Seeds

Results of responses shows that farmers used own seeds for succeeding production in the farms. Sorghum seeds are sourced out from DOA (former MAS) and chick pea are bought in the local markets resulting in lower crop yields in the end.

Procurement of Seeds

Procured from	Paddy	Pigeon Pea	Sesame	Maize	Groundnut	Green Gram	Sorghum	Chick Pea	Onion	Potato	Tomato	Tobacco	Cotton
Own seeds	27	160	195	72	179	107	68	23	20	–	–	0	0
MAS/DOA	11	5	3	0	6	2	4	2	0	–	–	0	20
Local marke	2	19	49	1	52	11	1	1	0	–	–	0	0
Others	0	0	0	1	0	0	0	0	0	–	–	2	0
Total	40	184	247	74	237	120	73	26	20	0	0	2	20

(16) Frequency of Spraying Agri. chemicals

The frequency of spraying agricultural chemicals is 2 to 7 times per season for paddy, 1 to 8 times for oil crops and 1 to 7 times for pulses. Vegetable farmers use agricultural chemicals with more frequency than farmers cultivating cereal, oil crop and pulses.

(17) Farming Tools

Farming tools popularly used are centering on draft cattle/buffaloes. Among 240 sample farmers, 163 farmers (67.9%) use draft cattle. Power tiller with two wheels and 4-wheel tractor is not yet common in their villages and CDZ. On the other hand, sprayer for controlling insects and diseases is commonly used.

(18) Post-harvest Facilities

Some 22 farmers reply that there are warehouse that they can use, but not available for drying purposes probably because of sun-drying is popularly used in their own areas. Rice milling is mentioned as available by four farmers, and oil extracting facility is mentioned as available by 16 farmers.

6.4 Other Information about Farm Management

(1) Required Acreage of Farmland and Income to Feed Family

When farmers were asked as to what they consider as minimum farm size and minimum income to feed a family using one pair of cattle/buffaloes, most of farmers indicated that 8 to 10 acres are necessary to feed a family. . Farmer's reply on rough standards on this question is shown below. Minimum requirement will be varied depending on yields of crops on upland or paddy field, irrigated or not, etc.

Required Acreage of Farmland and Income to Feed Family

Minimum farm size per farm (ac)	Largest 32ac, smallest 1.0ac, ave. 12.0 ac
Minimum income (Kyat/farm household/month)	Largest 600,000, smallest 30,000, ave.142,438

(2) Crop Yield

The table below shows the crop yields of the sample farmers for three years. It is observed that there is a gap between the data of Statistical Yearbook of CSO in groundnut and chick pea when compared with the results of the survey.

Crop Yields of Sample Farmers

Yields of 12 villages

(Basket, viss/ac)

	Monsoon paddy	Summaer Paddy	Pigeon pea	Maize	Sesame	Gorundnut	Green gram	Sorghum	Chick pea	Onion	Potato	Tobacco	Cotton
2010	–	30.0	9.6	56.7	3.3	19.6	4.6	3.5	3.8	–	–	332.2	–
2011	–	–	11.6	62.7	32.1	18.1	4.2	2.7	3.8	–	–	332.2	–
2012	–	–	9.0	61.0	3.6	22.7	3.9	3.6	3.8	–	–	332.2	–

Yields of the Statistical Yearbook

(Basket, viss/ac)

	Paddy	Pigeon pea	Maize	Sesame (late)	Gorundnut (rain)	Green gram	Sorghum	Chick pea	Onion	Potato	Tobacco (dry)	Cotton (long)
2007/08	76	15	54	11	46	14	NA	16	3,596	3,579	302	242
2008/09	78	16	55	12	47	15	NA	17	3,755	3,662	341	368
2009/10	79	16	56	12	49	15	NA	17	3,800	3,658	332	441

Source : Statistical Yearbook, CSO

(3) Production Cost of Crops

The data on production cost of representative crops based on the result of the sample farmers are as follows. Excluding chick pea and groundnut labor costs necessary for weeding, harvesting and transportation etc account for higher share compared to about 10% of agricultural chemicals. Urea is the main fertilizer they use though is considered that there are farmers who do not use expensive fertilizers. It would be better compare the cost of production prepared by DOA township offices.

Production Cost of Crops (Kyat/ac)

Crop	Urea	TSP	Other ferti.	Agri-chemical	Labor	Seeds	Total
Monsoon paddy	23,476	12,700	0	4,084	74,983	15,780	131,023
	17.9	9.7	0	3.1	57.2	12.0	100.0
Pigeon pea	12,828	3,440	0	6,142	21,760	4,716	48,887
	26.0	7.0	0	12.6	44.5	9.6	100.0
Maize	7,007	0	3,887	2,585	23,401	4,518	41,397
	16.9	0	9.4	6.2	56.5	10.9	100.0
Sesame	8,457	5,088	1,047	4,517	31,383	7,606	58,098
	14.6	8.8	1.8	7.8	54.0	13.1	100.0
Groundnut	11,455	7,651	194	7,859	49,551	75,015	151,726
	7.5	5.0	0.1	5.2	32.7	49.4	100.0
Green gram	5,871	8,737	1,000	6,042	28,490	7,898	58,038
	10.1	15.1	1.7	10.4	49.1	13.6	100.0
Sorghum	9,643	1,235	955	2,083	20,825	10,819	45,560
	21.2	2.7	2.1	4.6	45.7	23.7	100.0
Chick pea	3,282	0	0	2,900	13,769	19,951	39,902
	8.2	0	0	7.3	34.5	50.0	100.0
Onion	10,667	10,333	0	4,667	26,000	23,000	74,667
	14.3	13.8	0	6.3	34.8	30.8	100.0
Tobacco	20,000	15,500	0	5,838	97,485	33,324	172,147
	11.6	1	0	3.4	56.6	19.4	100.0
Cotton	2,625	3,100	0	16,350	127,190	5,350	154,615
	1.7	2.0	0	10.6	82.3	3.5	100.0

(4) Net Profit of Crops

Net profit of crops is calculated based on formula [Gross income – Production Cost = Net Profit]. However these figures are their estimation not based on [input x unit price and yield x unit price]. When estimating, reply of “100%” was excluded but “0%” was taken into account. Though township offices of DOA also prepare the data on crop profitability every year detail is not shown as well.

Net Profit of Crops

Paddy	Pigeon pea	Maize	Sesame	Groundnut	Green gram	Sorghum	Chick pea	Onion	Tobacco	Cotton
56%	43%	51%	44%	41%	23%	19%	29%	53%	58%	76%

(5) Purpose of Cultivation

Cultivation purpose is considerably different depending on crops. For example, 97% of pigeon pea is for exporting due to less demand in domestic market. On the contrary, oil crops such as groundnut and sesame are for home consumption at about 60%, and home consumption of sorghum mainly for cattle is also high at 80%. Onion is cash crop mainly for selling.

Purpose of Cultivation

Crop	For sale（%）	For home use (%)
Paddy	31	69
Pigeon pea	97	3
Maize	67	33
Sesame	60	40
Groundnut	61	39
Green gram	73	27
Sorghum	20	80
Chick pea	86	14
Onion	98	2
Tobacco	100	0

(6) Farm Gate Price of Crops

Following table shows farm gate price of major crops. Farm gate price differs due to maturity, size, form, colors, moisture content, and oil content for example.

Farm Gate Price of Crops

	Paddy	Pigeon pea	Sesame	Groundnut	Green gram
Shwe Twin	4,875	12,500	1,900	8,375	20,455
That Sin Kyal	-	12,167	1,800	7,444	14,500
Taung Ba	-	16,125	2,315	16,129	17,692
Tett Ma	-	19,467	2,780	27,853	25,500
Ba Lone	50,000	16,773	2,675	8,744	20,000
Chay Say	-	16,300	2,000	10,583	28,429
Nyaung Pin	-	14,563	19,500	12,036	-
Zee Pin Tan	-	12,638	21,042	7,464	-
Sai Kya	16,500	18,250	2,451	16,900	18,200
Shar Pin Hla	8,000	17,433	30,813	5,375	21,167
Kone Gyi	-	16,406	31,974	6,266	-
Nyaung Kan	-	17,147	34,200	6,550	25,714

(7) Percentage of Marketing

Most farmers market their products except keeping some portion for their home consumption. The rate of marketing of their products differs crop by crop. Pigeon Pea has no demand in domestic market and most farmers sell all to local brokers for export purpose. On the contrary, sesame and groundnut is essential food for most Burmese as vegetable oil, and many sesame and groundnut growers market them only 50%, and keep rests for home consumption.

(8) Determination Factor of Selling Prices

There were 158 replies about farm-gate prices but out of them, 150 replies “always accept the prices that middlemen present”. Only two farmers reply “negotiation based on current market prices, which will imply that buyer’s market is predominant in the area. The reasons why farmers’ weak standpoint are farmers' strong incentive to gain cash immediately after harvesting, in addition to socio-economic relation with buyers including personal debt, limited alternative for selling, and lack of bargaining power due to limited volume.

(9) Markets

Major crops mainly for selling are distributed to local markets. There exist middlemen, traders in each township to deal with crop marketing, and farmer themselves transport crops to their warehouses. However, in some areas, where crops produce such as onion are plentiful, traders and middlemen go to villages to

purchase and transport crops.

(10) Buyers

Local buyers are the one who buy every kind of crops in the area. However, buyers of Yangon come to purchase Pigeon pea, green gram, sesame, groundnut, maize, chick pea, tobacco etc.

(11) Contract Farming

The sample survey, showed only two farmers under contract farming. One is cultivating onion under the condition of provision of materials and purchasing on current price.

(12) Annual Income

On the question on income, expenditure and debt, the farmers find it difficult to answer so that the responses gathered varied considerably depending on villages, and therefore the consideration on the reliability of the data. The table shows estimated annual income of a farmer.

Annual Income

Village	Township	Estimated income (Kyat/year/household)
Ba Lone	Myingyan	3,937,500
Chay Say	Myingyan	1,801,500
Nyaung Pin	Myingyan	1,175,000
Zee Pin Kan	Myingyan	3,710,000
Sai Ka	Magway	9,726,000

(13) Agricultural Loans

Out of 120 farmers of six villages, 92 farmers (77%) use agricultural loans, of which 79 % avail of institutional loans from the government, followed by 13 farmers availing from NGO's. Interest rates are 0.75% per month for institutional loan, 1.0% for NGO's as compared to 4 to 10% for private loan. The interest rate of the private loan is different depending on availability of mortgage. However, most of farmers have not enough saving to procure seeds and fertilizers for next season, resulting in borrowing money. The farmers consider private loan with higher interest rate because it is easier to borrow from the private lenders than that of the institutional lenders.. Middlemen/traders, Poeza in local name, are mainly providing private loans. However, if crop production is not good borrowers will shoulder more debt, which is considered to be a factor causing poverty in CDZ where rainfed farming is predominant.

Type of Agricultural Loan

Type	Reply	Interest (%/month)
Institutional	79	0.75
Private	3	4~8
Borrowing from relative	6	2.5~10
NGO's loan	13	1.0
Others	3	2.5

(14) Promising Crops

There were 57 replies on this question. Most consider paddy as promising to cultivate followed by onion. But both crops require irrigation water to cultivate. The reasons for cropping are "more income", "requirement of market", and "securing foods".

Promising Crops

Crops	Reply	Crop	Reply
Paddy	15	Honey melon	1
Onion	13	Rubber	1
Sugarcane	6	Tobacco	1
Cotton	5	Potato	1
Tomato	4	Maize	1
Chick pea	3	Wheat	1
Groundnut	3	Chili	1
Watermelon	2		

(15) Technologies that Farmers Want to Introduce

Regarding irrigation, farmers want to introduce drip irrigation, construction of canals, agricultural mechanization, introduction of quality seeds, technologies to increase yields and technologies to prevent insect and pest damage.

(16) Agricultural Supports from the Government that Farmer Want

As to governmental support on agriculture, farmers want irrigation project, agricultural mechanization, agricultural loans, distribution of quality seeds, distribution of cheap fertilizers, marketing (stable market), soil improvement and electrification etc. In particular, demand for irrigation and farm mechanization is higher.

CHAPTER 7 MARKETING SURVEY

7.1 Selection of Target Crops

Target crops selection was conducted aiming at carrying out supply chain survey. For this purpose, selection criteria, included 1) grown in the Central Dry Zone, 2) carrying comparative advantage in the domestic market, 3) carrying comparative advantage in the international market, 4) being priority crops of the government, and 5) target experiment crops of DAR. .

(1) Grown in the Central Dry Zone

Crops that are grown in the three Regions in the Central Dry Zone, in Sagaing, Mandalay and Magway, are regarded as basic indicator for crop selection. The following table shows crops grown in the CDZ, which includes cereals, oil crops, beans and pulses, kitchen crops, vegetables and industrial crops.

Crop Production in the CDZ (1,000t)

#	Crop Name	Production (1,000t)	#	Crop Name	Production (1,000t)	#	Crop Name	Production (1,000t)
1	Rice	7,338	10	Green Gram	703	19	Sugarcane	5,219
2	Wheat	138	11	Garden Pea	43	20	Cotton	497
3	Maize (Cob)	8,478	12	Pigeon Pea	707	21	Mulberry	2
4	Sorghum	198	13	Chick Pea	419	22	Coffee	1
5	Groundnut	885	14	Black Gram	143	23	Tea	7
6	Sesame	749	15	Chili	54	24	Jute	0
7	Sunflower	467	16	Onion	1,004	25	Rubber	0
8	Oil Palm	0	17	Garlic	51	26	Coconut	44,127
9	Nigar Seed	35	18	Potato	117			

Source: Myanmar Agricultural Statistics (1997/98-2009/10), 2011, CSO

(2) Carrying Comparative Advantage in the Domestic Market

Comparative Advantage is assessed based on production share in the domestic market in Myanmar. The following table shows crops which carry comparative advantage, dominant production share, in the domestic market, and among cereals, Wheat, Maize and Sorghum are identified. Likewise, groundnut, Sesame and Sunflower have dominant production share among oil crops, whereas Green Gram, Garden Pea, Pigeon Pea, and Chick Pea have comparative advantage among pulses and beans. Sugarcane, Cotton and Mulberry are also identified as crop which carries comparative advantage in the domestic market.

Production Share of Crops in the CDZ (1,000t)

#	Crop Name	Production Share	#	Crop Name	Production Share	#	Crop Name	Production Share
1	Rice	20%	10	Green Gram	53%	19	Sugarcane	55%
2	Wheat	79%	11	Garden Pea	76%	20	Cotton	96%
3	Maize (Cob)	62%	12	Pigeon Pea	93%	21	Mulberry	56%
4	Sorghum	95%	13	Chick Pea	97%	22	Coffee	12%
5	Groundnut	68%	14	Black Gram	8%	23	Tea	8%
6	Sesame	89%	15	Chili	46%	24	Jute	0%
7	Sunflower	67%	16	Onion	93%	25	Rubber	0%
8	Oil Palm	0%	17	Garlic	25%	26	Coconut	9%
9	Nigar Seed	43%	18	Potato	20%			

Source: Myanmar Agricultural Statistics (1997/98-2009/10), 2011, CSO

(3) Carrying Comparative Advantage in the International Market

The world ranks of production value of Burmese Crops are analyzed based on the FAO statistics. Sesame Seed production is the highest in the world, whereas Pigeon Pea and Chick Pea are 2nd and 5th respectively among countries in the grove. World ranking of production value of Groundnut is 6th, Garlic and Chili are 7th and 8 th, and Rice is 8th in FAO's 2011 statistics.

The World Rank of Burmese Crops (Production Value)

Rank	Commodity	Rank	Commodity	Rank	Commodity
1	Sugar crops, nes	7	Garlic	15	Cereals, nes
1	Sesame seed	7	Vegetables fresh nes	15	Peas, dry
2	Pigeon peas	7	Buffalo milk, whole, fresh	15	Cottonseed
3	Mustard seed	8	Indigenous Geese Meat	16	Sunflower seed
3	Beans, dry	8	Chillies and peppers, dry	16	Millet
4	Cow peas, dry	8	Rice, paddy	17	Tea
5	Chick peas	8	Other bird eggs,in shell	18	Onions, dry
5	Arecanuts	8	Jute	20	Soybeans
5	Other Bastfibres	10	Indigenous Buffalo Meat	20	Sugar cane
5	Indigenous Duck Meat	10	Plantains	21	Fibre Crops Nes
6	Groundnuts, with shell	11	Natural rubber	21	Indigenous Chicken Meat
6	Fruit Fresh Nes	12	Coconuts	23	Indigenous Goat Meat
6	Indigenous bird meat, nes	14	Cotton lint	25	Indigenous Pig meat

Source : FAOSTAT（2011）

The following tables shows the world ranks of production volume of Burmese crops, quoted from the same statistics above. Sesame Oil and Sesame Seed mark the world number one record, while Pigeon pea production marks the second. Likewise, production volume of Cowpea is 4th, Chick Pea is 5th, and Groundnut with shell is 6th.

The World Rank of Burmese Crops (Production Volume)

Rank	Commodity	Rank	Commodity	Rank	Commodity
1	Sugar crops, nes	5	Hides Wet Salted Buffaloes	8	Rice, paddy
1	Sesame oil	5	Biological Duck Meat	9	Goose and Guinea Fowl Meat
1	Sesame seed	5	Chick peas	9	Cheese of Skimmed Cow Milk
2	Beans, dry	5	Groundnut oil	10	Indigenous Buffalo Meat
2	Pigeon peas	5	Duck meat	10	Buffalo Hide
3	Sugar crop, nes	5	Indigenous Duck Meat	11	Cotton Seed Oil
3	Indigenous bird meat, nes	6	Groundnuts, with shell	14	Cotton Lint
4	Mustard seed	6	Fruit Fresh Nes	15	Cotton Seed
4	Cow peas, dry	7	Vegetables fresh nes	17	Sunflower Oil
4	Bird meat, nes	7	Garlic	21	Sugarcane
5	Other Bastfibres	8	Chillies and peppers, dry		
5	Arecanuts	8	Indigenous Geese Meat		

Source: FAOSTAT（2011）

(4) Being Priority Crops of the Government

The priority crops are identified in the Myanmar Agriculture in Brief 2012 (August 2012), and are as follows;

- Cereals: Rive and Maize
- Oil Crops: Groundnut, Sesame and Sunflower
- Pulses and Beans: Black Gram, Green Gram and Pigeon Pea
- Industrial Crops: Sugarcane and Cotton

(5) Being Target Experiment Crops of DAR

Minutes of Meeting of The Detailed Planning Survey on The Japanese Technical Cooperation for The Project for Development of Water Saving Agriculture Technology in The Central Dry Zone in The Government of The republic of The Union of Myanmar, signed between DAP, DOA, DAR and JICA on February 29, 2012, stated that the crops and varieties for the Project will be identified based on the results of baseline study, while both side confirmed that the mandate crops of the three DAR Experiment Farms (Nyaung Oo, Magway, and Myingyan) should be considered as priority. The mandate crops of the three DAR Experiment Farms are as follows.

The Mandate Crops of the Three DAR Experiment Farms

#	Experimental Farm	Crop Name
1	Myingyan	Pigeon Pea、Groundnut、Sesame、Chick Pea
2	Nyaung Oo	Pigeon Pea、Groundnut、Sesame、Green Gram
3	Magway	Pigeon Pea、Groundnut、Sesame、Cowpea、Green Gram

Source: DAR

(6) Target Crops of the Supply Chain Study

Based on the above criteria, candidate of target crops for the supply chain study are selected by the JICA Survey Team. Then, the target crops are finally determined based on the discussion with DOA and DAR, and are shown in the table below. It should be noted that Mango, Jujube and Tamarind are nominated as potential fruits, in addition to watermelon at the meeting with DOA and DAR.

Target Crops of the Supply Chain Study

#	Category	Target Crops for Supply Chain Study
1	Cereals	Maize
2	Oilseed Crops	Groundnut, Sesame, Sunflower
3	Pulses	Green Gram, Pigeon Pea, Chick Pea
4	Industrial Crop	Cotton
5	Fruits & Vegetables	Onion, Watermelon

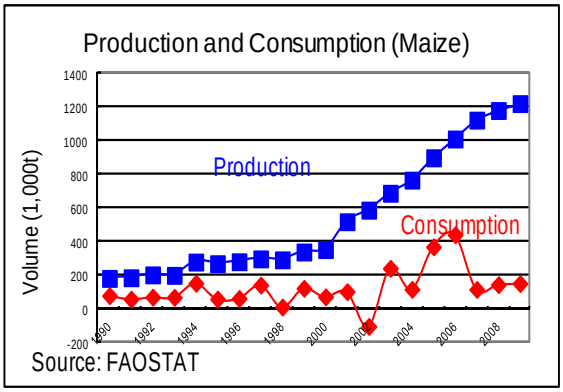
7.2 Characteristics of the Target Crops

7.2.1 Maize

(1) Production and Consumption

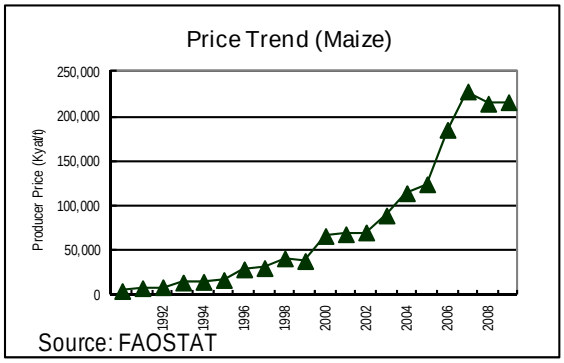
Maize has two planting season in Myanmar. Main production area of monsoon season is Shan, Bago, Magway and Nay Pyi Taw, where Maize is harvested during September and November, whereas major production areas of winter maize are Mandalay, Ayeyarwaddy, Meiktila and Kyingyan, where Maize is harvested during February

and March. It is said that quality of winter maize is better since it has less moisture than that of monsoon maize.



According to Agricultural Statistics [1], the main production are of Maize is differ from type of Maize, including for feed (seed) and for human consumption (cob)2. The statistics shows that the main production area of the Seed is Shan State, which produces 46% of national production (1.23 million t) in 2009-10. While the Cob is mainly produced in the CDZ including Magway, Sagaing and Mandalay, where 60% of total Cob in the country (14.3 billion cobs) are produced.

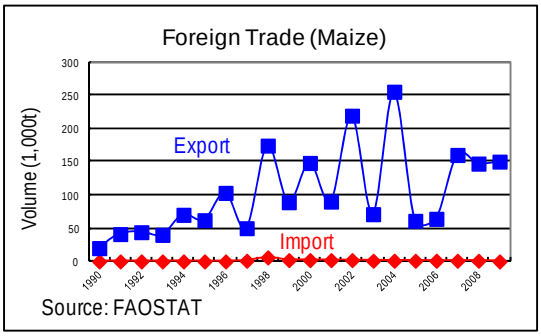
(2) Price Trend



According to FAOSTAT, price of Maize had been below 50,000 kyat/t level with slightly increasing tendency till year 2000. However, the price started increasing remarkably from 2001 to 2005, and then skyrockets by 1.8 times from 2006 to 2008.

During this period, price of crude oil in the international market had increased from 30US$/ barrel in 2003 to 60US$/barrel after 2 years. In 2008, the crude oil price increased to 140US$/barrel, which in turn result in increase of fertilizers, pesticides and agricultural machineries. The price increase of crude oil was affected to the price of Maize since the Maize can be an alternative source of energy.

(3) Trade of Maize



Maize is export goods in Myanmar. Maize for feed (Seed Maize) was exported 10,939t in 2009-10, which equivalent to 11,524,000kyat. Among them, 52% of Seed was exported to Malaysia, followed by Singapore (25%), Hong Kong (11%), China and Bangladesh (5% each).

According to Ministry of Commerce, around 100 to 200 thousand ton of Maize had been exported to Malaysia and Bangladesh till 2008, but major destination of Maize in recent years is China through border trade at Muse[3]. Interview survey to Myanmar Pulses, Beans & Sesame Seeds Merchants Association also serve to add weight to the tendency, that out of 1.5 million ton of total Mize production, 65% goes to China and rests goes to domestic market including Myanmar C.P. Livestock, PT JAPFA COMFEED INDONESIA Tbk, and local feed millers.

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[1] Myanmar Agricultural Statistics (1997/98-2009/10)
[2] According to Myanmar Agricultural Statistics, “Cob” means fresh corn with cob for human consumption, whereas "Seed" means animal feed and transacted as grain.
[3] The Golden Land of Trade and Investment Opportunities (2010-11)

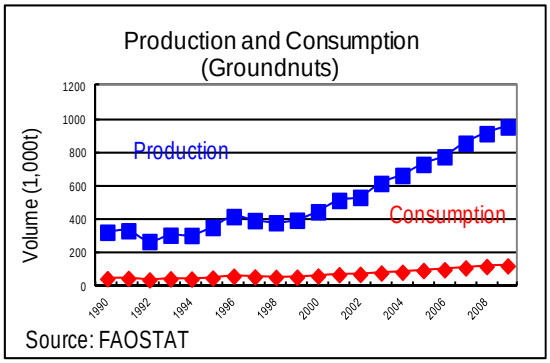
7.2.2 Groundnut

(1) Production and Consumption

Groundnut has a unique characteristic that, after flowering, it goes under ground to form shell. Therefore, Gourmet requires modest hardness of soil with modest water-holding capacity to grow. In this regard, sandy soil is good for Groundnut production.

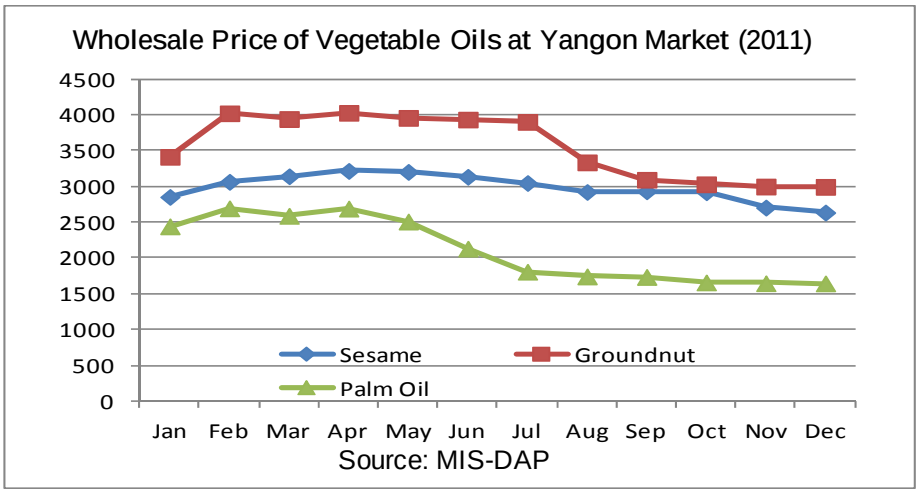
Main production area of Groundnut is Sagaing, Magway and Mandalay, and these three Regions produces 66% of national production in 2009-2010. Production of Groundnut has increased constantly, and becomes double during the recent 10years.

Among vegetable oils, Groundnut oil is the most popular among Burmese, and per capita consumption of the Groundnut Oil is 3.2kg per annum. The rate is higher than that of Sunflower Oil (2.8kg/capita/year) and Sesame Oil (2.0 kg/capita/year).



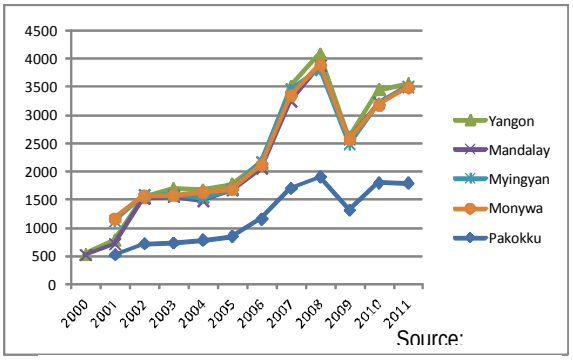
(2) Price Trend

According to the wholesale market in Yangon, among vegetable oil including Groundnut Oil, Sesame Oil, and Palm Oil, wholesale price of Groundnut oil is the highest, followed by Sesame Oil and Palm Oil. The same tendency can be observed at Mandalay wholesale market.



Wholesale price of Vegetable Oils (Yangon)

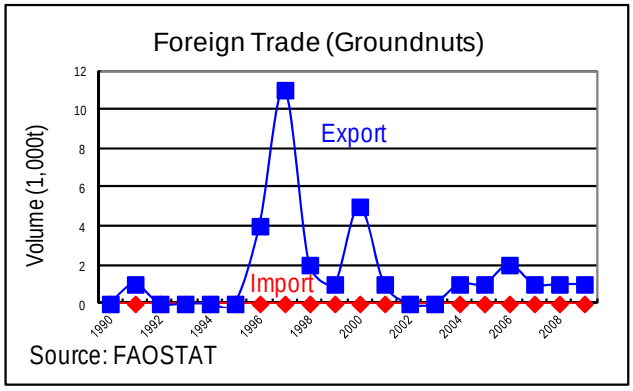
A diagram in the right side shows wholesale price of Groundnut in different areas in the CDZ, and indicated that there are no remarkable difference between Yangon, Mandalay, Myingyan (Mandalay) and Monywa (Sagaing), except Pakokku where price of Groundnut oil is one-half of other areas. In the long run, the price dropped once in 2009 due to rapid increase in the last two years. Except this period, the price of Groundnut has grown slowly.



Wholesale Price of Groundnut Oil

(3) Trade of Groundnut

Groundnut is an export good for Myanmar, and the amount of export is around 1,000t per year except year 1997 and 2000. Groundnut was exported 11,000t in 1997 and 5,000t in 2000.



According to Brokers, Millers and Traders Association in Mandalay, Monywa and Myingyan, the major export destination of Groundnut is China, and a few amounts go to Thailand.

7.2.3 Sesame

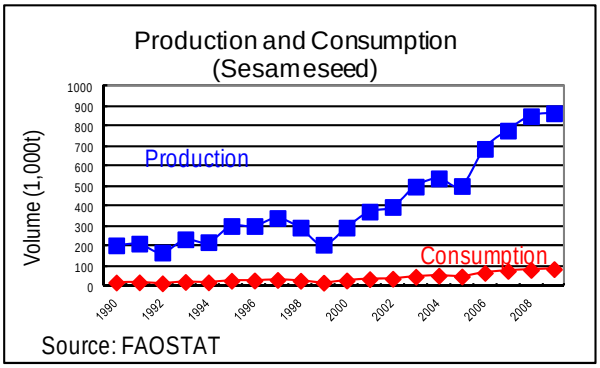
(1) Production and Consumption

Myanmar is the largest Sesame Seed and Sesame Oil in the World, and around 90% of them are produced in the CDZ. Particularly, Magway is the largest production area where produced is about 335,000t in 2009-10, which equivalent to 40% of the national total production.

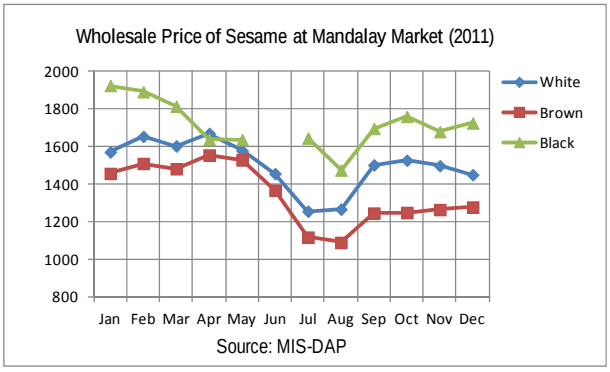
Among the CDZ, Aunglan Township in Magway Region is famous for producing excellent quality of Black Sesame. It is said that the origin of the variety is Japan, and major export destination of the variety is also Japan. On the other hand, main production area of White Sesame, which has high demand in China, is Kyaukse, and Kyaukse is price maker in the country.

(2) Price Trend

Price of Sesame differs according to its colors, and Black is the most expensive, followed by White and Brown. Growing period of Black seed is the longest (85-90 days), whereas that of Brown is the shortest (75 days). Sesame production provides farmers high income, but it is high risk crop in the CDZ where rainfall is not stable year.. Therefore, Sesame is called as “Gamble Crop” among farmers. Among three varieties, farmers tend to prefer Brown since it can mitigate risk of drought.

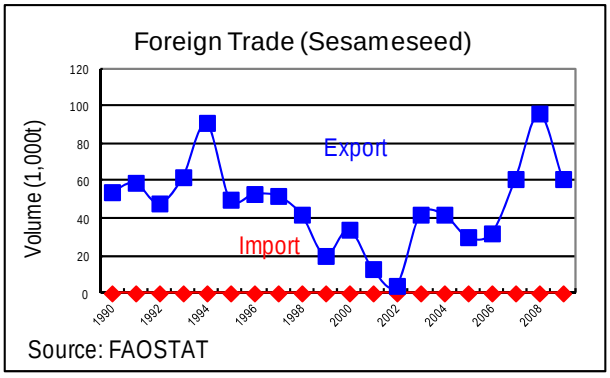


Price of Sesame drops during July and August, since Monsoon Sesame in Magway and Myingyan are harvested and marketed during this period. On the other hand, Sesame price increases from September due to increase of demand from abroad including China. Price leader of Sesame in the world is Japan, whereas domestic price are influenced by Production of Kyaukse for White Sesame and Magway for Black Sesame.



(3) Trade of Sesame

According to Ministry of Commerce, World's trading amount of Sesame is estimated at 800,000 ton per annum, and share of Myanmar's products account for 15% of the World trade. Annual export amount of Sesame is around 120,000 ton, and major destination is China[4]. According to FAO Statistics, export amount of Sesame fall apart year by year, due to unstable rainfall in the CDZ.



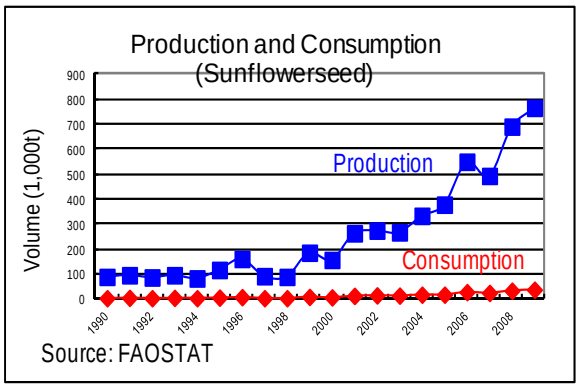
In recent years, Japanese customers are strict in chemical residuals, and strict inspection before export is required. When chemical residuals, which contained more than safe standard, are found in Sesame, it is rejected by Japanese customers and returned back to Yangon port. Inspection companies such as SGS and the government laboratory including PTAC, Post-Harvest Technology Application Center under the Ministry of Commerce, cannot inspect all items for the chemical residuals, hence samples are sent to Thailand for further analysis.

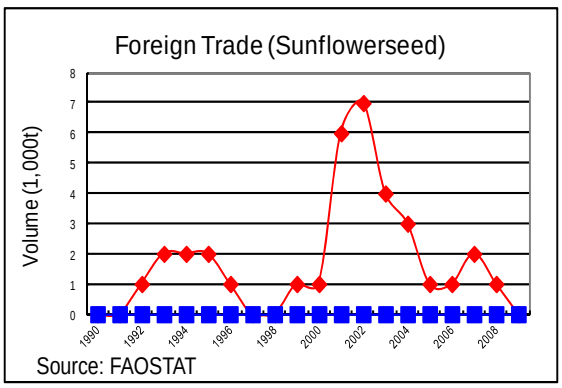
According to the inspection company, SGS, Sesame produced in Myanmar meet international standard including oil content (48%), but mixture of color is one of problems. Till 1997, rate of mixture was around 10%, but it increases to 30% in recent years. China does not care about color mixture since they use Sesame for oil extraction, but other countries including Indonesia tend to prefer single color.

7.2.4 Sunflower

(1) Production and Consumption

Sunflower production increases year by year. Main production areas are Ayeyarwady, Magway, Sagaing、and Mandalay, where 86% of National total production are produced. Production share of the CDZ is 61% in 2009-10. Sunflower is mostly combusted for Sunflower Oil and farmers are basically extracting the oil at home, while some portion of the production is used for snacks with funny packages which are sold supermarket, small storehouse. .

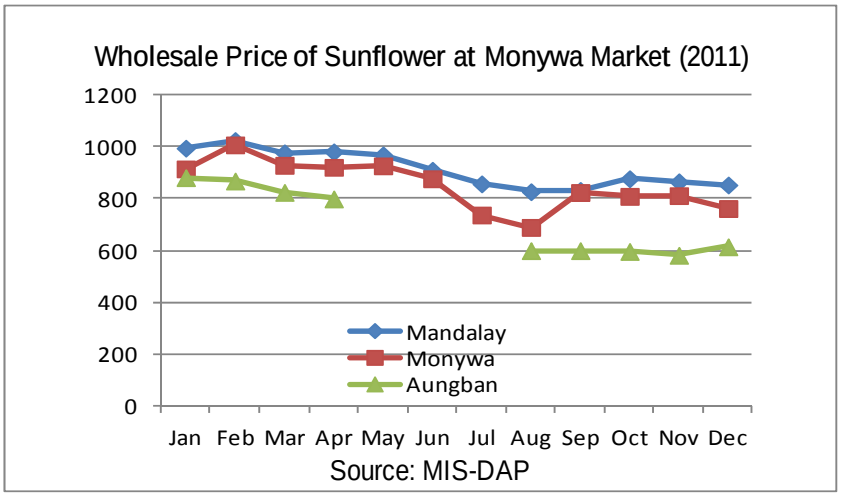




[4] "Explore Myanmar, The Golden Land of Trade & Investment Opportunities", 2010-11, Vol.1, No.1, Ministry of Commerce

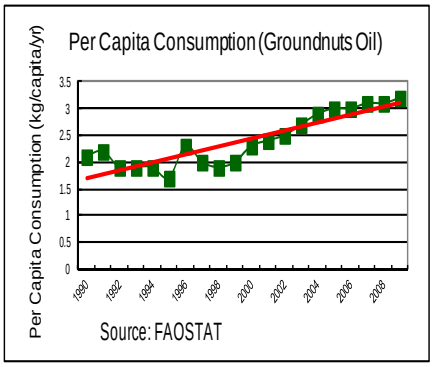
(2) Price Trend

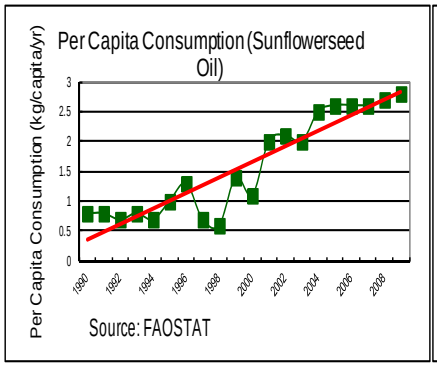
Price of Sunflower tend to increase during the winter season (January and February), and lower during the monsoon season (July to October). In Myingyan (Mandalay), Sunflower under mix cropping with Onion is marketed from May to June, and demand from Oil Millers increases from September. When we compare wholesale price of Sunflower at Mandalay, Monywa, and Sungban, the price at Mandalay is the highest followed by Monywa, and the Aungban (Shan State).

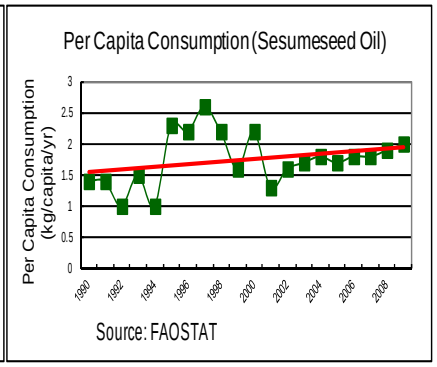


(3) Trade of Sunflower

Sunflower is import goods in Myanmar. Sunflower Seed produced in Myanmar has small grain and suitable for oil extraction, while imported Sunflower Seed from China has large grain and good for snacks. Sunflower Seed production plays important role in Myanmar since it can be an import substitutes of palm oil. Per capita consumption of Groundnut Oil and Sesame Oil increases 1.5 times and 1.4 times respectively during the past 20 years, whereas that of Sunflower Oil increases 3.5 times in the same period. Consumers prefer Sunflower Oil than Palm Oil which is imported to fill shortage of vegetable oil supply.







7.2.5 Green Gram

(1) Production and Consumption

Green Gram, or Green Mung Bean, is called as Pedesein among Burmese, and quite popular since it is material of bean sprouts. Small size is suitable for soup and salad has high demand in the country. In 2009-10, 8,000,000t of Green Gram was produced from 2,500,000 acre of farmland. Main production area of Green Gram is the three Regions in the CDZ, in addition to Bago, Yangon, and

Ayayarwaddy.

Quality of Green Gram is better in the Lower Myanmar than the Upper Myanmar, where Green Gram is harvested during monsoon season, which result in higher moisture content. Therefore, introduction of mechanical dryer is recommended to decrease moisture contents, which is main cause of turning moldy, rot and getting worms.

(2) Price Trend

Price of Green Gram decreases from January to June, and increases from July to December. The reason is that harvest season of Green Gram in surrounding area of Mandalay starts January till June, whereas export to China and other foreign countries starts from July till December. In 2011, the highest price is 1,419 US$/t (FOB-Yangon) in April and the lowest price is 749 US$/t (FOB-Yangon) in December.

(3) Trade of Green Gram

Share of Green Gram in whole pulses and beans export in Myanmar is around 25%. Export volume of Green Gram in 2009-2010 is 326,000 ton, and 50% of the amount is exported to India, followed by Singapore (17%), Malaysia (8%), China (8%), and rests include Indonesia, the Philippines, Thai, UAE, Vietnam, Japan and Taiwan. Green Gram is used for bean sprouts and spring rain (bean-starch vermicelli) in Japan.

Export Volume of Green Gram

#	YEAR	EXPORT	
		AMOUNT (TON)	VALUE (MILLION USD)
1	2007/2008	329,088	198,763
2	2008/2009	316,867	172,777
3	2009/2010	326,182	286,676

Source: Ministry of Commerce

Export volume of Green Gram increased in 2009. According to the Crop Exchange Center in Monywa, the reason was that China and India compete in procurement and China won due to high demand for medicinal use which can provide higher prices. Since then, India increases domestic supply and price of Green Gram in Indian market decreases; hence, India is no longer attractive market for Myanmar exporters.

7.2.6 Pigeon Pea

(1) Production and Consumption

Pigeon Pea or Toorwhole is called as Pesingon in Myanmar, and its production volume is second in the world, followed by India. According to the Ministry of Commerce, Pigeon Pea production was 460,000 ton in 2009-2010 from 1,500,000 acre of farmland in Myanmar. Out of these volumes, 93% was produced from the three

Regions in the CDZ. Production area of Pigeon Pea is shown in the diagram below.

Pigeon Pea has no demand in the domestic market. Most of production goes to India, where Pigeon Pea has high demand and is used for lentil soup. To use Pigeon Pea for lentil soup, processing procedure includes pealing and splitting. It is said that Pigeon Pea is difficult to cook when it is over mature.

(2) Price Trend

Pigeon Pea has different colors, and Red, which is called as Lemon in Myanmar, commands the highest price. , White has the lower price in the domestic market. In Mandalay area, White Pigeon Pea is harvested from January to March, and price of the beans decreases during the period. While the price increases from May to December due to Export season to India.

On the other hand, harvest season of Red Pigeon Pea is from January to April, and export season to India is from June to December, which results in supply shortage in domestic market. Quality of Green Gram in Myanmar is higher than that in India and other countries, resulting in higher price of Myanmar products in the international market[5].

Price Leader of Pigeon Pea is India, since it produces 3 million tons in a year, and considered as World's highest producer of Pigeon Pea. Therefore, market trend of Pigeon Pea depend on Indian's production, which makes it difficult for Myanmar farmers and traders to develop production and trade strategy of the beans.

(3) Trade of Pigeon Pea

Export volume of Pigeon Pea is 300,000 ton per annum in Myanmar, which account for 15% of the World's trading volume of the beans. Around 80% of the export volume is marketed to India, followed by Singapore (10%), Malaysia (4%), UAE and Middle East.

Around three to four years ago, East African countries including Kenya, Tanzania and Mozambique started planting Pigeon Pea under Contract Farming with Indian companies, and break into the world market from 2 to 3 years ago. At the beginning, production volume of these countries were 50,000 ton per annum, but the countries produced 200,000t/year in 2012, which became competitors against Myanmar which exported 300,000 t/year in the same year. Export price of Pigeon Pea in the East African countries is below 50 to 100US$/t, while that of Myanmar is over 50-100US$/t. However, it is said that quality of Pigeon Pea, particularly Red (=Lemon) is higher than the competitors, and Myanmar has comparative advantage in producing the variety.

[5] The Golden Land of Trade and Investment Opportunities (2010-11)

Export Volume of Pigeon Pea

#	YEAR	EXPORT	
		AMOUNT (TON)	VALUE (MILLION USD)
1	2007/2008	269,900	137,260
2	2008/2009	472,200	240,370
3	2009/2010	193,977	142,487

Source: Ministry of Commerce

7.2.7 Chick Pea

(1) Production and Consumption

According to the Agricultural Statistics, total production volume of Chick Pea is 434,000 ton in 2009-2010, 96% of which is produced in the CDZ. Major production areas of Chick pea in the CDZ are Myingyan, Mandalay, Pakokku and Magway. Chick Pea has several varieties, but major varieties produced in the surrounding area of Mandalay are White-Large, Split Chick Pea, and Yellow-Large. Chick Pea has high domestic demand after processing, including splitting and milling, and is fried, use as soup, and other local food consumption.

(2) Price Trend

Price of Chick Pea depends on demand and supply situation, and higher in August and lower in March to April, and December in the domestic market. Price of the White-Large becomes highest in August, while lowest in December. The reason why the price is lowest in December is that the demands from other countries are less in this season, and market transaction aiming at export reaches a peak in August.

On the other hand, price of Split Chick Pea is lowest in March due to oversupply in domestic market, whereas the price goes highest in August because of less volume in the market. In March, price of Yellow-Large becomes lowest, while the price reaches its peak in June since wholesalers and traders tend to keep their stock in the storage until export season of August.

(3) Trade of Chick Pea

Myanmar is exporting country of Chick Pea. Export volume of Chick Pea in 2009/2010 is 46,173 tons (135,607,000kyat), with 56% of the volume going to India. The rests were exported to Pakistan (20%), Singapore (10%), Malaysia (4%), and UAE (3%).

7.2.8 Cotton

(1) Production and Consumption

Production of Cotton in 2009-2010 is 514,000 with 97% of the volume produced from the CDZ. Among the three Regions in the CDZ, Magway produces the highest volume, followed by Mandalay and Sagaing. In the agricultural statistics, Cotton production is divided into three types, including Long Staple, Wagyi (Short Staple), Mahlaing 5/6. Production volume of Long Staple is the highest and accounting for 93% of total production, followed by Mahlaing 5/6 (4%) and Wagyi (3%).

Myingyan is famous for the production of Cotton, and produces well-ventilated, smooth and soft cotton wears such as Lungi and shirt. The following table shows production volume of Long Staple Cotton in Myingyan Township. Planted area became double and production volume increased by 5.7 times from 2003/2004 to 2009/2010, but both figures decreased by a half in recent years.

Production of Long Staple Cotton in Myingyan TS
(From 2003-2004 to 2012-2013)

No	Year	Planted (ac)	Harvested (ac)	Production (viss)	Yield (viss/ac)
1	2003 - 2004	5,365	5,365	765,627	143
2	2004 - 2005	5,505	5,505	945,908	172
3	2005 - 2006	8,206	8,206	1,638,847	200
4	2006 - 2007	9,472	9,472	1,883,660	199
5	2007 - 2008	10,261	10,261	2,154,185	210
6	2008 - 2009	10,658	10,658	4,289,834	402
7	2009 - 2010	10,728	10,728	4,345,805	405
8	2010 - 2011	10,454	10,454	4,247,207	406
9	2011 - 2012	9,816	9,816	3,994,870	407
10	2012 - 2013	4,855	4,855	1,895,224	390

Source: Myingyan TS, DICD, MOAI

According to DICD in Myingyan, the farmers stopped planting Cotton because it is no longer profitable, and instead changed to Sugarcane, for example, to earn more income. The government forced the planting of Cotton from 2007 to 2011, but after relaxing economy policy, farmers can now select crops based on their own interest. Unit price of Cotton is 1,000 kyat/viss until 2012, and profitability in terms of B/C was below 1.7, which is lower than other crops including sugarcane. However, due to growing tendency of garment sector in the domestic market, demand for Cotton increases which resulted in the increases in procurement price of the raw material. The DICD forecasts that production of Cotton will increases in 2013.

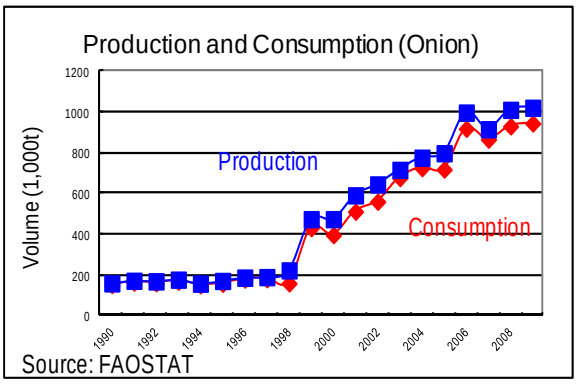
(2) Trade of Cotton

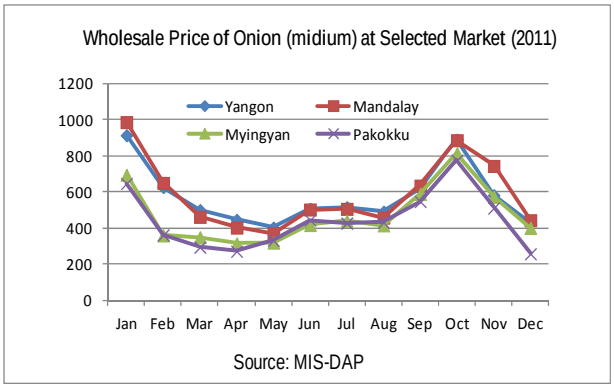
According to DICD Myingyan, until 2001, Cotton had been exported by the Ministry of Agriculture and Irrigation (MOAI) by getting export license, but from 2001 to 2012, only the Ministry of Commerce could export Cotton. After 2012, Cotton was exported by private firms due to privatization policy of trade. Cotton is exported to Thailand (50%), India (30%), Malaysia (10%) and China (10%). Cotton is exported to Thailand, India, and Malaysia by ship from Yangon port, whereas export to China is by land transportation via Muse, at a China border town.

7.2.9 Onion

(1) Production and Consumption

Production volume of Onion is 1,092 thousand tons in 2009-2010, and 92% of the total volume is produced in the CDZ. Among the three Regions in the CDZ, Magway produces the highest volume followed by Mandalay and Sagaing. Onion has two cropping season, during the monsoon and winter season, with 97% of production concentrated during the winter season. In monsoon season, only a production of Onion is limited in Magway and Sagaing.



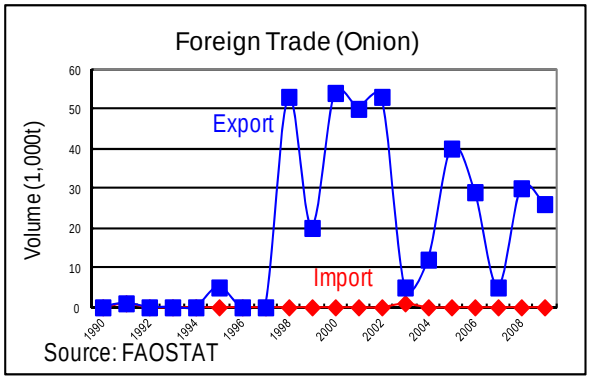


(2) Price Trend

Wholesale price of Onion start to decrease from March due to new inflow of Winter Onion in domestic market, and the lowest price record in April and May. During this period, Winter Onion from Monywa, Myitthar, Myingyan, Myinmu and Shwebo floods the domestic market. However, Winter Onion is usually not for export due to its higher moisture content.

Price of Onion increases from May, and reach its peak during December and January. According to DAP's price information; wholesale price of Onion is higher in the huge consumption areas including Yangon and Mandalay, whereas the price is lower in production areas including Myingyan and Pakokku.

(3) Trade of Onion



According to Myanmar Agricultural Statistics, export volume of Onion is 2,660t and export value is 3,176 thousand kyat in 2009-2010. Major export destinations are Malaysia (90%), followed by Vietnam (5%) and Indonesia (4%).

On the other hand, according to Myanmar Onion, Garlic and Culinary Production and Exporting Association, export of Onion to China usually pass through China-Myanmar border, where illegal trades were also observed. However, it is said that after elimination of export tax on agricultural products, illegal trade at the border has been reduced.

Onion trade with India is a sort of barter trade, as when Myanmar is hit by drought, India exports Onion to Myanmar, and when India hit by flood and heavy rains, Myanmar export to India like in year 2013.

7.2.10 Watermelon

(1) Production and Consumption

Around 90% of Watermelon produced in Myanmar is Taiwan variety, which has green stripe, with round and large shape. Watermelon is mainly produced at the river side of Chindwin and Irrawaddy Rivers, including Monywa, Magway, Myingyan and Mandalay. From these production areas, Watermelon is marketed to nearby consumption areas including local and regional markets, while a part of products is exported to China through border town

Muse.

Demands of Watermelon at the domestic markets drop during winter season, but there are few demands from hotels and restaurants in the large cities. In China, demand for Watermelon reaches its peak during New Year (1st week of February). The price is at its highest in the China market. There is a high demand on Seedless variety in China. Production period of the China-targeted seedless variety in the Upper Myanmar including Mandalay is from August to October, where harvest season is from October to December.

In the Lower Myanmar including surrounding areas of Yangon, Watermelon is planted during November to January and harvested in January and February. Major varieties in the Lower Myanmar are OPV164, OPV168, and OPV855, whereas that in the Upper Myanmar is Seedless variety.

(2) Trade of Watermelon

Watermelon is exported to China and Thailand through the border trade. Export volume of Watermelon in 2009-2010 is 1,533 thousand tons, but the volume increase to 28,900 thousand tons in 2010/2011 (until August). From the surrounding area of Mandalay, around 90% of production volume goes to China via Muse by land transportation. Watermelon exported from Myanmar goes to not only Yunnan, but also to the border towns of Mongol and Russia.

7.3 Supply Chain of the Selected Crops

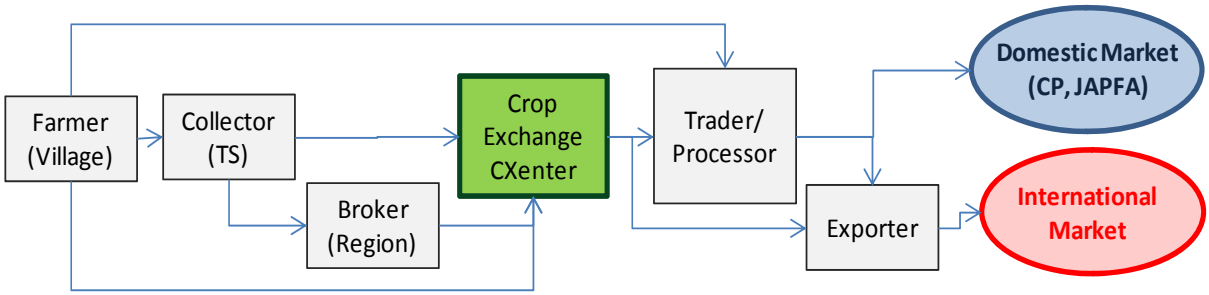
To conduct supply chain of the selected crops, starting point of the chain was identified based on the Agricultural Statistics. Major production area among three Regions is determined as a starting point of the market chain. The result is shown in table below. The crops that have no significant difference among three Regions, including Groundnut and Chick Pea for example, will be surveyed in all Regions. Watermelon is surveyed in Mandalay and Sagaing based on recommendation from DOA. Maize supply chain is surveyed not only at Crop Exchange Centers (CECs) but also at CP Group which has established the largest supply chain of livestock products including feed production.

Major Survey Area of the Selected Crops

Region	Target Crops
Mandalay	Groundnut、Chick Pea、Pigeon Pea、Onion、Cotton、Watermelon
Sagaing	Maize、Sunflower、Groundnut、Chick Pea、Pigeon Pea、Watermelon
Magway	Sesame、Groundnut、Green Gram、Pigeon Pea

7.3.1 Maize

Major supply chain of Maize is summarized in the diagram below. Farmers bring Maize to nearby Township by tractor or vehicle to sell product to Collector or Broker in the TS. Then, the collector or Broker brings the Maize to the Crop Exchange Center in the Regional center or nearby large city to transact with Millers, Processors, Traders, and Exporters. According to the Farm Household Survey conducted by the JICA Study Team, Maize producers sell around 70% of total production volume, and remaining volume are kept for their own-consumption.



Maize Supply Chain

Crop Exchange Center (CEC) is established in major cities in whole countries. In the CDZ, the CECs exist in Monywa (Sagaing), Myingyan (Mandalay), Mandalay, and Magway. The Broker, Miller and Traders Maha Kahtaintaw Association or The Chamber of Commerce operate the CEC to provide transaction place of oil seeds, pulses and beans, and cereals such as Maize to members including brokers, millers, traders, and exporters. Usually, transaction at the CEC is conducted based on a sample, and when negotiation is successfully concluded, middleman in production place (or seller) send product to buyers. According to CEC Mandalay, 70 to 80% of transacted amount of Maize is exported to China and Thailand, and the rests is marketed domestically including feed producers.

The largest buyer of Maize in domestic market is CP Group. The CP Group covers whole supply chain of livestock products including feed production, livestock breeding, processing of livestock products, and retailing at own shops, and vertically integrates the supply chain for effective management of their agri-business. The CP Group also produces Maize Seed under contract farming with farmers.

Under contract farming, farmers can select seeds from several varieties that the firm supplies, and sell back 100% of product to the same firm. The CP Group has production base in Shan, Bago, Magway and Nay Pyi Taw. After harvest, farmers bring Maize Seed to nearby processing plant within 3 to 4 hours, so that the firm can ensure good germination rate. Therefore, the firm constructed the seed processing plant at production site, and established strict check system at the time of receiving product from contracted farmers. The processing plant is operated at Thante and Aythaya, and production volume of each plant is 4,60t and 1,000t in 2013. Major export destinations of the Maize Seed are China, Vietnam, Cambodia and Laos. The seed is exported through exporters.

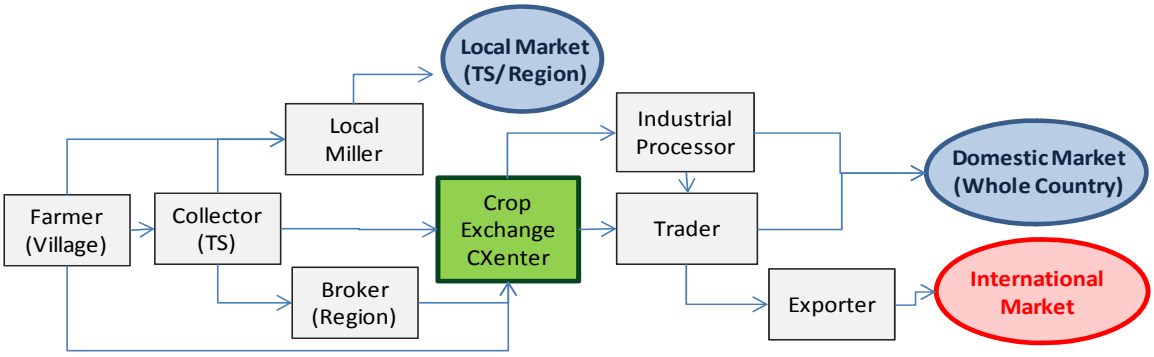
On the other hand, the Group also produces concentrated feed from Maize and other materials, and established feed processing plant at Yangon (production capacity is 540t/day), Mandalay (200t/day), Taunggyi (200t/day) and Kyaukme (150t/day). The feed is for poultry, swain, goat and cow, and is developed by mixing Maize with rice bran, fish flour and soy flour. The firm sells the concentrated feed at Northern States, Mandalay, and Shan.

7.3.2 Oil Crops

(1) Sesame

Oil crop is quite important agricultural product for Burmese after Rice. According to the farm household survey (JICA 2013), Sesame farmers sell 60% of total product to local traders, and keep 40% for their home consumption. After sundry and removing seed cover at their field, farmers bring Sesame to nearby Township and sell to Collector, or the Collector come to village to collect the harvested Sesame. Then, Collectors bring the Sesame to Crop Exchange Center for further transaction and negotiation with Brokers, Millers, and Exporters. Usually, handling fee of Collector and Broker is 1% of selling price. For example, if

farm gate price of Sesame is 29,700kyat/basket, wholesale price was 30,000lyat/basket.



Supply Chain of Sesame

As of June 2013, Sesame Oil produced by local processor is sold at local market at price of 43,000kyat/viss. Also, Oil Cake, a by-product of Sesame Oil, is transacted at the CEC, in addition to selling to local feed processors. Wholesale price of Sesame Seed at CEC is around 35,000 kyat/basket in June 2013, and marketed to Traders and Exporters from Mandalay and Yangon. FOB price (June 2013) of White Sesame is 2,200US$/t and Black Sesame is 2,300US$/t, according to Ministry of Commerce.

Sesame is usually exported as raw seed, and oil is extracted by the importing country. However, Korean companies conduct primary process in Myanmar and import Sesame as roasted powder. Korean Government charges import tax on raw sesame, but the tax is exempted if the import goods are processed. The following diagram shows the procedure of the primary processing of roasted sesame powder.

Production Process of Roasted Sesame Powder (Magway)

(2) Groundnut

Basically, supply chain of Groundnut is almost the same as Sesame. However, according to CEC in Yangon, Groundnut is transacted whole year round, while Sesame's transaction period is seasonal. Groundnut from the CDZ is traded during April and September.

Farmers harvest Groundnut with branch and leaves, and dry at their backyard after removing branch and leaves. According to the farm household survey (JICA 2013), farmers keep 40% of harvested volume and sell 60% of product to local traders. Usually, farmers bring their product by their own animal cart or vehicle, and sell to Local Collector. Then, Collectors or Brokers bring sample to the CEC and negotiate with middleman from outside of TS.

There are many local oil millers of Groundnut at TS level and Region level. For example, Triple Nine Great Integrity Trading Co., Ltd. is local miller in Myingyan which produce Groundnut Oil using raw material procured from CEC Myingyan. The firm sells their product at Mandalay and Yangon through their own commercial channel.

(3) Sunflower

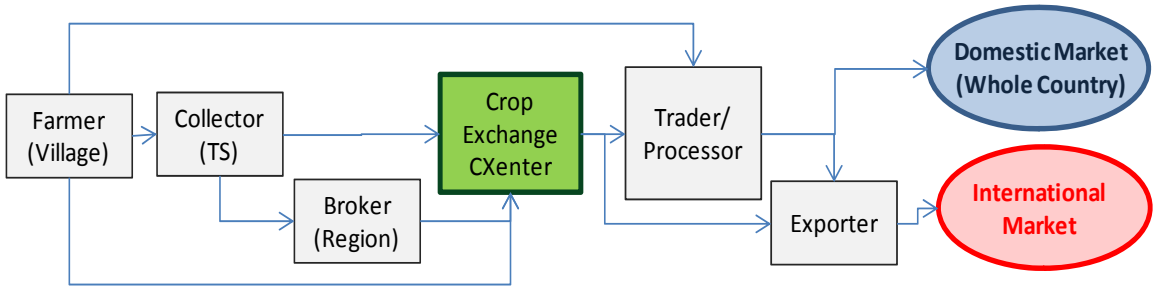
According to CEC Monywa, transaction of Sunflower at the CEC is quite few, and most farmers produce Sunflower for their home consumption and extract oil at their home. If there is a transaction at the CEC, all products come from the CDZ, including Ayardaw and Butalin in Sagaing Region (December). Only in rare case that Sunflower comes from Kalay in Sagaing Region in August.

It is said that Sunflower from the CDZ is good for oil production. Most of farmers extract oil using the traditional way, so that bad smell in oil is detected which reduces the quality of the oil. However, Sunflower Oil is more popular among local people than Palm Oil due to health reason.

7.3.3 Pulses and Beans

Basically, supply chain of pulses and beans is almost same with that of oil crops. After keeping some amount of product for home consumption, farmers sell their produce to local traders at nearby Township. Thereon, local traders including collectors and brokers bring sample to the CEC and sell to millers and traders.

At present, pulses and beans need to be processed (cleaned, pealed, sorted, and split) when exported to India, Singapore, Malaysia and Pakistan. However, buyers from China do not require the processing procedure. Therefore, most processing plants are established at Yangon. The following diagram shows typical supply chain of pulses and beans.



Supply Chain of Pulses and Beans

(1) Green Gram

Main production area of Green Gram in the CDZ is Magway at least till 2010. However, according to CEC Magway, farmers in Magway tend to give up Green Gram production due to price decrease in China market. Green Gram has been profitable crops for farmers, and is quite popular to farmers since it can provide cash within short period. However, as far as the profitability concerned, it is no longer priority for farmers if the

decreasing trend in the China market continues.

According to the farm household survey (JICA 2013), farmers in the CDZ market 70% of product and keep remaining for own-consumption. Farmers dry Green Gram at their backyard after harvest, and wait until cover of beans split. The farmers sell the beans at nearby TS and transaction to broader market is basically conducted at the CEC. At Yangon CEC, transaction of Green Gram is held whole year round and the inflow from the CDZ are usually between May to November. However, it is said that some traders do not use the CEC and buy directly from farmers or local traders to reduce transaction cost.

(2) Pigeon Pea

There is no demand for Pigeon Pea in Myanmar and supply chain of the beans extends mainly abroad, especially to India. According to the farm household survey (JICA 2013), farmers in the CDZ market 97% of product. . At the CEC, transaction is made by local sellers and buyers from Yangon for export purposes.

According to New Golden Gate (1991) Co., Ltd., a private processing and trading company located in Yangon, Red and Small variety of Pigeon Pea inflows from Mandalay, Monywa and Magway during September to November, whereas Yellow and Large variety inflows from Shan State. 90% of Pigeon Pea is exported to India. The firm also indicated that export to India reduced by 30 to 50% in 2012 due to good harvest of Green Gram in India. Transaction becomes difficult and considered a gamble the same as when the East African countries enter into the market two years ago.

(3) Chick Pea

Farm household survey of JICA Study Team indicated that Chick Pea producers sell 86% of their production, and the rate is higher than that of Green Gram. Since Chick Pea has high demand in domestic market, processing is conducted not only in Yangon, but also in local areas. There are around 20 processing factories in Monywa in Sagaing Region. Thanlar Mon, a private firm of Chick Pea processing, sells processed Chick Pea to Yangon and Mandalay after drying, pealing, sorting, splitting and packing. The factory procures raw material through transaction at the CEC Monywa, and bring their products to buyers' storage by their own truck.

On the other hand, New Golden Gate (1991) Co., Ltd. in Yangon procures Chick Pea from CEC in Yangon and Mandalay and export to India (80%), in addition to Pakistan and Bangladesh.

7.3.4 Cotton

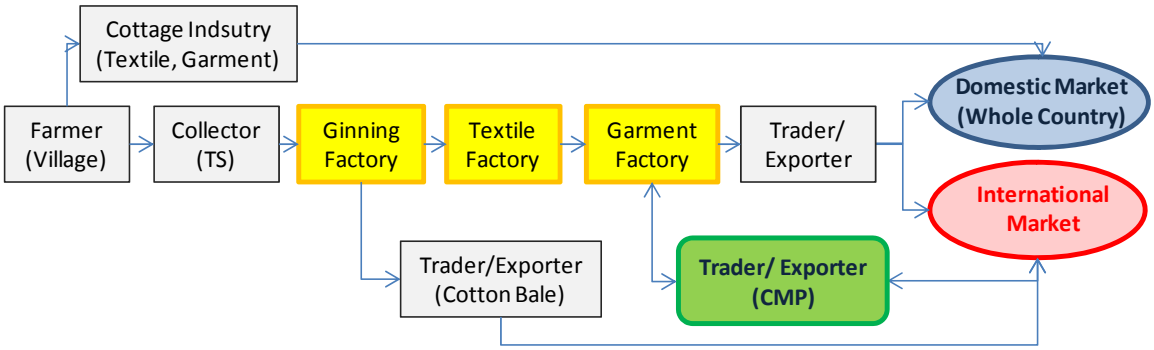
Supply chain survey of cotton started from Myingyan, which is known as production place of good garment. According to the Department of Industrial Crop Development (DICD)-Myingyan, there is one (1) state ginning factory owned by the Ministry of Industry, and four (4) private ginning factories in Myingyan Township. The private factories undertake contract farming with farmers. Farmers sell their product to collectors in TS and collectors bring Cotton to the ginning factories. In case of the state factory, the Government truck goes around the villages to collect product from farmers. Since Cotton production in Myingyan is minimal in 2012, the state owned ginning factory cannot operate, though expected to operate again from October or November since Cotton production in 2013 is expected to increase.

Cotton produced in the ginning factories are pressed and packed in cotton bale (1.5m×2.0m×1.5m), which has 100viss/bale weight or 1t/6bale. The cotton bale goes to 11 spinning factories owned by the Ministry of Industry (to Myittha factory from Myingayn), or to Meiktila factory owned by the Military. Part of the product is sold to Traders from Yangon and Mandalay, who export the raw cotton to China, Thailand, India,

and Malaysia.

There are many small scale garment industries in Myingyan, but most of them procure textile thread and cotton cloth from nearby market. Also, there are many home-made Lungi producers in Pakokku in Magway. They plant Cotton in their backyard and spin thread by themselves. The cottage industry provides cash earning opportunity to villagers in the area.

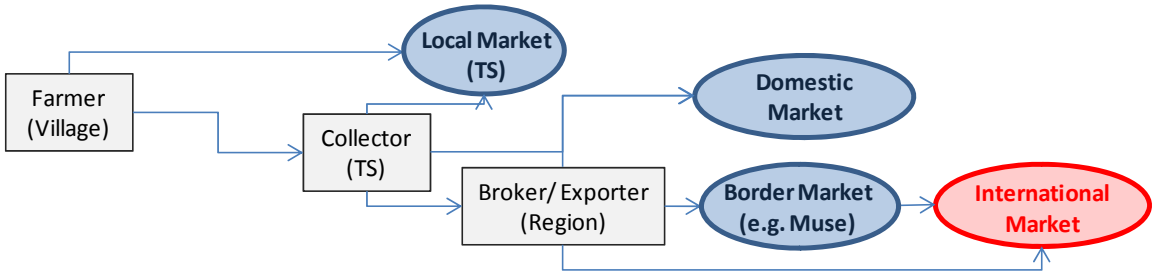
It is said that CMP (Cutting, Making and Packing) business was introduced to garment sector in Myanmar from around 1994. The system is a sort of consignment manufacturing, and garment factory in Myanmar import raw material from abroad and produce final product to sell the counterparty. The supply chain is concluded at the downstream industries, and no connection with the upstream industries. Main stream of supply chain of Cotton is as follows.



Cotton Supply Chain

7.3.5 Onion

In the CDZ, Onion is produced in the river bank areas of Chindwin and Irrawaddy, including Magway, Myingyan, Pakokku, and Nyaung Oo, and is marketed to other Regions by traders in production areas, traders from other Regions and Exporters. Around 70% of Onion in the CDZ is marketed to Yangon, and rests goes to local market and Regional market in the Upper Myanmar. In Mandalay, Onion is imported from Myingayn and Monywa, in addition to Myittha and Meiktila. Supply chain of Onion is shown in the following diagram.



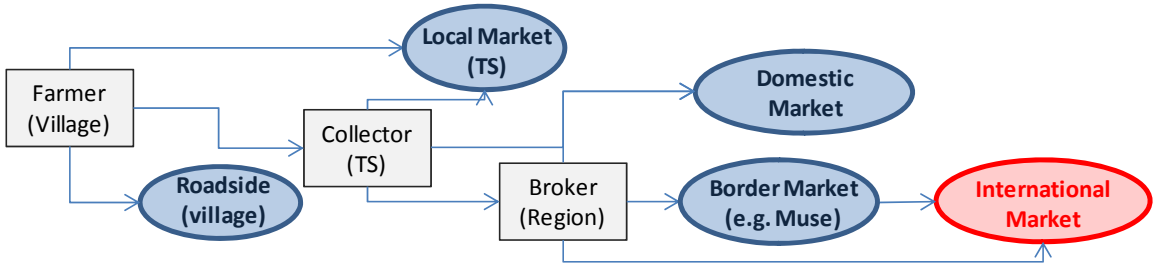
Onion Supply Chain

7.3.6 Watermelon

Watermelon is produced in river bank area which is characterized as silt loam areas applying fallow irrigation method. Production area of Watermelon in Myanmar includes Monywa, Magway, Myingyan, and Mandalay, mostly river bank area of Chindwin and Irrawaddy River. Farmers sell their product to collectors in nearby TS, or sell at the roadside by themselves. Watermelon is also transacted at wholesale market in

each Region and transported to Mandalay and Yangon in addition to local markets. As of May 2013, retail price at roadside or TS market is 60 to 80 kyat/kg, while wholesale price at Regional market is 70～100 kyat/kg, and wholesale price at Yangon and Mandalay is at 250～320 kyat/kg.

From Mandalay, Watermelon is transported to Muse and exported to China. From Monywa, land transportation takes around 20 hours in some cases. Market transaction at Muse market reaches peak at 8:00am and wholesale price at the border is 300kyat/kg in 2013 winter. Supply chain of Watermelon is shown in the diagram below.



Watermelon Supply Chain

7.4 Market Needs of the Target Crops

Information on determinant factors of transaction volume and prices are discussed in this section. This information was basically obtained at the CECs in each Region and major City, operated by Broker, Miller and Traders Association, or Chamber of Commerce and Industries. The former is an organization that consisted of local traders including brokers and millers, and Traders and Exporters from large city including Yangon and Mandalay.

The CECs that the JICA Study Team visited are Yangon, Mandalay, Monywa (Sagaing), Myingyan (Mandalay), and Magway. Also the Team visited Post-Harvest Technology Application Center (PTAC) under Ministry of Commerce, SGS (private inspection company for agricultural commodities), and processing factories of oil crops and pulses and beans, to obtain practical information on current crop transaction.

After obtaining the information on determinants of trading volume and prices, the Study Team visited DAR on July 6, 2013 to discuss and identify actions to be taken to the market needs.

7.4.1 Maize

Maize is used for animal feed and human consumption in Myanmar. According to traders and processors at the CECs, major determinants of price and trading volume of Maize are size, color, moisture content, and protein content. The following table shows market requirement on the determinant factors and ideal actions to be taken.

MARKET Needs and Ideal Counter Measures [Maize]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size	・ Bigger is better	・ Determinants of size are 1) Genetic factor, and 2) farming practice. 1) Yezin Hybrid-6, -10, -11 and CP888 are larger variety. 2) Proper irrigation, fertilizer management, weed management, spacing (2.5 feet) is required.
Color	・ Dark yellow color is better (Myingyan). ・ Major buyer of maize is Myanmar C.P. Livestock Co., Ltd, which prefers bright grain.	・ Orange color contains much Carotene (vitamin A) ・ Determinant of color is genetic factor. Yezin Hybrid-6, -10, -11 have Orange color
Moisture Content	・ Lower moisture content is better. Maize from Shan has higher moisture content (17-18%) than that from Myingyan (14.5%). High moisture content is weak in fungus, heavy to carry, and rotten during transportation. Mechanical dryer is used in Shan, while sundry is practiced in the CDZ. ・ For export quality in Yangon, moisture content should be less than 14%.	・ Post harvest management is important. Mechanical Dryer, Corn Sheller, Harvester, Storage to harvest and dry within short period, before rain occurs.. ・ High moisture causes Aflatoxin, Fungus, etc.
Protein Content	・ Higher protein contents better.	・ Determinants of protein content are 1) Genetic factor, and 2) proper farming practice. ・ Fertilizer management is important. Nitrogen increases protein content a little.

Source: JICA Study Team

7.4.2 Groundnut

Main usages of Groundnut are edible oil, and other food stuff including snacks and salad. According to traders and processors at the CECs, major determinants of price and trading volume of Groundnut are size, color, variety, moisture content, and oil content. The following table shows market requirement on the determinant factors and ideal actions to be taken.

MARKET Needs and Ideal Counter Measures [Groundnut]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size	・ bigger is better ・ Main usages in domestic market are oil extraction and snacks. For snacks, size, freshness, color (white and red, but no difference in price) is important.	・ Determinants of size are 1) Genetic factor, and 2) proper farming practice. 1) Early maturity type (100-120days) produces smaller size, which is good for feed. Larger size is for confectionary purpose. 2) Soil fertility and irrigation, rain affect size of products
Color	・ “fine red” is better	・ Determinant of color is genetic factor. SP121, Magway-10, Magway-11 have White/ Pink color, while Japanese variety has Red color.
Variety	・ Spanish variety is white and round shape, whereas Japanese	・ 3 types; Spanish, Virginia, and Valencia. Valencia includes “Japan Gyi”.

	variety is red and longer ball shape. For oil extraction, Spanish variety is better. ・ Two varieties; 3 months variety and 6 months variety	・ Spanish type, SP121 for example, has White and Pink colors. Farmer prefers Spanish type since it is traditional variety, drought tolerant, and higher oil content (48-50%).
Location	・ Groundnut from Magway is bad quality (higher rate of broken beans) because good one is exported.	・ Sandy soil is good for producing Groundnut since it has to go into the soil after flowering.
Moisture Content	・ 12 to 13% of moisture content is good quality. If moisture content is high, color changes to yellow.	・ 8 to 9% of moisture content is better for storage (max 6 months). ・ To keep longer period, cold storage with 15℃ is required. ・ High moisture causes Aflatoxin. ・ Moisture content affect germination rate
Oil Content	・ Monsoon groundnut has the highest price because it has high oil contents. More than 42% of oil content is good product. ・ For summer groundnut, more than 36% of oil content is good.	・ Main determinant of oil content is genetic factor. ・ Spanish variety has 48-50% of oil content, while Japanese variety has 42-44% of oil. ・ Keeping in storage without temperature control decreases 4-6% of oil content

Source: JICA Study Team

7.4.3 Sesame

Sesame in Myanmar is traded worldwide.. Therefore, quality requirement to Myanmar's Sesame is quite high. Major determinants of price and trading volume of Sesame are size, color, moisture content, oil content, acidity content, and chemical residuals. The following table shows market requirement on the determinant factors and ideal actions to be taken.

MARKET Needs and Ideal Counter Measures [Sesame]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size	・ more than 6.5mm is better (for Japan)	・ Irrigation increase size of Sesame seed
Color	・ In Mandalay: Black (3,500k/viss) > White (2,850K/viss) > Brown (2,400K/viss) ・ Black seed is originally from Japan and export to Japan ・ Monywa: Red, White, Black and Brown sesame are available but Red has the most oil and has highest demand. Next is White, which is the most expensive due to international (China) demand. China prefers "White" for traditional food and medicine, while Japan prefers "Black". ・ Magway: Rate of production is White (60%), Red (23%), Black (17%). White is for China, Black is for China, Japan and Korea, Red is for oil mill or home consumption. Black sesame is the highest price, farmers do not want plant Red since price gap between Black and red is around 500k/viss. ・ Yangon: 6 Colors: Black, Science Black,	・ Determinants of color are genetic factor and post harvest management. 1) Black: Sinyadana-2, -3 2) White: Sinyadana-4, -8. -10 3) Red: Nani (local variety) ・ White sesame is sensitive for storage since pests prefer this variety. ・ After harvesting, farmers piles sesame with branch on the ground to dry under the sun. However, rain makes poor color. Therefore, shade is required at the time of drying.

	Brown, Red, White, and Yellow. In Yangon CEC, 50% is Scientific (for Japan, China, Taiwan), 30% is White (for China), and 15% is Red.	
Location	・ "Aunglam Sesame" (Magway) is the best due to weather condition, soil, good farming practice. ・ Magway's sesame is good since it is drought tolerant variety. But Kyaukse's sesame is better since they use Korean variety which is similar to African seed (color is Pearl White)	・ Magway is the main production area of Sesame.
Moisture Content	・ Moisture content: less than 12% is better (Myingyan). Higher moisture content has bad smell, and change color to white. Package (plastic bag) also should be dried. ・ less than 8% (Yangon)	・ 5-6% of moisture content is good for storage (max 2 years under 25℃ condition) ・ High moisture content after harvesting causes fungus and insect damages
Oil Content	・ For oil contents, more than 40% is good, and price difference by oil contents is 1000 to 2000 K/basket (=15viss). ・ For oil extraction, more than 48% of oil content is better. (Magway) ・ Oil content: Black (50-58%), White (52-53%), Red (48-50%). Irrigated Sesame has less oil, while rainfed Sesame has rich oil.	・ Determinants of oil content are genetic factor and suitable water supply. 44 to 46% of oil content is the best. 1) Black: Sinyadana-2, -3 → 42-43% 2) White: Sinyadana-4, -8. -10 →44-46% 3) Red: Nani (local variety) →41-42% ・ Irrigation increases size of Sesame seeds. Sprinkler irrigation is better than flow type irrigation. Adequate rain, not too much rain, is also important factor.
Acidity	・ Japan's inspection is severe. Japanese inspector use litmus paper to check acidity. Acidity content should be 0.5-2.0%. After rain, acidity should be checked since rain sometime contains acid. China does not check acidity content. (Magway) ・ Only Japanese standard, more than 3% is not acceptable. Japan use litmus paper for the test. (Yangon)	・ Higher moisture content increases acidity rate. Basically, Sesame in Central Dry Zone has lower acidity content. ・ Post harvest management is important. Piling on the ground with layer style increase acidity rate, and standing style is better for acidity control. After harvest, it is better to keep under shade for 7 to 10days for drying.
Chemical residual	・ Chemical residual: Only Japanese standard; Inspection is conducted in Thailand to acquire certification	
Others	・ Color, oil contents, freshness, cleanliness, flavor, and smell are main check point of procurement. ・ Sesame with dust and dirt makes price cheaper.	

Source: JICA Study Team

7.4.4 Sunflower

Even though trading volume of Sunflower is not large, production increases since it is an import substitute of Palm Oil. Main usage of Sunflower in the CDZ is edible oil. According to traders and processors at the CECs, major determinants of Sunflower are size and oil content. The following table shows market requirement on the determinant factors and ideal actions to be taken.

MARKET Needs and Ideal Counter Measures [Sunflower]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size	・ Quality of Myanmar product is low, China is higher and size is larger	・ Main determinant of size is variety. ・ Confectionary type has bigger and longer seeds, while oil extraction type has smaller shape. The former is longer term variety and the latter is shorter term variety. Traditionally, Myanmar produces short-term variety for oil, and confectionary type is imported from China.
Oil Content	・ Sunflower oil is mostly for self consumption. Farmers extract oil by themselves. ・ Oil extracting skill is not good, because smells remain in the oil. Removing smells from oil is subject to be tackle.	・ Determinant is variety (genetic factor). ・ Yezin Hybrid-1 is rich in oil content, and is also short-term variety (80days), disease tolerant, high yield (55-60baskey/acre). ・ Sinshwekya-2 and -3 are open pollinated variety for edible oil production purpose. Usually production period of oil type variety is 80 to 85 days, and 48-52% of oil content is good seed.
Others	・ Sunflower is not profitable and production is very little. ・ The most popular cooking oil is Sesame, followed by Groundnut and Sunflower.	・ Less than 4-5% of moisture content is good for storage (max 1 year).

Source: JICA Study Team

7.4.5 Green Gram

Demand on Green Gram is high both at the domestic and international markets. In the CDZ, Green Gram is planted during monsoon period which result in higher moisture content. High moisture content causes many problems including fungus and insect damages. Major determinants of Green Gram are size, color, and moisture content. The following table shows market requirement on the determinant factors and ideal actions to be taken.

MARKET Needs and Ideal Counter Measures [Green Gram]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size	・ Size of CDZ product which goes to India is smaller, whereas that of Delta which goes to China is larger. ・ Big size (Yezin-14 and -11; hybrid variety) is for export to China and India, while small size (local variety) is for domestic consumption. ・ Large size goes to China and Taiwan, while small size goes to Indonesia. ・ Small size (2000k/viss) is more expensive than large size (1500k/viss) Burmese prefer young, small and soft bean sprouts which is good for soup and salad.	・ Main determinant of size is genetic factor. Impact of fertilizer management and irrigation is quite small. ・ Yezin-9 and MES-1 has bigger size (6×6g), whereas Yezin-6 is smaller (4×4g). ・ Smaller size in basket has more weight.
Color	・ There are two colors, Gold and Green, and Gold is the best quality with less warm.	・ Main determinant of color is genetic factor. Yezin-1 and -14 has yellow-green color, the best color. Yezin-1 is dominant variety since

	・ Bright/ light green is better, whereas dark/ brown/ yellow is worse. ・ Over-matured bean's color turns to yellow. Maturity depends on rain, moisture, and sunshine. Cold storage is required to keep good quality beans. If it rains during harvest season, quality becomes worse.	it has been distributed 10 years ago, while Yezin-14 is new variety, distributed 3 years ago. ・ Main production areas of Yezin-1 and -14 are Bago and Yangon, where Green Gram is planted after paddy in late monsoon.
Moisture Content	・ Less than 10% in winter season, and less than 15-16% in rain season.	・ Less than 10% is good for storing longer period (1 to 2 years under 25℃ condition). Cold storage is required to keep longer period.
Others	・ Productivity in Delta is higher than CDZ ・ In 2009, China and India competed in buying Green Gram, but demand in China was higher due to medicinal use and could be bought at higher price. China is major buyer of the beans. ・ Farmers used to plant after sesame, but no production now since 2 years ago because Green Gram is not profitable. China's buying price is cheap.	・ Magway is the main production area which has sandy soil, under rainfed condition. ・ Green Gram is not profitable since 2011, since production in India increased which resulted in price decrease in the Indian market. ・ But Green Gram can make money within 2 months, most farmer plant it with Pigeon Pea under mix cropping condition. ・ Since Green Gram is shorter type variety, it cannot survive if Dry Spell is longer. Therefore, Green Gram is good to plant in riverbank area, and is difficult to grow in CDZ's climate condition.

Source: JICA Study Team

7.4.6 Pigeon Pea

Market of Pigeon Pea is India, and to meet requirement of Indian market is necessary. According to the CECs, main determinants of trade volume and price of Pigeon Pea are size, color, cleanness, and freshness.

MARKET Needs and Ideal Counter Measures [Pigeon Pea]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size/ Color	・ Color (red, orange, and white) and Size (large, medium, and small) is main determinant of price. ・ Small and red is the most expensive (1100k/viss), and next is medium and Red (1075k/viss). The cheapest is large and white (950k/viss). (Monywa) ・ Red has higher price (1035k/viss), whereas White has lower price 1000k/viss. (Myingyan) ・ Blight Red makes higher price than Dark Red. Price difference is 75K/viss. (Magway) ・ Large and White is the best quality since 10 years, but small and yellow becomes best this year due to high demand in India. (Yangon)	・ Main determinant of size is genetic factor. ・ Smaller size gets higher price since it can easily be processed, including pealing, decollating, and cooking. ・ Red has higher price and more profitable.
Location	・ Production in Sagaing is one third of national total. ・ Pigeon Pea from CDZ is the best quality. Customer prefers small size which is easy to peel and cook.	

Variety	・ Variety from CDZ (ICCV2, ICCV3) is good and price is higher, while that from Shan is lower since moisture content is high and many warms	・ "Pigeon Pea Small (in local name)" is local variety, and "Monywa Shwedinga" is improved variety, originally came from India. Both varieties have Red color.
Others	・ Buyer from Yangon buys from local trader with 10% commission fee. ・ Freshness, cleanness, and no warm are also important indicators.	・ Most Pigeon Pea is exported to India for e.g.lentil soup and curry. In Myanmar, it has a little demand for medicinal use.

Source: JICA Study Team

7.4.7 Chick Pea

Main determinants of trade and price of Chick Pea are size and color. In addition, according to the CEC, market needs and requirement on size and color is as follows.

MARKET Needs and Ideal Counter Measures [Chick Pea]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Size	・ Variety from Pyey (Mya Kyae Mon) is larger, but volume is not so large ・ larger is better (the most important indicator) (Yangon)	・ Main determinant of size is genetic factor.
Color	・ Color (red, white, yellow) and size (bigger is better) are main determinant of price. Red ("929") is most expensive (1000k/viss), and next is White ("V2", 975k/viss). Cheapest is Yellow ("Taiwan", 950 k/viss) (Monywa) ・ Color and variety is major determinant of price difference. Best variety is "V2 (white)" and next is "Taiwan (yellow)", followed by local variety "929 (Red)". "V2" and "Taiwan" is for export, whereas "929" is for local consumption only. (Myingyan) ・ Yellow (Taiwan variety) makes highest price and second is Red (929). Price difference between Yellow and Red is 75k/viss. White (V2) is not popular. (Magway)	・ Main determinant of color is genetic factor. There are 2 major types, including Kaburi type and Desi type. Kaburi type has white color, whereas Desi type has Red, Yellow, Black and Green color. - Yezin-3 = "V2 (White)" = Kaburi = ICCV 2 - Yezin-4 = "Taiwan (Yellow)" = ICCV 88202 - Yezin-6 = "929 (Red)" = Desi = ICCV 92944 - Yezin-8 = "White" = Kaburi = ICCV 97314 ・ Usually, price of Kaburi type (white variety) is the highest. ・ "929 (Red)" is the most drought tolerant variety. ・ V2 (White)" cannot grow in Magway.
Location	・ Production in Sagaing is 46% of national total.	・ Kaburi type grows in upland area including Sagaing region, while Desi type grows in low land after paddy, such as Magway and Mandalay.
Others	・ Domestic demand is for noodle, curry and snacks ・ Freshness, cleanness, and no warm are also important indicators.	・ Local market prefers Desi type. ・ Yezin-3, -4, and -8 are early maturing variety.

Source: JICA Study Team

7.4.8 Cotton

Cotton has two major varieties, including Long Staple and Short Staple, with the former as major variety in Myanmar. Determinants on trade and price of Cotton are the variety, color, cleanness, and moisture content. Market needs and requirement are also obtained from DICD office in Myingyan Township, Triple Nine Great Integrity Trading Co., Ltd., and ginning factory in Myingyan under Ministry of Industry.

MARKET Needs and Ideal Counter Measures [Cotton]

Check Point	Market Needs/ Requirement	Ideal actions to be taken
Variety	・There are four (4) types; 1) long one (1st class), 2) short one (middle class), 3) yellow and 4) summer yellow (low class). ・The long staple is more expensive and is for export since it is soft and smooth, good for traditional clothes in Indonesia and Malaysia for example. ・While short staple is hard, and good for jeans.	・Major varieties of long staple are “Ngwe-Chi 6” and “Line-66”. “Ngwe-Chi 6” is very popular and yield is higher (1,000 viss/acre), but very weak against pest. Whereas “Line-66” is suitable variety for CDZ and can resist pest, but yield is lower (400-500 viss/acre). ・Major varieties of short staple are “Malaing-5” and “Malaing-6”.
Color	・White is better.	・Genetically, most variety has white color, and color is matter of post harvest handling. Best growing season is planting in May, grow in monsoon season, and harvest in September.
Cleanness	・Dust and dirt reduce quality of cotton.	・Also, cleanness is matter of post harvest handling. Improvement of ginning machine is necessary.
Location	・Cotton seed from Myingyan is famous. Its usage is animal feed.	・In general, CDZ is not good for growing cotton since cotton needs plenty of water.
Moisture Content	・Humidity is one of indicator since moisture content reduces quality of cotton. Moisture content can be checked by hand. Less than 7.0% is better.	・Moisture content is a matter of post harvest handling. It is closely related to its growing stage. After bearing cotton on the tree, all cottons have to be harvested before rain, and time management is quite important.
Others	・From cotton tree, 60% of cotton is for soft cotton (cotton yarn, medical use, etc.), whereas 40% is for cottonseed which in turn use for 38% for cotton cake (feed for cow), 125 for cotton oil, and 50% for feed for fish (CP). ・The government's quality specification is as follows; - Length: 28.6 - 30.2mm - Smoothness: 3.8 – 4.2 microneyar - Strength 7.8 – 8.5 lb/mg - Ripened Ratio: 0.97 – 1.00 - Yield 37% - 39% (from veil, residual is cotton seed) - Number: 40 – 50 (classification of spinning, less than 40 is hard, more than 50 is enough soft, still good)	・Cotton needs 5 to 6 months for growing, and harvest is done 3 times in one season. 1st harvest is for upper parts, and after 2-3 weeks middle parts is harvested (2nd harvest). The last harvest is the lower parts, and is done after the 2nd harvest. For each harvest, it takes 2-3 days usually.

Source: JICA Study Team

7.4.9 Onion

Information on determinants is obtained at Mandalay (Thri Marlar Market), Sagaing (Myi Thalar Market), Magway (Yan Pe Market), Yangon (Crop Exchange Center). At Yangon Crop Exchange Center, the Study Team obtained market needs from Myanmar Onion, Garlic and Culinary Production and Exporting Association. According to the traders and wholesales, determinants of Watermelon are size/ appearance, hardness, and color. The following table shows market requirement on each determinant.

MARKET Needs and Ideal Counter Measures [Onion]

Check Point	Market Needs/ Requirement
Size/ appearance	・ Size makes price differences ・ Small is good for fry, export to Vietnam, Thailand and Malaysia, after fried in these country, fried onion goes to EU. Middle size goes to local consumption and sometime goes to Thailand. Large size is for local consumption particularly for Restaurant ・ Closed Peel > Broken Peel (closed peel can be kept longer and has good appearance) ・ 1st class (450k/viss), 2nd class (400k/viss), 3rd class (350k/viss), rotten (less than 200k/viss). Big and grown from seedling can be kept for 9 months in storage, whereas small and plant from onion itself can be kept for 2 months only
Hardness	・ Harder is better for keeping long time. Price difference between “Hard and closed peel” and “Soft and rotten” is more than 30k/viss. (Monywa) ・ Soft skin is better than hard skin. Soft skin can be cooked more easily and color will change to light brown when fried (hard skin will change to dark brown). (Monywa)
Color	・ light purple > dark purple (consumer prefer light color) ・ Gold color (Shwe Phalar variety) is better than Purple one (Padauk Pyun variety). The difference of color makes price gap around 20-30k/viss.
Location	・ product from Myittha is good (looks young, sweet due to irrigation) ・ Myittha variety is very good, but it cannot be grown in Monywa since planting season and farming method (water spray method) is different.
Others	・ Onion from India is not good (but sometimes imported due to drought) ・ Trader from China and Malaysia come and buy to export to China, Thailand and India. (Monywa) ・ From CDZ, 70% goes to Yangon, while 30% goes to other region. ・ Since 2012, no export tax and illegal trade at border area started to decrease.

Source: JICA Study Team

7.4.10 Watermelon

Information on determinants is obtained at Sagaing (Myi Thalar Market), Nyaung Oo (Mani Sithe Market), and Yangon (Thiriminglar Market). Accordingly, the determinants on price making and trading volume are size, shape, weight, and taste. The following table shows market requirement on each determinant.

MARKET Needs and Ideal Counter Measures [Watermelon]

Check Point	Market Needs/ Requirement
Size	・ bigger is better
Shape	・ Round shape is better than long one. If it exported to China, shape and size should be same. The difference makes price difference of 500k.
Weight	・ Heaver is better since it may contain much water.
Taste	・ higher sugar contents is better
Variety	・ The best variety is “Ohnmar Danti” (red and sweet variety). ・ Seedless (2500k/piece) > Dark Line (1600k/piece) > Monotone (1200k/piece)
Others	・ Farmers usually sell at local market and road side, or to middleman in Monywa TS. Some middleman brings water melon to Wholesale market in Muse (Chinese border) and sells to Chinese middleman. Demand in China market increase in the beginning of March to middle of April. (Monywa)

Source: JICA Study Team

CHAPTER 8 SOIL AND WATER ANALYSIS

8.1 Soil Analysis

Soil sample were collected at 50 points in 4 Townships including Nyaung Oo, Myingyan, Magway and Chauk. The samples are also obtained from 12 villages in the CDZ where the JICA Study Team conducted the farm household survey. Soil analysis is sub-contracted to Soil Science Section in DAR in Yezin. The soil samples are brought in DAR on May 23, 2013, and result of analysis is completed on July 5, 2013.

Number of Samples f Soil Analysis

Township	Number of Sample
	Soil Analysis
Nyaung Oo	10
Myingyan	20
Magway	19
Other Township	1*
Total	50

Note : *a soil sample in Chauk Township is collected at Mingan village which is a pilot village in "The Development Study on Suitable Agricultural and Rural Development for Poverty Reduction Programme in the Central Dry Zone of the Union of Myanmar: 2006-2010"

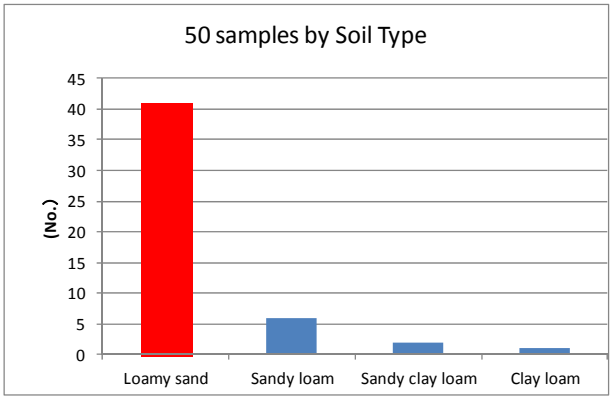
**27 Townships are not included in the 3 target TS, but included in the CDZ.

8.2 Analytical items of Soil Survey

Totally 17 items including pH, EC, Total N, Available N, Available P, Available K, Organic matter, Organic carbon, Soil texture, Soil textual class, Moisture, Exchangeable Ca, Exchangeable Na, Exchangeable Mg, Extractable Cu, CEC, Base saturation, are applied in the sub-contracted Soil Analysis.

8.3 Result of Analysis

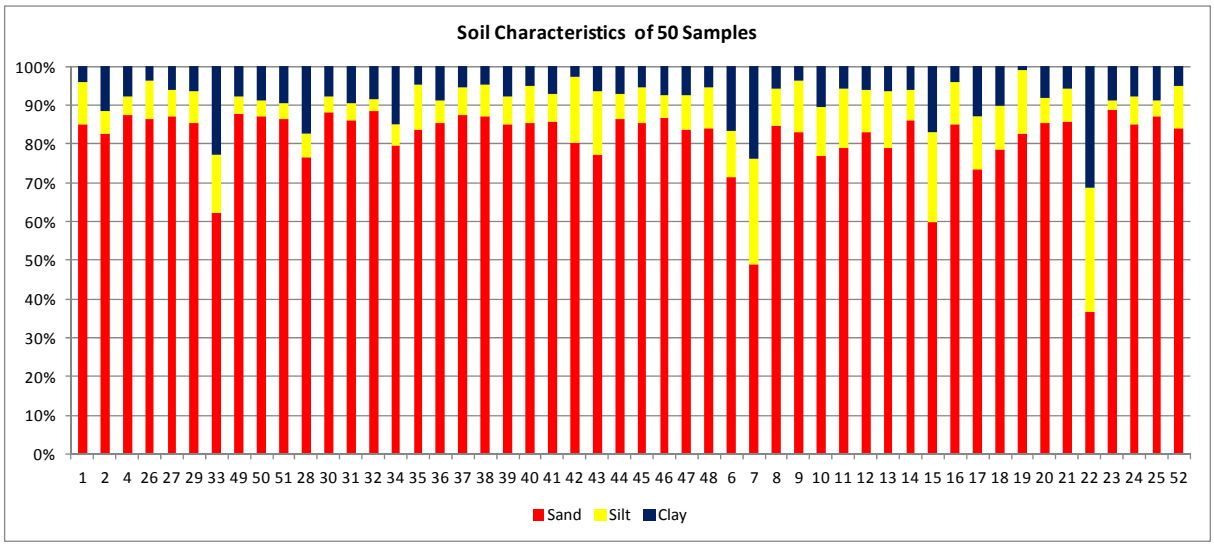
1) Soil Type



For soil type, Loamy Soil is dominant, with 41 samples identified out of 50 soil samples. However, the Study Team observed that Sandy Soil is also dominant in the Study Area when the Team visited and obtained tactile impression. The sandy soil is defined as clay content is 0-15%, sand content is more than 85%, tactile impression is sandy, cannot feel clay, and less water and fertilizer holding capacity. The samples obtained in the Survey is only a "dot", and it is recommended to refer "Soil Types and Soil Characteristics of Myanmar, MOAI", developed by Land Use Division of MOAI, to grasp more broad-based soil type in the CDZ.

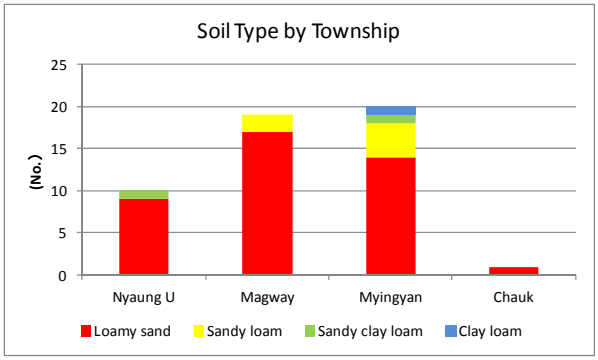
2) Soil Texture

Soil Texture analysis of the 50 samples indicated that around 80% of sample is sand and clay is quite a few. Sample number 7, 15, 22 and 33 shows less sand, and onion, tomato, and tobacco are planted in these sample area.



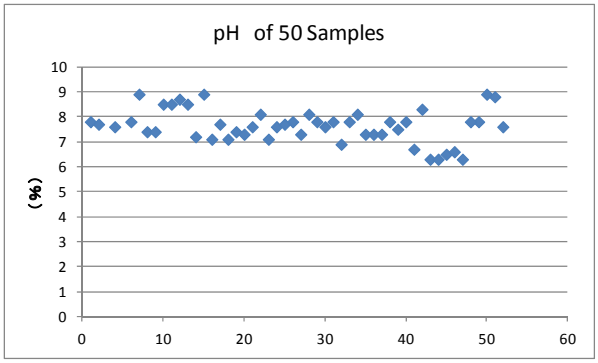
3) Soil Type by Township

When we look at soil type by Township, Loamy Sand is dominant in all Townships, but soil type varies in Myingyan Township where Sandy Loam and Sandy Clay loam are mixed. However, it should be noted that the sample shows only a “dot” of the field and does not represent all area.



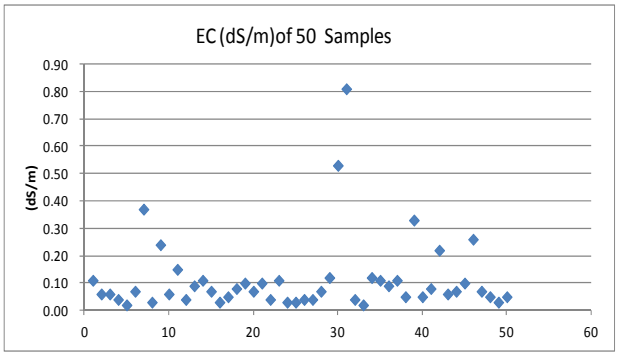
4) pH

pH of the 50 samples is shown in the following diagram. As the result indicated, acescence (pH5.5) is less, and alkali soil (more than pH7.0~8.0) is dominant. There are eight (8) samples which show more than pH8.5, strong alkali soil. The reason why alkali soil is dominant is that the CDZ has less rainfall, similar to Northern Africa.



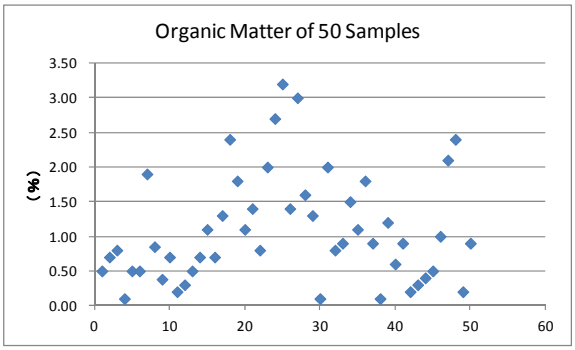
5) EC

As for Electric Conductivity of the sample soil, 10 samples in Nyaung Oo and 19 samples in Magway indicated that saline soil cannot be seen in these areas, whereas 2 samples in Myingyan show 0.53dS/m and 0.81dS/m, which indicates existence of saline soil.



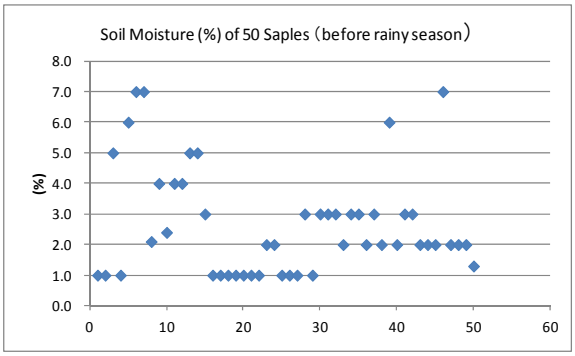
6) Organic Matter Content

The result of analysis indicated that organic matter content is very low in the sample soils from the Study Area. The highest is 3.2% while the lowest is 0.1%. In conclusion, organic matter content is very low in the CDZ where Sandy soil is dominant, which will result in low water holding capacity in the area.



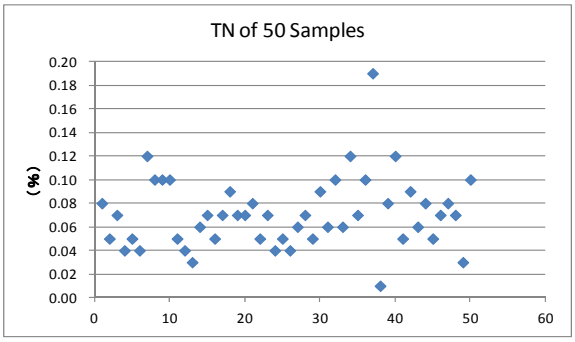
7) Soil Moisture Content

The samples were collected in May, before rainfall, and soil water content is 7.0% at the maximum and 1.0% at the minimum. Many samples show 3.0% of soil water content, indicating that the soil sample from the CDZ hold less water, similarly to desert sand. Less organic matter content and less soil water content might be correlated.



8) TN

Total Nitrogen content in the 50 soil samples is not even, but most sample show 0.03~0.19, ranging “very low level” to “low level” by DAR’s definition. Low TN content and less organic matter content might be correlated.



8.4 Water Analysis

(1) Outline of the Water Analysis

50 water samples in total were collected from the Study Area, and water analysis was conducted by Water Utilization Research Section of DAR under subcontract with JICA Study Team. The samples were obtained from tube-wells, creeks, irrigation canals, and Irrawaddy River, since it was quite difficult to find water source in the CDZ before monsoon season. The samples were brought in DAR on May 23, 2013, and analysis was concluded by July 5, 2013.

Number of Sample of Water Analysis

Township	Number of Sample
Nyaung Oo	13
Myingyan	3
Magway	7
Other TS	27**
Total	50

Note：27 Townships are not included in the 3 target TS, but included in the CDZ.

The water samples collected from the Study Area are shown in the table below. Most samples were obtained from tube-well, since topography of the Study Area is hilly and water source from irrigation project is limited.

Water Samples by Type of Water Source

Water Source	Number of Sample
Tube-well	32
Irrigation canal (project by ID and WRUD)	10
Farm Pond	3
Creek	2
Wadi	2
Irrawaddy River	1
Total	50

(2) Quality Standard of Irrigation Water

The following table shows quality standard of irrigation water in Myanmar. Different from Japanese standard, COD, SS, and DO are not included in the standard.

Quality Standard of Irrigation Water

No.	Item	Unit	Usual range in irrigation water	Comments
1	pH	-	6.0-8.5	-
2	EC	dS/m	0.75-3.0	Plant growth is primarily limited by the salinity (ECw) level of the irrigation water with sodium unbalance and can further reduced yield under certain soil texture condition.
3	Ca^{++}	ppm	0-401	If the calcium in the soil-water taken up by the crops is less than 2 me/L, there is a strong probability that the crop yield will be reduced.
4	Mg^{++}	ppm	0-60.75	Toxic to number of crops at few-tenths to a few mg/L in acid soils.
5	Na^{+}	ppm	0-920	Typically toxicity symptoms are leaf burn, scorch and dead tissue along the outside edges of leaves in contrast to symptoms of chloride toxicity which normally occur initially at the extreme leaf tip.
6	K^{+}	ppm	0-2	
7	$CO3^{=}$	ppm	0-3	Carbonates are associated with the level of alkalinity.
8	$HCO3^{-}$	ppm	0-610	Bicarbonate could increase the SAR of the soil water by precipitating calcium and magnesium. This can be corrected by frequent application of gypsum in soil surface.
9	Cl^{-}	ppm	0-1,065	If there is toxic ions accumulate to excessive concentrations, they cause chlorosis, bronzing and leaf turn primarily at the leaf top, leaf edges to mid-leaf are.
10	$SO4^{=}$	ppm	0-960	The sulphates tend to combine with some of the calcium and aluminum compounds in the hardened cement and from calcium

				alminates-sulphate or gypsum, which causes the concrete to swell.
11	Fe^{++}	ppm	0-5	Not toxic to plant in aerated soils, but can contribute to soil acidification and loss of essential phosphorus and molybdenum.
12	Mn^{++}	ppm	0-0.2	Toxic to a number of crops at few-tenths to a few mg/L but usually only in acids soil.
13	Cu^{++}	ppm	0-0.2	Toxic to number of plants at 0.1 to 1.0 mg/L in nutrient solution.
14	Zn^{++}	ppm	0-2	Toxic to many plants at widely varying concentrations, reduced toxicity at increase pH(6 or above) and in fine-textured or organic soils.
15	SAR	-	0-15	Sodium Absorption Ratio

Source: DAR

Acceptable level of EC and SAR are indicated as follows.

EC's limitation for use

Limitation for use	EC(dS/m)
None	≤0.75
Some	0.76-1.5
Moderate	1.51-3.00
Severe	≤3.00

The Sodium hazard of water based on SAR value

SAR Value	Sodium hazard of water	Comments
1-10	Low	Use on sodium sensitive crops such as avocados must be cautioned
10-18	Medium	Amendments (such as Gypsum) and leaching needed
18-26	High	Generally unsuitable for continuous use
>26	Very high	Generally unsuitable for use

(3) Analytical Items

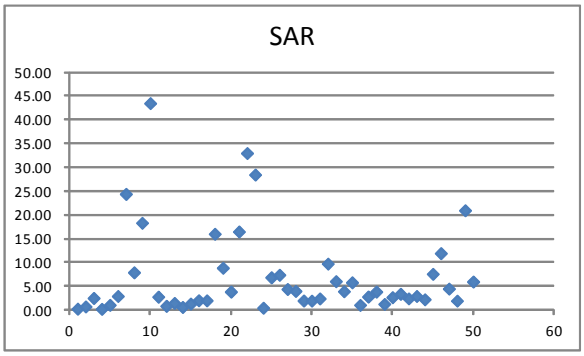
Totally 15 items including SAR, pH, EC, Ca, Mg, Na, K, CO3, HCO3, Cl, SO4< Fe, Mn, Cu, Zn, are adopted in the water quality analysis.

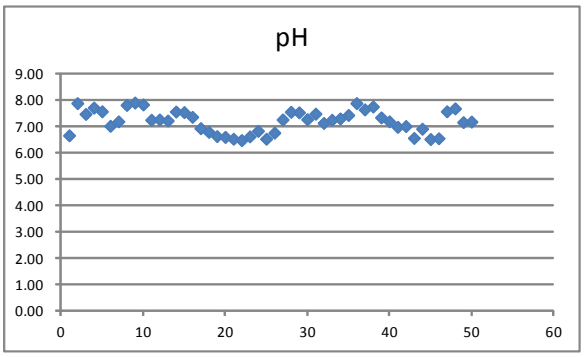
(4) Result of Analysis

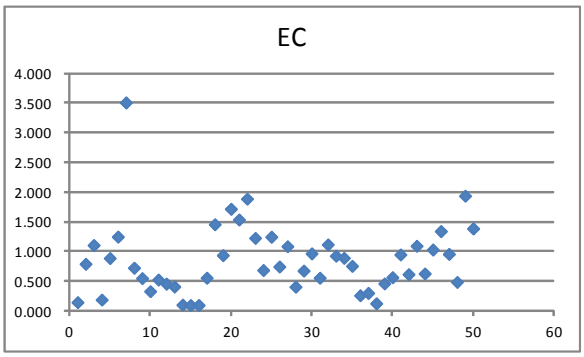
Among 15 analytical items of the water analysis, items which do not meet the standard are SAR, EC, HCO3, Mn and Zn. From tube-well in Nyaung Oo, 2 water samples shows over the usual range of Zn. A sample from tube-well in Yamethin Twonship also shows over the standard level of Mn.

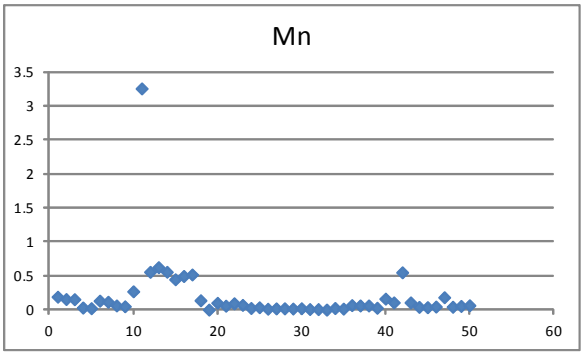
Regarding pH, all samples are within the standard value of 6.0~8.5, with minimum 6.47 (acescence) and maximum 7.89 (alkalinity).

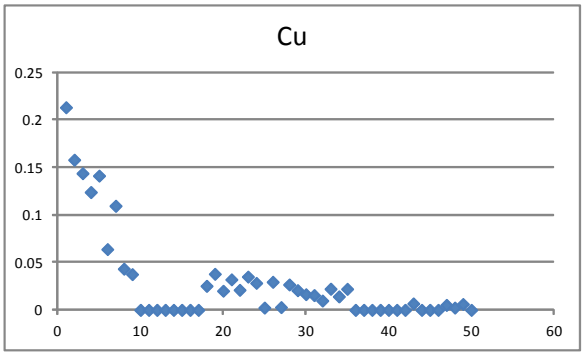
As for Electric Conductivity of the sample water, a sample from tube-well in Myingyan Township shows EC3.51, meaning over the standard level of 0.75~3.0. In addition, 6 samples over the standard level of 26, which is defined as "very high", indicate not suitable for irrigation water in general.

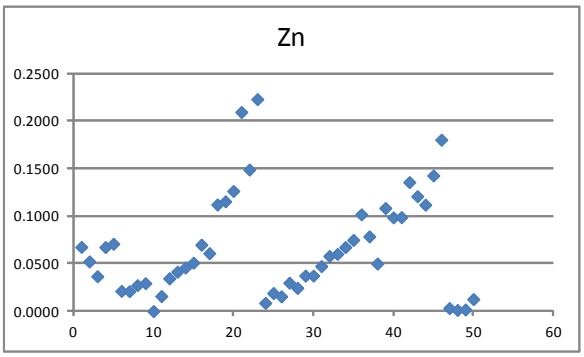












Result of Water Analysis

CHAPTER 9 RECOMMENDATIONS

9.1 Efforts for the Development of Water Saving Agricultural Technologies

When considering so called water-saving agriculture", it may not be realistic to tackle this matter in a village where no irrigation water is available. As seen in the picture, it may be difficult to apply water-saving technologies such as hydroponic, micro-irrigation and drip irrigation in the extensive farmlands with gentle slope cultivating sesame, groundnut and pigeon pea and may not be economically feasible.

It is suggested that activities using hardware such as drip irrigation will be applied for intensive crop farming that will bring higher income. On the other hand, agricultural technologies using software will be applied for extensive farming such as pigeon pea, groundnut and sesame.

For more details, the following ideas are suggested:

- Application of drought tolerant varieties (farmers have already applied this idea)
- To plant drought tolerant pulses before sesame instead of the conventional pattern of sesame and pulses to cope with unstable rainfall condition,
- To plant dragon fruits which has strong tolerance against drought, which area have been increasing compared to the period of the Development Study by JICA in 2006 to 2010,

- Mulching is not extended yet in CDZ probably because of difficulty of rice straw as mulching material in CDZ, high price of plastic sheet for general farmers, and consumption of crop by-products for animal feed. It is suggested to use meshed plastic curtain combined with mulching using pigeon pea stem and toddy's leaves to prevent evaporation by strong sunshine.

- To extend Bokashi making using IMO (Indigenous Micro-Organism) to improve water holding capacity of the predominant sandy soil,
- To extend embankment to prevent soil erosion combine with planting leguminous trees such as ipil ipil for example,

- To extend deeper plowing by using power tiller and 4-wheel tractor to plow the soil deeper at about 30cm combined with compost to improve water holding capacity of the soils,

- To improve traditional farming tools to plow the soils deeper. Japanese Bicchu spade with 3 to 4 nails will become a sample.
- Hydroponic and micro-irrigation will be applicable as a technology using hardware but only for cash crops being cultivated in small areas. And also simple drip irrigation system will be also applicable for tomato, cucumber, mango and citrus as a model. In that case, investment of about Kyat 1.0 million for tube-well and pump will be necessary.

9.2 Countermeasure for Soil Erosion

Sandy soil and farmland with gentle slope is often observed in CDZ. The sandy soil is easily eroded by strong rainfall. To cope with this issue, farmers have constructed embankment as seen in the picture. This embankment will become more effective by planting leguminous trees like ipil ipil to fix surface soils of farm lands. Leguminous trees can be fed to animals.

	
Pits and Embankment	Embankment

9.3 Rainwater Harvesting

The rainfall in CDZ can be characterized as squall-typed one, and sometimes it rains strong enough to erode surface soil of farmlands. By storing rainwater into the pits with size of about o.5 m depth x 1.0m length x 0.4 to 0.5 m width as seen in the photo in Yenangon township, soil moisture can be improved and also soil erosion can be prevented.

9.4 Water-saving by Hydroponic and Micro-Irrigation

Water-saving technologies of Hydroponic and Micro-Irrigation demonstrating and operating by Tdh, Italian NGO, in Yenangyon and Natmauk townships can be said to be a typical water-saving technology, and can be applied for cash crops cultivating in a limited acreage. It may be possible to apply this technology to cultivate watermelon and melon with higher sugar content, which may be sold named " sweet melon and watermelon in ** village in CDZ".

		
Rainwater harvesting from roof	Cultivation bed of PET	Irrigation tanks (2units)
		
Micro-irrigation	Micro-irrigation using plastic bucket	Micro-irrigation for carrots

9.5 Utilization of SAP

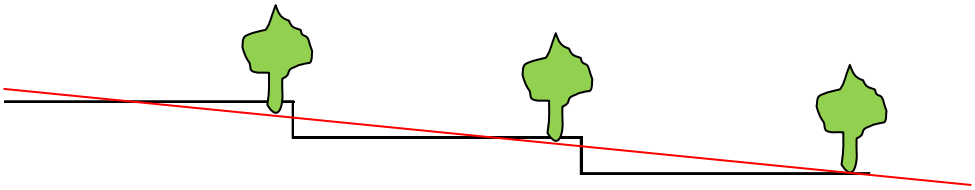
SAP (Super Absorbent Polymer) being sold in Kyaukse Township is produced originally in Germany and imported from Thailand. The price is Kyat 16,000/700g. SAP's effectiveness is described as follows.

- SAP can absorb and hold 400 times of water of its weight (is explained that 1 to 2 g SAP put beside a plant can hold moisture for about 2 weeks),
- SAP is not harmful for crops and environment,
- SAP can supply potassium to plant,
- SAP can save cost for irrigation water,
- Yield will be increased.

At present, only one farmer (owner of agricultural material shop) is testing SAP on his farm. The issue will be the price of Kyat 16,000/700g, therefore practical use by farmers will be limited. As well as hydroponic technology, SAP may become one of alternative themes to test for the improvement of water holding capacity of the soil during the Project.

9.6 Improvement of Sloping Farmlands

This suggestion is generated from the idea if sloping land becomes level by terrace method as a model of soil erosion prevention, soil erosion will be considerably decreased however, if considering necessary cost, it may be difficult to implement this idea. Planting leguminous tree of ipil ipil combined with land leveling will help prevent of soil erosion.



Terrace farm and ipil ipil

9.7 Research on Withering Points of Crops

If soil moisture decrease gradually, plants on farm it will be difficult for plants to survive and finally may be withered. The withering point is the rate of soil moisture when withering. It is reported that initial withering point is about pF3.8, and eternal withering point is pF4.2 when plants will be killed. The withering point is different by plant but it is estimated to be about steady value for all plants.

It is considered that plants will be difficult to survive if dry spell becomes long, and even if they survived, yield will be decreased.

DAR has no experience about testing withering point in CDZ according to DAR. It will be worthy to research withering points of various crops during the Project. It is suggested that research about withering point of plants by using Tensio-meter and other equipment under the different soil conditions in Myingyan, Magway, Nyaung Oo townships.

9.8 Clearing and Use of Mesquito

	
Mesquito	A bush of Mesquito

It is said that Mesquito seeds were distributed with aerial application long time ago. Mequito is fast growing tree with deep roots of about 20 m into the ground and drought tolerant. The leaves of Mesquito contain high protein useful for animals. But Mesquito has sharp and dangerous thorns with several centimeters. At present Mesquito can be seen everywhere beside road and farmlands and is left without cutting and becomes harmful trees for farming.

The efforts for elimination and effective use of Mesquito are considered to be not so difficult. Small size chainsaw and weeding machine can be used to cut them and chopper (photo) will be effective to make them into chips, which will be used to improve water holding capacity of soils and to make animal feeds.

9.9 Improvement of Data and Information Management in DOA Offices

The suggestion may out of the water-saving technology development but it is suggested to improve document and data management technology to establish unified format compiled in one document for easier utilization for DOA staff and various donors.

At present, various documents on agricultural production and climate are kept in shelf in the form of individual files as seen in the photos. Therefore it took long time to collect necessary data for the JICA Study team. Many documents are still hand writing despite extension of computers in society. It will not be difficult to input data into computer. Some data on agricultural production are deficit depending on DOA offices.

Taking into consideration that technical cooperation by international donors and NGOs will be increased in the agricultural sector, compiling data using computers will contribute to the efficient management of sequential and precise data. Number of computers in township, district and regional offices of DOA is not sufficient to undertake this suggestion. As part of the Project, it is suggested to provide DOA with necessary computers.

	
Regional Office of DOA in	Data Collection at DOA Region Office, Mandalay

9.10 Crop Selection Based on Market Needs

Prior to the supply chain survey, 10 crops were selected, and these crops included Maize, Sesame, Groundnut, Sunflower Green Gram, Pigeon Pea, Chick Pea, Cotton, Onion, and Watermelon. During the market needs survey, requirements of stakeholders of both domestic and international markets, including form of product, colors, oil content, and water content, which directly affect the decision making of transaction volume and price of products were collected. Details are discussed in Chapter 7. Based on the market needs, it is recommended to select crops to support during the Project.

It is expected that demand of Maize will continuously increase based on high demand on animal feed in China and surrounding countries, and production support to Maize Seed in addition to the Maize Cob (fresh Maize for food) is required. For oil crops, Sesame has high international demand while Groundnut has high demand for edible oil in domestic market. Therefore, development and to dissemination of high oil content and drought tolerant varieties of Sesame and Groundnut are necessary, in addition to dissemination of post-harvest technologies to avoid fungus and to decrease acid value. For pulses and beans, development and dissemination of drought tolerant varieties, and development of short term varieties to increase farmers choice for crops planting and early encashment, are required.

Watermelon has high demand in both domestic and international market, and can target China-Mongol and China-Russia border where summer season is quite short and where it is difficult to grow vegetables and fruits in the winter season. In the Central Dry Zone, sweet Watermelon can be grown under proper irrigation management. Therefore, in addition to development of high sugar content varieties, dissemination of water saving technologies is effective to expand target market.

9.11 Additional Discussion on Farming Method to Meet Market Needs

Countermeasures to the market needs including determinants of trading volume and price were discussed with DAR at the end of the field study. The action to be taken as mentioned in Chapter 7 basically depends on discussion with related Sections of DAR. Needless to say, DAR's mandate is research and development of seed and crop varieties in addition to soil and water analysis. Therefore, it is recommended to discuss with DOA which is good at analyzing countermeasures of farming method to meet the market needs obtained.

9.12 Improvement of Farm Level Seed Management

Sesame, Green Gram, Pigeon Pea and Chick Pea has several colors which makes different prices. Principal determinant of color is genetic factor, and seed selection and management is quite important to meet demand of target market. However, seed management at farm level is not relevant in general, which promote unwanted intercross. For example, Pigeon Pea is open pollination crop, which requires enough distance of each farm lot to avoid unwanted intercross. According to DAR Dry Zone Crop Research Center in Nyaung Oo, isolation distance of Pigeon Pea is at least 100m, ideally 400 to 500m. However, farmers usually do not have such knowledge and dissemination of proper seed management at farm level is required.

Sesame seed before sowing, Many colors are observed (Farm field in Magway Region)

9.13 Response to Needs of International Market

In this study, market-in approach was taken to provide information on selection of target crops in the forthcoming technical cooperation project, in addition to providing information on environmental suitability of crops in the central dry zone. From the market side, some issues which is new to Myanmar, including chemical residual issue and property right protection, in addition to consumers' and buyers' preference, were raised.

After abolishment of import tax on fertilizers and pesticides, it is said that farmers who apply fertilizers and pesticides have increased, which in turn resulted in chemical residual problems on Burmese agricultural products including Sesame and Pulses/ Beans. Therefore, it is necessary to disseminate knowledge and information on proper pesticide management, in addition to blocking inflow of illegal pesticides and to establish inspection system of chemical residuals.

Property right issues for improved or hybrid seeds is also new issues to the government. It is said that pirated seeds inflow to the union through inland border area, which give Foreign Seed Companies pause in investing in Myanmar. To promote dissemination of improved or qualified seed, protection of property right is important, and suggestion to the government on further policy reform such as establishment of monitoring system on the property right is recommended.

These issues cannot be solved peoples in the production area, and policy level measures are necessary. In this regard, it is quite meaningful that the project makes suggestions or recommendation to counterpart organization including DOA and DAR.

9.14 More Choice for Farmers

Climate condition in the CDZ is not stable and farmers have to make decision on which crops or varieties to be grown based on duration of Dry Spell, timing of rain, and other environmental and economic factors. Farmers in the CDZ have made decision on a case-by-case basis based on their experiences. It is recommended that the DOA and DAR support increasing drought resilience of farmers through scientific dissemination of research outputs R&D results of DAR, International Organizations, and NGOs and private sectors.

Also, many farmers use self-harvested seed for their crop production, since qualified seeds developed by DAR are difficult for farmers to access due to lack of amount of the seed. Also, more farmers have to choose crops and its varieties to be grown since market demand of some crops including Pigeon Pea and Cotton for example is not stable under the influence of international market. In this regards, farmers need more information on crop selection, including characteristics of variety, market needs on quality of products, marketability and profitability of crops and varieties. It is important for the project to take into consideration of increasing farmers' choice through establishing effective dissemination system of result of research activities.

Appendix

Appendix-1 Statistical documents

(1) Statistical Yearbook 2011, CSO

This is A4-sized statistic book including CD-ROM, which is issued by CSO (Central Statistical Organization) size)

General item	Agriculture concerned item
Annual precipitation by region, maximum temperature, minimum temperature, humidity 2001-2010	National level: Area classified by type of land 1990-2011
Regional annual precipitation by month 2001-2010	National level: Land utilization of net area sown 1990-2011
National population by sex and its increasing rate 1990-2011	National level: Area sown, not harvested and harvested 1990-2011
Rural/ urban population by region 1990-2010	National level: Area sown by type of planting classification 1990-2011
Population density by region 1990-2010	National level: Irrigable area and flood protection areas 1990-2011
Value of foreign trade 1990-2011	National level: Area by type of irrigation 1990-2011
Export of principal commodities 1990-2011	National level: Area of crops under irrigation 1990-2011
Direction of rice export trade	National level: Sown acreage, harvested acreage and production of selected crops 1990-2011
Average retail prices of selected commodities at Yangon 1990-2010	Regional: Sown acreage of selected crops 2004-2011
Consumer Price Index by region 2006-2011	National level: Sown area, harvested area and production of fruits 2006-2011
	National level: Sown area, harvested area and production of vegetables 1990-2011
	National level: Yield per harvested acre of selected crops 1990-2011
	National level: Distribution of quality seeds 1990-2011
	National level: Agricultural loans by crop 1990-2011
	National level: Prices of selected crops at harvested time 1990-2011
	National level: Livestock breeding 1990-2011
	National level: Production of meat, milk and egg 1990-2011

In the topic of Land use data, there is an item of “Occupied Area”. This Occupied Area is the dimension both fallow land and cultivating land ongoing.

Moreover, there are 2 kinds of maize. Maize (cob) is the core including seed and mainly being used for snack. Unit of Maize (cob) is figured as number. While maize (seed) is used for feed grain and mainly for exporting. Maize (seed) is figured by basket.

Myanmar Agricultural Statistics, 2011 CSO

General item	Agriculture concerned item
Regional population 2004-2009	National：level Area classified by type of land 1997-2010
Regional population density 2004-2009	Regional Area classified by type of land 2004-2010
Annual precipitation by region, maximum temperature, minimum temperature, humidity 1981, 1991, 2001, 2009	National level：Land utilization of net area sown 1997-2010
Regional annual precipitation by month 2009	National level：Area sown by type of planting classification 1997-2010
Annual precipitation by region 2000-2009	National level：Irrigated area by type of irrigation 1997-2010
National level:Monthly household expenditure by group 1997, 2001, 2006	Regional ：Irrigable area and flood protection areas 2004-2010
By region・By rural/Urban：Monthly household expenditure by group 1997, 2001, 2006	National level：Irrigable area and multiple cropping in irrigated area 1997-2010
	Regional ：Irrigable area and multiple cropping in irrigated area 2004-2010
	National level：Area of selected crops under irrigation 1997-2010
	Regional ：Area of selected crops under irrigation 2004-2010
	National level：Agricultural loan by crop 2000-2010
	National level：Area sown, harvested and cropping intensity 1997-2010
	National level：Sown acreage of selected crops 1997-2010
	Regional ：Sown acreage of crops 1997-2010
	National level：Average yield per harvested acre of selected crops 1997-2010
	Regional ：Average yield per harvested acre of selected crops 1997-2010
	Regional ：Production and utilization of paddy 2004-2010
	Regional ：Production and utilization by crops 2003-2010
	National level：Production of selected crops 1997-2010
	Regional ：Production of paddy and other crops 1997-2010
	National level Sown area, harvested area and production of fruits 1997-2010
	National level Sown area, harvested area and production of vegetables 1997-2010
	Prices of selected crops at harvest time 1997-2010
	GDP and agricultural output (GDP) 1997-2010
	Export of major agricultural commodities 2004-2010
	Export destination by crop 2004-2010

(2) Myanmar Agriculture in Brief 2012, MOAI

item
Basic information data of Myanmar 2010-2011
Myanmar economy and agriculture
Crop production in Myanmar and neighboring countries
Main crops cultivated in Myanmar
Agricultural land
Provision of sufficient irrigation water
Agricultural mechanization
Provision of other agricultural inputs
Main function of MOAI

(3) Talking Figures: Some Statistics in Agriculture of Myanmar and Asia-Pacific Region, MOAI

item
Myanmar in brief
National level&by region Average annual rainfall 2011
National level Land utilization 2010-2011
Water source in Myanmar
National level&by region Land area, population & density
National level&by region Urban and rural population 2010-2011
National level&by region Composition of administrative bodies 2009
GDP by sector 2009-2010
Irrigation networks in Myanmar
Net sown area and irrigated are in Myanmar 2002-2011
Cropping intensity in Myamar2002-2-11
Sown area and production by different crop groups in Myanmar 2010-2011
National level&by region Area importance of some major crops by different Regions in Myanmar
By region Major soil type and Crop's suitability
Major cropping pattern in Central Dry Zone
National level：Area (sown & harvested) , yield and production of crops 1991-2012
National level：Sown area of vegetables in Myanmar 1991-2012
National level：Sown area of fruits in Myanmar 1991-2012
ASEAN- Irrigated land as proportion of agricultural land 2009
ASEAN-Paddy and other crops area and yield and production 2009

(5) Myanmar Agriculture at a Glance 2012, DAP, MOAI

Item
MOAI organization chart
Regional meteorological data by station（2009, average between 2000 & 2009）
National level precipitation curved line
National level population by sex 1998-2011
Regional population by sex （2011）
By region,urban & rural population（1983, 2008/2009, 2009/2010, 2010/2011）
National Economy（GDP,GDP per person）
The contents of Land use (1995/1996, 2000/2001, 2008/2009, 2009/2010, 20 10/2011, 2011/2012)
National-based crop acreage by crop (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National-based crop acreage by crop (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National-based crop yield by crop (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National-based production by crop, (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National-based semination area by crop, harvested area, yield, production (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National based irrigated area and cropping ratio (1995/1996, 2000/2001,2005/2006, 2008/2009,

2009/2010, 2010/2011, 2011/2012)
National based irrigated area (breakdown)
National base agricultural machinery(1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National based Seed distribution amount (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National based Loan by Crops (1995/1996, 2000/2001,2005/2006, 2008/2009, 200920/10, 2010/2011, 2011/2012)
National based fertilizer distribution amount by crop (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National based agricultural chemical usage for each crops by MMOAI(1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
National based agricultural processed product
National based price shift by crop (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Agricultural export (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Agricultural education
Investment in Agricultural sector
Number of Livestock(1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Meat/Egg production(1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Fisheries (1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Aquaculture pond(1995/1996, 200020/01,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Forestry production(1995/1996, 2000/2001,2005/2006, 2008/2009, 2009/2010, 2010/2011, 2011/2012)
Agricultural production index ratio among ASEAN countries
National based crop production cost breakdown and yield.（2007/2008, 2008/2009,2009/2010, 2010/2011, 2011/2012）
Agricultural import (2003/2004, 2004/2005, 2007/2009, 2009/2010, 2010/2011, 2011/2012)

(6) Livestock and Fisheries Statistics (2008-2009), 2010 CSO

Main items
Population estimates by area, population density(2004-2008)
Annual precipitation by region, Annual average temperature, Annual average humidity 1980, 1990, 2000, 2008
Regional temperature by month, Precipitation, rainy day number(2008 only)
Average and actual precipitation by region（1998-2007）
National figure of livestock number by animal（(1987/1988-2008-2009)
National figure of cow, buffalo, goat, pig and fowls (198719/88-2008-2009)
National figure for the number of association keeping livestock
Artificial Insemination record by region (1996/1997-2002/2003)
State owned farm‘ s Livestock number by each livestock(1986/1987-2008/2009)
National meat production and meat production by meat（(1987/1988-2008-2009)
National meat production by producer (1987/1988-2008-2009)
National egg production by producer (1987/1988-2008-2009)
National feeding stuff request (1987/1988-2008/2009)
National livestock and fishery product`s price
Consumption of livestock and fishery production by region. (2006)
National fisheries concerned data (production, export, and its price, exporting destination)

(7) Myanmar Census of Agriculture 2010 May 2013 SLRD, MOAI

This is the latest census issued in May 2013 by SLRD. This census has eight (8) topic items as presented below and each theme has explanation and its statistical reason. The 8 topics are about agriculture in Myanmar and the situation in the subsector. This census is mainly national based data except for the one part including by-region

1. Overview of food accessibility situation in Myanmar
2. Distribution of agricultural lands under paddy in different regions
3. Land utilization, land types and land tenure in Myanmar
4. Sustainable irrigation development and the increase of the area under irrigation
5. Improving rural farmers' economy: combining the raising of cattle/other livestock with crop cultivation
6. Aquaculture: a potential major economic activity in Myanmar
7. Multi-economic activities of agricultural households in Myanmar
8. Gender profile of Myanmar's agricultural household s

Appendix-2 Abstract of DAR Centre

DAR Centre in Myingyan

Date of research	17 May 2013 (Fri)
Village	-
Village Tract	-
Township	Myingyan
Region	Mandalay
Place	15 minutes by car from the central of Myingyan Township
Interviewee	Director Ms.Daw Tin Than (mobile) 09-4925-2991 and her staff
General information	
Year Established	Established in 1954 Pilot program has started in 1984. This farm is one of the 24 farms (17 centres and 8 branches) of DAR. This farm is one of the 5 branches located in Mandalay.
Number of staff	17 (2013)
Budget（2012/13）	Kyat 41.9 million
Dimensions and Altitude	Dimentions:107.2 ac (cultivating acreage:80.69 ac) Altitude:70m
Research object crop	Pigeon pea, Groundnut, Sesame, Chick pea
Study purpose	・ Development for high yield cultivar of dry zone oriented Crop, such as pigeon pea, sorghum, chick pea ・ Research for cropping system of pigeon pea, sorghum, chick pea ・ Distribution of good quality seed and demonstration for new production technologies for farmer
Water source of irrigation	5 tube –wells are set. 3 of these are for irrigation purpose. However, the water is not suitable for irrigation because of alkaline pH(PH 8.2-8.5)
Soil condition	PH: 6.55 Sand 65.81 % Silt 11.44% Clay 20.00% Sandy loam 2.75% ＊Regarding the soil analysis, refer to the attached document of Nyaung U research farm

Meteorological condition (2012)

Month	Rainfall (mm)		Temperature （）	
	10-year average	2012	2012	
			Max.	Min.
Jan	2.29	6.09	20.20	12.00
Feb	2.79	-	33.60	13.60
Mar	1.52	4.83	37.00	19.00
Apr	12.7	10.92	39.70	24.40
May	103.63	23.62	40.80	27.30
Jun	81.03	62.74	36.60	26.80
Jul	73.66	26.42	35.80	26.30
Aug	130.05	134.11	34.20	25.60
Sep	166.62	138.94	34.20	23.50
Oct	129.29	52.32	34.20	23.50
Nov	16.76	5.58	31.20	20.80
Dec	4.93	-	30.00	11.10
Total	742.44	465.57	-	-

Activities

1. Hybridization
2. Selection
3. Yield trial
4. Demonstration
5. Agro-technique
6. Water saving

Achievement

Variety	Duration (days)	Yield (kg/ha)	Release year	Remark
Pigeon pea				
ICPL-87	120-140	641.2	1988	Short duration
ICPL-93003	160-180	1,282.4	1999	Medium duration
ICPL-87119	160-180	1,603.0	2000	Medium duration
Chick pea				
JCCV-3	80-85	1162.0	2000	Short duration
JCCV92944	85-90	1594.4	2004	Short duration

Cultivating acreage (ac)of Myingyan District

Pigeon pea	269,911
Green gram	75,271
Chick pea	33,580
Groundnut (rain)	83,389
Groundnut (post rainy)	31,512

Contact Farmer(CF) of DAR

Myingyan DAR Centre has 15 contact farmers.（1 CF is nominated in 5 villages）.The CF are mostly interviewed by DAR and their academic background, high concern for agricultural technology, their status (rich or poor) will be considered. Most of CF is Village chairman who are assigned over 3 years, and they are mostly assigned by both DOA and DAR.
Officer of DAR cannot access to all the farmers. Therefore, as an extension system, officers direct CF to extend agricultural technologies to farmers.
DOA is in charge of distribution of improved variety and extension of its technology. On the other hand, DAR in charge of disease prevention and protection from insects, folia application, and distribution of bacteroid.

Conserving water agricultural technology

“We want to study conserving water technologies.”

In this farm, with the condition of meteoric water, water-saving canal (1 feet width), which crosses each ridges, is constructed by each 8ft in the intercropping

	field of Pigeon pea and sesame since 2 years ago. There are 3 alternative depth, 0ft, 1ft and 2ft, and soil moisture is measured every 15 days. Until now, 1ft depth results in the highest soil moisture. As of May 2013, it is the season for preparation before cropping, we can see the pilot result coming month. Therefore, this technology is not yet transferred to farmers. Average input of fertilizer is 5 ton/ac (12.5 ton/ha), which is less than the average in Japan.
	

Dry Zone Agricultural Research Centre, Nyaung U Farm, DAR

Date of research	6 May 2013 (Sat)
Village name	-
Village Tract	-
Township	Nyaung U
Region	Mandalay
Location	About 5 minutes away from Nyaung U city centre by car
Interviewee	Farm manager: Ms.Daw Khin Myint Kyi
General info：	
Year Established	This farm was established as one of the 24 farms of CARI, and it became Dry Zone Agriculture Research Centre in 2004.
Number of staff	12 staff、11 laborers
Budget	Kyat 39.263million (2012/13)
Dimensions and altitude	Total dimensions 121.44 ac (incl. 77.91 ac for tillage), altitude: 63 m
Research object crop	Pigeon pea, Groundnut, Sesame, Green gram (mung bean)
Research purpose	・ To develop new high yield variety with good quality and suitability for dry zone area ・ To develop proper farming technologies ・ To distribute good quality seed and exhibit new farming technologies for farmers. ・ To discuss and solve the problem faced by farmers in CDZ. ・ To develop the cropping system of Pigeon pea Pigeon pea
Aim for Activities (2013-2014)	・ Developing the new high yield variety with high suitability to the CDZ ・ Develop the high drought resistance with proper yield performance Production of high quality seeds for farmers. ・ Testing proper farming technology for farmers in CDZ.

Soil Type	Sandy soil（Alfisol） PH: 5.8 to 7.5 Red brown savanna 25.24 % Broqn savanna 9.92% Reddish brown savanna 3.43% Brown savanna 4.82% Shallow reddish brown savanna 7.79% Light reddish brown savanna 6.79%

Meteorological condition

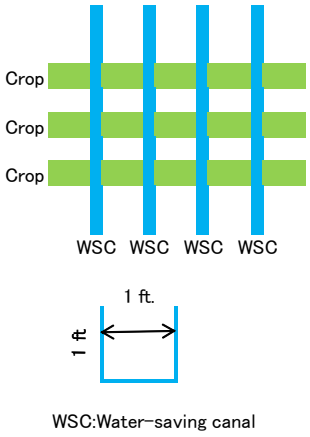
Month	Rainfall (10 year's average) (inches)	Temperature (10 year's average)	
		Min.	Max.
Jan	0.0640	11.768	34.223
Feb	0.0030	13.345	39.294
Mar	0.0690	20.279	42.348
Apr	0.3640	23.733	44.176
May	4.3650	26.366	43.174
Jun	3.0490	25.456	40.986
Jul	0.8157	26.407	39.986
Aug	3.7151	25.479	40.120
Sep	6.3390	24.219	39.436
Oct	6.8750	23.140	38.816
Nov	0.1730	19.72	37.457
Dec	0.3050	15.431	34.16
Total	26.1400	-	-

The varieties released with cooperation with ACIAR	Pigeon pea: Thahtaykan, Monywa Shwedinga Groundnut: Sinpadatha-8, Sinpadatha-11
Promising fruit tree	Jujube: no available statistics for jujube. However, there is significant increase in planting Jujube and government also promotes to plant Jujube. Mango: Higher suitability than other township
Promising vegetable	With irrigated water, the priority is given to 1.Tomato, 2nd Cow pea, 3rd Cucumber. These vegetable has high demand and planted in areas with cool weather around Mt.Popa.
Cooperation of ACIAR	ACIAR cooperate for 3 kinds of crops such as Groundnut, Chick pea and Pigeon pea which are suitable for CDZ. No technical cooperation for conserving water
Irrigation in CDZ	According to the farm manager, the first priority of water use in CDZ is for dinking. Irrigation water is only second concern because of water shortage.
Number of Township in CDZ	51 Township Remarks: Yametin, Thatkon, Pwintphyu is excluded from CDN and classified in Nay Pyi Taw council area. In survey of JICA, 54 townships were initially included in CDZ. Later, these 3 townships were excluded in the first steering committee.
Conserving water agricultural technology	To cover the surface of soil by Cover Crop (Especially leguminous weed) in order to inhibit evaporating and soil flow.. Mulching cultivation：Utilization of crop waste. Farmers know how to make compost with IMO

Dry Zone Agricultural Research Centre ,DAR (Nyaung U)	Jujube(Indian date) in the field.	Farm manager & staff discussion

DAR centre in Magway (Oil Crop Research Center)

Research date	22 May 2013 (Wednesday)
Village name	-
Village Tract	-
Township	Magway
Region	Magway
Location	Around 10 minutes from city centre of Magway by car
Interviewee	U Thein Htay Oo, Deputy dorector
General information:	
Year Established:	Established in 1927 as one of the 7 Crop Research Centre of DAL. In 1946, the body moved to MAS. In 2010, it became Sesame Research Centre under DAR.
Number of Staff	22 staff and 20 laborers (2011)
Budget（2012/13）	Kyat 54 million
Dimensions and altitude	Dimentios:100.182 ac(Incl,58.51ac for tillage), Altitude:NA
Research object crop	Pigeon pea, Groundnut, Sesame, Cow pea, Green gram
Research purpose	This pilot farm is testing special kinds of crops (Pigeon pea, Groundnut, Sesame, Cow pea, Green gram) under unfavorable condition representing Sagaing, Mandalay and Magway.
Water resource of irrigation	There are 2 tube-wells in the farm. One has broken pump and the other is for drinking use only. Therefore, farmers depend only on rain water.
Soil type	PH: 6-7.5 Sand 56.51 ac Red Clay 2.00 ac Regarding the soil analysis Oil crop research centre`s documentation is attached.
Meteorological conditions	10 year average: Rainy day: 53 days, Rainfall: 31.48 inches 2012: Rainy day: 38 days, 21.35 inches
Service	This center aims for systematic research activities such as... * To cooperate with farmers, consumers and distributors to solve problem of local agriculture. *To develop good quality variety and distribute seed for farmers and extend its technology.
Activities	1. To find out high yielding and pests and diseases resistant oil crops varieties which are suitable to the local area 2. To observe the technologies which can solve the agricultural problems in local area 3. To produce pure oil crop seeds and to produce regionally adapted other crops by breeding
Purpose	To achieve domestic demand and supply of edible oil. To increase farmer's income To boost up national economy with the application of

	advanced agricultural research result.
Contact Farmer (CF) nominated by DAR	Currently total 10 farmers are nominated from 6 to 7 Villages of 26 townships in Magway area. They are elected based criteria such as, rich or poor, high/low concern to the activities of DAR, academic background and so on. Mostly CFs is Village chairman. There is no term limit for CF and they can continue if they wish. They are Volunteers. The tested variety`s seeds are distributed to CF Then CF will try the seeds as demonstration and test its yield.
Conserving water agricultural technology	1. DAR headquarter is testing water-saving canal. It is not yet applied to farmers.  WSC:Water-saving canal 2. Water harvesting When rain occurs in CDZ, the water flows up to down and rain water is wasted. Therefore, there is a plan to construct pit between farm land or end of slope in order to save rain water.  According to the director XX, if you dig around 40 cm, moisture is found even in the dry season in February. Hence, will be able to keep higher moisture. This technology was confirmed when the survey team visited Yenaungyon Township. As shown in the photo, a similar pit and embankment technology was found to be constructed which was implemented by UNDP in 1995.

	
DAR Magway Research Center	Farmland in the farm (testing windbreak)

Appendix-3 Village survey (14 villages)

In addition to farm household survey and data collection of regional and township office of DOA, village survey was implemented. The criteria to chose village is, ① Conservation water agricultural technology is implemented,② Received aid from ACIAR, ③ Tdh is implementing conserving water agricultural technology. To select the village, the survey team seek the advice of DAR centre and DOA township office in Myingyan, Magway and Nyaung U Townships.

Village Survey

No.	Village Name	Village Tract (VT)	Township (TS)	(Region)
1	Phon	Balon VT	Myingyan	Mandalay
2	Zee Pin Kan	Zee Pin Kan	Myingyan	Mandalay
3	Ywar Thar Yar	Ywar Thar Yar	Myingyan	Mandalay
4	Shwe Hlaing	Pyon	Nyaung U	Mandalay
5	Kaung Si	Taung Zin	Nyaung U	Mandalay
6	Htee Pu	Htee Pu	Nyaung U	Mandalay
7	Dahat See	Dahat See	Nyaung U	Mandalay
8	Taung Shae	Kuywar	Nyaung U	Mandaly
9	Taung Ba	Taung Ba	Nyaung U	Mandalay
10	Myoe Hla	Yuar Thar	Nyaung U	Mandalay
11	Si Pin Thar	Lat pan Daw	Magway	Magway
12	Myin Kin	Mal Hla Taung	Magway	Magway
13	Mingan		Chauk	Magway
14	San Kan Gyi	Ma Gyi Kan	Yenanchaung	Magway

Village Survey in CDZ

Research date	9th May 2013 (Thursday)
Village name	Myin Kin
Village Tract	Mal Hla Taung
Township	Magway
Region	Magway
Location	About 15minutes from city centre of Magway by car
Interviewee	Village chairman and several villagers
General info of the village:	

<table>
<tr><td>Geography</td><td>Flat terrain. In summer, 600 feet away from Irrawaddy river (located west side from the river). In the rainy season, the distance is 300 feet.</td></tr>
<tr><td>Population</td><td>1,397 people　in 2013</td></tr>
<tr><td>Total number of households</td><td>332 households</td></tr>
<tr><td>Number of farmers</td><td>50 households</td></tr>
<tr><td>Number of Landless households</td><td>282 households（Farm labor）</td></tr>
<tr><td>Average households number</td><td>4.2 people /household</td></tr>
<tr><td colspan="2">Agricultural information:</td></tr>
<tr><td>Farmland structure</td><td>Total cultivated area: 150ac (incl 80 ac for Up-land, 70 ac for paddy field of lowland) This 80 ac for up-land is likely to be cultivated illegally.</td></tr>
<tr><td>Water resource of irrigation/irrigation method</td><td>Pumping irrigation from Irrawaddy river (WRUD`s project). Furrow irrigation is implemented in farm</td></tr>
<tr><td>Water usage fee</td><td>Kyat 12,000/ac/season(rainy season)、Kyat 15,000/ac/season(summer)</td></tr>
<tr><td>Ground water level</td><td>Only 10feet</td></tr>
<tr><td>Tube-well</td><td>250 places in village. The usage of the well is for vegetable cultivation in their garden and for drinking water</td></tr>
<tr><td>Main crop and variety
(In order with large area)</td><td>Sesame (the first year)、Groundnut (the 2nd year)、 Green gram、 Sunflower、
vegetables (Roselle, gourd, beans, water cress, tomato、 Paddy</td></tr>
<tr><td>High revenue crop
(In order with high revenue)</td><td>Groundnut 、 Sesame 、 Paddy 、 Green gram 、 Sunflower</td></tr>
<tr><td>Planting fruit tree</td><td>Mango for sell</td></tr>
<tr><td>Usage (sell or own consumption)</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Sesame</td><td>99</td><td>1</td></tr>
<tr><td>Groundnut</td><td>99</td><td>1</td></tr>
<tr><td>Green gram</td><td>99</td><td>1</td></tr>
<tr><td>Sunflower</td><td>100</td><td>0</td></tr>
<tr><td>Vegetables</td><td>100</td><td>0</td></tr>
<tr><td>Paddy</td><td>75</td><td>25</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Sesame</td><td>Zone Phyu, black sesame</td></tr>
<tr><td>Groundnut</td><td>Thong Thain, Vietnam white</td></tr>
<tr><td>Green gram</td><td>Kyauk sein</td></tr>
<tr><td>Sunflower</td><td>NA</td></tr>
<tr><td>Vegetables</td><td>NA</td></tr>
<tr><td>Paddy</td><td>Manotca, Aeyapaday Thar</td></tr>
</table>
</td></tr>
<tr><td>Sale destination</td><td>Farmers visit San (broker company) in Magway to sell.</td></tr>
<tr><td>Soil</td><td>Sandy soil: poor fertility, Loamy soil: not so poor
No erosion because of the flat terrain.</td></tr>
<tr><td>Conserving water agricultural technology</td><td>This village was introduced by DAR township and this village is WRUD`s beneficiary area.
Conserving water agricultural technology is　not identified.
However mushroom cultivating was considered as water-conserving agriculture (implemented in CDZ development survey).
Cultivation in garden is very limited but important in efficient water use.</td></tr>
<tr><td>The minimum size of farmland for livelihood</td><td>10 ac/households</td></tr>
<tr><td>The minimum living cost</td><td>Kyat 80,000/month /household（5 member per household）</td></tr>
</table>

Remark	Pumping irrigation from Irrawaddy river is implemented and water course is facilitated. Irrigated area is paddy field, the other is upland. Compared to CDZ of rainfed agriculture, this area is in better condition in agriculture. Shallow ground water level makes it easier to dig water well and farmers can cultivate vegetable (basin irrigation), fruit (citrus) in their garden and mushroom which requires less water to cultivate.

Irrigated area donated by WRUD

cultivation by ground water use

Village survey in CDZ

Research date	9 May 2013 (Thursday)
Village name	Si Pin Thar
Village Tract	Lat Pan Daw
Township	Magway
Region	Magway
Location	Around one (1) hour away from city centre of Magway
Interviewee	Village chairman and a few villagers.
General information of village	
Geography	Almost flat terrain
Population	885 people in 2013
Total number of households	175 households
Number of farmers	75 households
Number of landless farmers	100 households（Farm labor）
Average number of household member	5.0 people/ household
Agricultural information	
Farmland structure	Total cultivated area:1,500ac (Incl. Upland:1,300ac Lowland(paddy field):200ac
Water source of irrigation /irrigation method	Farmers built weir in the river and transmit water from weir to water course. However, the weir was damaged in 2012. At presentthe damaged weir and sedimentation prevent water flow to water course. Farmers obtain water with treadle pump from shallow well for their garden cultivation.
Water use fee	None (This it not the project of ID, WRUD)
Ground water level	40 feet (It can be dug in a day). The cost for digging is Kyat 60,000/well
Tube-well	15~20 tube- wells in the village. The water is for garden cultivation and drinking.
Main crop and variety (in order with large area)	Sesame + Pigeon pea (intercropping) Groundnut Paddy Pigeon pea

<table>
<tr><td>High revenue crop
(In order with high revenue)</td><td>Sesame　Groundnut　Paddy　Pigeon pea</td></tr>
<tr><td>Planting fruit tree</td><td>Tamarind and Mango for sale</td></tr>
<tr><td>Usage (Sell, own consumption)</td><td>
<table>
<tr><th>Crop</th><th>For sale (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Sesame</td><td>75</td><td>25 (for oil & seeds)</td></tr>
<tr><td>Groundnut</td><td>80</td><td>20</td></tr>
<tr><td>Pigeon pea</td><td>90</td><td>10</td></tr>
<tr><td>Paddy</td><td>10</td><td>90</td></tr>
<tr><td colspan="3">Vegetable planting:2-3 times/year (roselle, gourd, chilie, tomato, onion）</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Sesame</td><td>Warkyaanet</td></tr>
<tr><td>Groundnut</td><td>Toontarni</td></tr>
<tr><td>Pigeon pea</td><td>Pwintphyu Thukha</td></tr>
<tr><td>Paddy</td><td>Monywa Shwedinga</td></tr>
</table>
</td></tr>
<tr><td>Sell destination</td><td>Farmers visits U Thein Tun Win（broker）to sell their product in Magway.</td></tr>
<tr><td>Soil condition</td><td>Sandy loam and middle fertility level. Farmers use fertilizer.</td></tr>
<tr><td>Conserving water agricultural technology</td><td>Ground water level is only 40 feet (around 12 meters). Shallow well and/or treadle pump are used and it is effective to provide　limited water resource. Unglazed pottery with full　water is set under Mango tree and this leaking water is used as　stable irrigation.
（Refer to photo below）</td></tr>
<tr><td>The minimum size of farmland for livelihood</td><td>10 ac / households</td></tr>
<tr><td>The minimum living cost</td><td>Average number of households: Kyat 300,000/month/household</td></tr>
<tr><td>Remark</td><td>To use the unglazed pottery for fruit tree seedling is primitive method however this method is very suitable for locality with the view of conserving water method even when target crop and irrigated area is limited.
Moreover, treadle pump irrigation can be a model for intensive vegetable cultivation of conserving water agriculture with the condition of narrow ground water level and easy digging.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Treadle pump in garden for irrigation and domestic work</td><td>Mango Cultivation with water resource of unglazed pottery</td><td>Damaged diversion weir and sedimentation</td></tr>
</table>

Village Survey in CDZ

Research date	4 May 2013 (Saturday)
Village Name	Phon
Village Tract	Balon
Township	Myingyan
Region	Mandalay

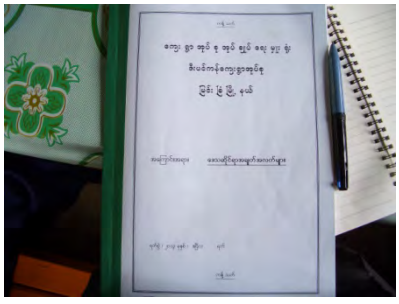
<table>
<tr><td>Location</td><td>30 minutes by car from city centre of Myingyan</td></tr>
<tr><td>Interviewee</td><td>Village chairman</td></tr>
<tr><td colspan="2">General information of Village :</td></tr>
<tr><td>Geography</td><td>Undulating land</td></tr>
<tr><td>Population</td><td>600 people (in 2013)</td></tr>
<tr><td>Total number of households</td><td>165 households</td></tr>
<tr><td>Number of farmers</td><td>135 households</td></tr>
<tr><td>Number of landless farmer</td><td>30 households（Farm labor）</td></tr>
<tr><td>Average number of households</td><td>3.6 people/household</td></tr>
<tr><td colspan="2">Agricultural information：</td></tr>
<tr><td>Farmland structure</td><td>Total cultivated land:700ac (Upland:620~630ac, Lowland (paddy field):
70~80ac</td></tr>
<tr><td>Water resource of irrigation / irrigation method</td><td>Furrow irrigation is used for upland. The water comes from rain water or pumped from tube-well. For paddy field, the water is irrigated from dam. For vegetable in garden, farmers use water pot only.</td></tr>
<tr><td>Water use fee</td><td>NA</td></tr>
<tr><td>Ground water level</td><td>100~160 feet</td></tr>
<tr><td>Tube-well</td><td>Irrigating upland by tube well. Investment is necessary for digging operation.
For digging operation: Kyat 500,000, Pump :Kyat 500,000(made in china)＝Total Kyat 1.0 million</td></tr>
<tr><td>Main crop and variety
(in order with large area)</td><td>Onion Chick pea Monson Paddy(Manaw Thuka) Pigeon pea
Vegetable: Cauliflower, Cabbage, Eggplant, Mustard, Tomato</td></tr>
<tr><td>High revenue crop
(In order with high revenue)</td><td>Onion, Chick pea, Cabbage</td></tr>
<tr><td>fruit tree</td><td>Tamarind and Mango for sale</td></tr>
<tr><td>Usage (sell, own-consumption)</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Onion</td><td>100</td><td>0</td></tr>
<tr><td>Chick pea</td><td>99</td><td>1</td></tr>
<tr><td>Pigeon pea</td><td>100</td><td>0</td></tr>
<tr><td>Paddy</td><td>0</td><td>100</td></tr>
<tr><td colspan="3">Vegetable: planting by 2~3times/year (Roselle, gourd, Chili, tomato)</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Onion</td><td>Shwe Pharar</td></tr>
<tr><td>Chick pea</td><td>Yezin 6</td></tr>
<tr><td>Pigeon pea</td><td>Monywa Shwe Dinga</td></tr>
<tr><td>Paddy</td><td>Manowtoka</td></tr>
</table>
</td></tr>
<tr><td>Selling destination</td><td>Farmers go to Myingyan to sell to broker</td></tr>
<tr><td>Soil condition</td><td>Sandy and poor soil. Construction in bank to stop flow of soil..
Rotary cultivator with 2 wire（Kyat 1.9million/car）can cultivate 10 inch depth
.</td></tr>
<tr><td>Conserving water agricultural technology</td><td>Upland depends on rainy water. Rotation irrigation in paddy field. Tube-well is individually owned and it is sold to farmer who do not use irrigation (Kyat5,000/day). No mulching cultivation here.</td></tr>
<tr><td>The minimum size of farmland for livelihood</td><td>10 ac / households</td></tr>
</table>

The minimum living cost	NA	
Remark	Onion is main production. Upland depends on rain water. However one part of upland has tube-well, where onion and vegetables are cultivated. The farmer, who does not own Tube-well, pays for water fee and obtains water to irrigate his crops. However the beneficiaries are only farmers around tube-well. Interviewee (farmer) input chemical fertilizer more than the recommendation of DOA. Draft cow for cultivation is around Kyat 800,000, set of draft cow cost is Kyat 1.6 million.	
		
Onion planting with Tube-well Irrigation	Farmer own culitivator. However, they use mainly draftcow.	Onion as main product

Village Survey in CDZ

Research date	5th May 2013 (Sun)
Village Name	Zee Pin Kan
Village Tract	Zee Pin Kan
Township	Myingyan
Region	Mandalay
Location	30 minutes by car from city centre of Myingyan
Interviewee	Village chairman. GAD[1], located in all village tract also participated. (GAD makes directly such as number of population and households and so on. Refer to the attached document)
General info of Village	
Geography	Undulating
Population	1,875 people (in 2013)
Total number of households	426 households
Number of farmer	258 households (61% of population)
Number of landless farmer	168 households (163 Farm labor households + 5 government staff households)
Average number of households	4.4people /households
Agricultural information	
Farmland structure	Total cultivated land: 4,245ac (Upland:3,415 ac, Lowland (paddy field):70~80ac)

[1] General administrative department

<table>
<tr><td>Water resource of irrigation / irrigation method</td><td>5 tube-well in the village, which are owned by one farmer. It makes possible for pumping water and use of water whole year round.</td></tr>
<tr><td>Water use fee</td><td>Farmer without own water source of irrigation need to pay Kyat 3,000/hr from tube-well owner.</td></tr>
<tr><td>Ground water level</td><td>80~150 feet</td></tr>
<tr><td>Tube-well</td><td>Depth is from 80 to 150 feet. 258 farmers' use of tube-well. Kyat 1.0million is needed to dig well and buy pump as investment.</td></tr>
<tr><td>Main crop and variety
(in order with large area)</td><td>Groundnut + Pigeon pea (intercropping) Sorghum Sesame
Chick pea (lowland) Maize
Vegetable cultivation in garden is only for own consumption (Gourd, Tomato, Pumpkin, Roselle. No onion production for inappropriate land condition with red sandy soil (low fertility) including high salt content.</td></tr>
<tr><td>Hight revenue crop
(In order with high revenue)</td><td>Maize、 Pigeon pea, Groundnut, Sesame</td></tr>
<tr><td>fruit tree</td><td>Plum</td></tr>
<tr><td>Usage (sell, own-consumption)</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Groundnut</td><td>50</td><td>50</td></tr>
<tr><td>Pigeon pea</td><td>98</td><td>2</td></tr>
<tr><td>Chick pea</td><td>80</td><td>20</td></tr>
<tr><td>Sesame</td><td>75</td><td>25</td></tr>
<tr><td>Sorghum</td><td>100</td><td>0</td></tr>
<tr><td>Maize</td><td>100(grain)</td><td>0(leave+stem)</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Groundnut</td><td>SP21</td></tr>
<tr><td>Pigeon pea</td><td>Monywa Shweginga</td></tr>
<tr><td>Chick pea</td><td>Yezin 4, V2</td></tr>
<tr><td>Sesame</td><td>Kanchi</td></tr>
</table>
</td></tr>
<tr><td>Sell destination</td><td>Farmer visit Aye company in Myingyan to sell their product.</td></tr>
<tr><td>Soil condition</td><td>Red & sandy soil is dominant. Composting with sesame waste and cow manure is input to farmland. However, shortage of manure production results in shortage of input to farmland.
To stop soil flow, 6 inch width bank is constructed.</td></tr>
<tr><td>Conserving water agricultural technology</td><td>No conserving water agricultural technology. Use both groundwater and rain water.</td></tr>
<tr><td>The minimum size of farmland for livelihood</td><td>7 ac/households(if with proper rainfall)</td></tr>
<tr><td>The minimum living cost</td><td>NA</td></tr>
<tr><td>Remark</td><td>During rainy season, groundnut and pigeon pea is mainly cultivated.
Bank construction to stop soil flow is handed down from generation as their agricultural method.
One farmer owns 5 tube-wells and collect water fee from other farmars.</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Sampling from Tube-well</td><td>Storage reservoir for drinking water, donated by UNHABIT(available for 4</td><td>Directly made by GAD</td></tr>
</table>

	month/year)	

Village Survey in CDZ

Research date	5th May 2013 (SUN)
Village name	Ywar Thar Yar
Village Tract	Ywar Thar Yar
Township	Myingyan
Region	Mandalay
Location	40minutes by car from city centre of Myingyan
Interviewee	Village chairman and other farmar. Chairman is incharge of contact farmar. (Most of village chairmans are in charge of contact farmers).
General information of Village	
Geography	Undulating
Population	1,535 people (in 2013)
Total number of households	265 households
Number of farmers	155 households (58%)
Number of Laundress farmers	110 households (Farm labor)
Average number of households	5.8 people/households
Agricultural information	
Farmland structure	Total cultivated area:1,8165ac (Upland:1,800 ac Lowland(paddy field):16ac)
Water resource of irrigation / irrigation method	6 households own tube-well. Except for the irrigated area by these 6 tube-well, other lands depend on rain water. Farmers who do not own tube-well need to pay Kyat 5,000 to obtain water for irrigation. Furrow irrigation is implemented for tomato, tobacco chili, Watermelon, maize.
Water use fee	Farmers who do not have water source need to pay Kyat 5,000 to obtain water
Ground water level	100~200feet
Tube-well	Digging depth is from 100 to 200 feet. 6 farmers owners. Total Kyat1.0 million (Kyat 500,000 for digging and Kyat 500,000 for pump) is necessary for investment.
Main crop and variety (in order with large area)	Sesame Pigeon pea Groundnut (monsoon season) Watermelon Tomato Tobacco Intercropping for Groundnut and Sesame or Groundnut and Pigeon pea. Vegetable cultivation is for Chili and Roselle. Onion cannot be cultivated without water source of irrigation.
High revenue crop (In order with high revenue)	Watermelon、 Pigeon pea, Tobacco, Tomato, Groundnut, Sesame
fruit tree	Mango, Plum for sell
Usage (sell, self-consumption)	

Crop	For sell (%)	For Home use +seeds (%)
Groundnut	95	5
Pigeon pea	98	2
Watermelon	100	0
Sesame	70	30
Tomato	100	0

	Tobacco | 100 | 0
Varieties	Crop: Sesame — Variety: Kanchi Pigeon pea — Monywa Shwe Dinga Groundnut — SP121 Watermelon — 855 (varietiy from Taiwan) Tobacco — Domestic species Tomato — 909 (variety from Taiwan)
Sell destination	Farmers go to Myingyan to visit Aye company to sell their product.
Soil condition	Poor soil in the east and south of village. Middle fertility in the west. Sandy loam is better than Sandy?????. Cow manure is input to farmland to improve soil condition. However, farmers are rotating farmland because of the shortage of cow manure. Bank is constructed to prevent soil flow during rainy season.
Conserving water agricultural technology	No conserving water agricultural technology is seen here. The rich farmers dig Tube-well while others depends on rainy season.
The minimum size of farmland for livelihood	NA
The minimum living cost	NA
Remark	Water source and soil condition decides kinds of crops to be planted. This affects yield and farmers income (this is the impression of survey team). With water source, farmers can chose crop with high revenue. Farmer owning tractor (PREET7549 made in India) use custom work. The tractor can dig 10 inch which is deeper than using draft cow Plowing：Kyat 20,000/ac, harrowing:120,000/ac International Development Enterprise (IDE) donated drinking water facility in 2011.

Tractor (made in India) withdiskplow

Tomato cultivation irrigated by Tube-well

Tomato cultivation by furrow irrigation

Village Survey in CDZ

Research date	7 May 2013 (Tuesday)
Village name	Dahat See
Village Tract	Dahat See
Township	Nyaung U
Region	Mandalay
Location	1hour by car from Nyaung U
Interviewee	Village chairman and farmers
General information of village	

<table>
<tr><td>Geography</td><td>Hilly area, Altitude 400m</td></tr>
<tr><td>Population</td><td>537 people (in 2013)</td></tr>
<tr><td>Total number of households</td><td>133 households</td></tr>
<tr><td>Number of farmers</td><td>70 households</td></tr>
<tr><td>Number of Landless farmers</td><td>63 households（Farm labor）</td></tr>
<tr><td>Average number of households</td><td>4.0 people / households</td></tr>
<tr><td colspan="2">Agricultural information</td></tr>
<tr><td>Farmland structure</td><td>Total cultivated area: 2,000ac for Upland</td></tr>
<tr><td>Water resource of irrigation / irrigation method</td><td>Agriculture here depends on rainy season completely. For tomato, farmers use a glass of drinking water to irrigate.</td></tr>
<tr><td>Water use fee</td><td>NA</td></tr>
<tr><td>Ground water level</td><td>1,000 feet. Too deep to dig tube-well and cost is expensive for farmers to dig. There is no Tube-well for irrigation use in this village.</td></tr>
<tr><td>Tube-well</td><td>Only one tube-well, built by government 30 years ago, exist for the use of drinking water</td></tr>
<tr><td>Main crop and variety
(in order with large area)</td><td>Sesame + Pigeon pea (mixed farming) Tomato、 Groundnut、 Sorghum
Vegetables: String bean for sell
Tomato farmland is used for rotation for both tomato and Pigeon pea + sesame.</td></tr>
<tr><td>High revenue crop
(In order with high revenue)</td><td>Pigeon pea、 Tomato、 Sesame、 Groundnut
Remarks: Sesame cannot be harvested once in 5-years.</td></tr>
<tr><td>fruit tree</td><td>Mango, tamarind, Jujube, Persimmon for sale</td></tr>
<tr><td>Usage (sell, self-consumption)</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Sesame</td><td>99</td><td>1</td></tr>
<tr><td>Pigeon pea</td><td>99</td><td>1</td></tr>
<tr><td>Tomato</td><td>100</td><td>0</td></tr>
<tr><td>Groundnut</td><td>10</td><td>90</td></tr>
<tr><td>String bean</td><td>99</td><td>1</td></tr>
<tr><td>Fruits</td><td>100</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Sesame</td><td>Kanchi</td></tr>
<tr><td>Groundnut</td><td>3 month variety & 6 month variety</td></tr>
<tr><td>Pigeon pea</td><td>Monywa Shwedinga</td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Sell destination</td><td>Sell to U Sein Tun or Kyaw Kyaw shop of Kyaukpadaung. Farmers use Tragyi as transportation.</td></tr>
<tr><td>Soil condition</td><td>Sandy and poor fertility. As fertilizer, cow and poultry manure and tamarind are used.
To avoid erosion, farmers construct bank.</td></tr>
<tr><td>Conserving water agricultural technology</td><td>Altitude is 400m. No irrigated water. Very tough environment to cultivate Tomato with a glass of drinking water. No mulching cultivation for tomato.</td></tr>
<tr><td>The minimum size of farmland for livelihood</td><td>10 ac/households</td></tr>
<tr><td>The minimum living cost</td><td>NA</td></tr>
<tr><td>Remark</td><td>The village was introduced by Nyaung U DAR Farm’s manager
Very sever environment of water shortage.
Farmers learned tomato cultivation from the farmers around Mt. Popa.
Giving a glass of water to tomato only in transplanting moment is the ultimate method of conserving water. Tomato cultivation improved</td></tr>
</table>

	farmer's livelihood here. IMO method is not known by farmers.

		
Tomato farmland with slope (Before rainy season)	String bean (string bean)	Rain water is stored in ceramic jar

Village Survey in CDZ

Research date	7 May 2013(Tuesday)
Village name	Htee Pu
Village Tract	Htee Pu
Township	Nyaung U
Region	Mandalay
Location	1.5 hour by car from city centre of Nyaung U
Interviewee	Village chairman and farmers
General information in Village	
Geography	Undulating
Population	1,065 people (in 2013)
Total number of households	253 households
Number of farmers	150 households
Number of Landless farmers	103 households (Farm labor belongs to upland work and extraction of Toddy)
Average number of households	4.2 people /households
Agricultural information	
Farmland structure	Total cultivated area: 3,000ac for Upland。
Water resource of irrigation / irrigation method	Water source for irrigation is storage reservoir. Water is available from June to March. This storage reservoir is rehabilitated by investment of monk in 2006 and by doing yearly repair.. For the tomato farmland (450 ac), famers take glass of drinking water from drinking water facility (donated by UNICEF and JICA) to irrigate tomato when transplanting. Tomato farmland is furrowed.
Water use fee	Glass of water from drinking water facility is free of charge. However, farmers from outside of village need to pay for water.
Ground water level	1000 feet is necessary to be dug Tube-well. This it too costly for farmers.

<table>
<tr><td>Tube-well</td><td>None.
Only drinking water facility (donated by UNCEF/JICA) exists in this village.</td></tr>
<tr><td>Main crop and variety
(in order with large area)</td><td>intercropping of Sesame and Pigeon pea groundnut Tomato Sorghum
Vegetable: Cow pea for home use
Pigeon pea has strong resistance to dry areas.
Sesame cannot be harvested twice a 3-year.
Groundnut in drought year can be harvested a quarter of average year.
Tomato, can be harvested every year but decreasing frequency. Rotation system is implemented for both pigeon pea and sesame.</td></tr>
<tr><td>High revenue crop
(In order with high revenue)</td><td>Pigeon pea Tomato Groundnut Sesame</td></tr>
<tr><td>fruit tree</td><td>Mango, Tamarind, Jujube (native grown), Persimmon for sale + home use</td></tr>
<tr><td>Usage (sell, own -consumption)</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Sesame</td><td>75</td><td>25</td></tr>
<tr><td>Pigeon pea</td><td>99</td><td>1</td></tr>
<tr><td>Groundnut</td><td>50</td><td>50</td></tr>
<tr><td>Tomato</td><td>100</td><td>0</td></tr>
<tr><td>Sorghum</td><td>0</td><td>100</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Sesame</td><td>Aung Ban</td></tr>
<tr><td>Groundnut</td><td>Japan-1</td></tr>
<tr><td>Pigeon pea</td><td>LV:Red color</td></tr>
<tr><td>Tomato</td><td>DAR Variety</td></tr>
</table>
</td></tr>
<tr><td>Sell destination</td><td>Farmers sell tomato to U Sein Tun (broker) or U Yenaung (broker) in Kyaukpadaung. As to Groundnut, Sesame, and Pigeon pea, farmers visit Kyaw Kyar shop to sell the products. Farmers sell mango around village.</td></tr>
<tr><td>Soil condition</td><td>To stop erosion, bank is facilitated, which is traditional technology.
About tomato farmland, soil condition is red clay soil, which is better than sandy soil. Sandy and poor fertility. Chemical fertilizer and goat waste mixed with crop waste is input to farmland as fertilizer, however; waste of livestock is not enough. Farmers sometimes buy poultry manure.</td></tr>
<tr><td>Conserving water agricultural technology</td><td>Tomato cultivation started in 1990. There is no irrigated water. Therefore a glass of water is given to the tomato when it is re-planted. The environment of water is very severe in this village.</td></tr>
<tr><td>The minimum size of farmland for livelihood</td><td>10 ac / households</td></tr>
<tr><td>The minimum living cost</td><td>NA</td></tr>
<tr><td>Remark</td><td>Nyaung U DAR Farm accompanied the survey team. Very severe environment in irrigation water. A glass of water is used to irrigate Tomato when it is transplanted. This means that farmers have to divide limited water equally in the severe environment.</td></tr>
<tr><td colspan="2">    </td></tr>
</table>

storage reservoir （No water before rainy season）	Plowing of tomato farmland (Mt. Popa in back view)	Tomato farmland and Jujube of natural growing

Village Survey in CDZ

Research date	6 May 2013 (Tuesday)
Village name	Shwe Hlaing
Village Tract	Pyon
Township	Nyaung U
Region	Mandalay
Location	1.5 hour by car from city centre of Nyaung U
Interviewee	Village chairman or farmers.
General information in village	
Geography	Undulating。
Population	1,078 people (in 2013)
Total number of households	237households
Number of farer	160 households
Number of landless farmers	77 households（Farm labor）
Average number of households member	4.5 people / households
Agricultural information	
Farmland structure	Total cultivated area: 800 ac for Upland。
Water resource of irrigation / irrigation method	No Tube well for irrigation. Use 100% rain water. Farmer just waits for rain if they face drought.
Water use fee	NA
Ground water level	1000 feet is necessary to dig for tube-well. It is too costly for farmers to dig well.
Tube-well	Drinking water facilitation of BAJ (Bridge Asia Japan)
Main crop and variety (in order with large area)	Groundnut Sesame Pigeon pea Green gram Sesame and Pigeon pea is intercropped (larger area) Groundnut and sesame is also intercropped. The reason for intercropping is farmers want to obtain income from two kinds of crops. Vegetable（Roselle, pumpkin, beans）is only for own consumption. Onion cannot be cultivated because of water shortage.
High revenue crop (In order with high revenue)	Groundnut, Sesame, Green gram, Pigeon pea
fruit tree	Mango is for own-consumption. Tamarind, Jujube is for selling.
Usage (sell, own-consumption)	(see table below)
Varieties	(see table below)

Crop	For sell (%)	For Home use +seeds (%)
Groundnut	94	6
Sesame	99	1
Pigeon pea	99	1
Green gram	99	1

Crop	Variety
Sesame	Meikhtila
Groundnut	Kaung Gong
Pigeon pea	LV:Yellow & red color

	Green gram | Domestic species
Sell destination	Farmers go to Nyaung-U (broker) or Myasein Yaung company to sell products. As to Tamarind, buyers who possess processing machine in Magyi Saung village come to village to buy products.
Soil condition	Sandy loam and low fertility. Bank is constructed to prevent soil flow but cannot avoid damage when strong rain attacks. As fertilizer, farmers use cow manure and ash, however, cow manure is insufficient.
Conserving water agricultural technology	This village totally depends on rain water.
The minimum size of farmland for livelihood	10 ac/households
The minimum living cost	NA
Remark	This village totally depends on rain water. This village is typical case of CDZ agricultural situation with changeable and fluctuating rainfall. As to Tube-well, it is too deep thus costly for farmers to dig well. Groundnut cultivated area is the largest in this village because groundnut oil is necessary for cooking to the farmers here.

Sampling soil of farmland

Bank as Boundaries of each farmland

Village Survey in CDZ

Date	May 6, 2013
Village Name	Kyaung Pin Si
Village Tract	Taung Zin
Township	Nyaung U
Region	Mandalay
Location	One hour distant by car from the center of Nyaung U
Interviewees	Village chairman and farmers
General information of the village：	
Land form	Farmland with gentle slope
Population	Above 2,000 persons (as of May 2013)
Total Households	375 households
Number of farm household	150 households
Landless household	225 households, working in toddy juice collection and its processing, and Farm labour
Averaged family size	5.3/ household

<table>
<tr><td colspan="2">Information on agriculture：</td></tr>
<tr><td>Composition of the farmlands</td><td>Total cultivable area is 800~1,000 ac, all is upland</td></tr>
<tr><td>Irrigation water source & irrigation methods</td><td>Agriculture rely on rain. No tube-well for irrigation</td></tr>
<tr><td>Water charge</td><td>None</td></tr>
<tr><td>Groundwater level</td><td>It is necessary to dig 600 to 700 ft for a tube-well, which is expensive for farmers, and impossible due to lack of capital.</td></tr>
<tr><td>Tube-well</td><td>A tube-well for domestic water dug by the government is available</td></tr>
<tr><td>Main Crops and varieties in order</td><td>Groundnut、 Sesame、 Pigeon pea
Sesame and Pigeon pea are the crops for intercropping. The reason for intercropping is to get income from two crops and to avoid the risk of drought damage. Sesame is not drought tolerant crop. Vegetables are not cultivated due to lack of water.</td></tr>
<tr><td>Profitability of crops in order</td><td>Pigeon pea, Sesame, Groundnut</td></tr>
<tr><td>Fruits</td><td>Jujube grows naturally in the village and its fruits are sold as well as Tamarind. Jujube’s seeds are for export to China, and flesh of the fruits is for processing Jam and juice etc.</td></tr>
<tr><td>Purpose of cultivation</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Groundnut</td><td>95</td><td>5</td></tr>
<tr><td>Sesame</td><td>99</td><td>1</td></tr>
<tr><td>Pigeon pea</td><td>99</td><td>1</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Variety</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Sesame</td><td>Meikhtila (white)</td></tr>
<tr><td>Groundnut</td><td>Kaung Gong</td></tr>
<tr><td>Pigeon pea</td><td>Monywa Shwedinga</td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Buyer</td><td>Villagers go to broker to sell products</td></tr>
<tr><td>Soil</td><td>Slight erosionusually occurs in farm , and farmers prepare e embankment to prevent soil erosion by using sand bags. They use compost to improve soil but cow dung is not enough to meet demand.</td></tr>
<tr><td>Water-saving technology</td><td>None</td></tr>
<tr><td>Minimum farm size to feed a family</td><td>NA</td></tr>
<tr><td>Minimum income to feed a family</td><td>NA</td></tr>
<tr><td>Findings：</td><td>Rainfed farming in the village. Kinds of crops cultivating in the village are not many due to reliance on rain. It can be said that the village is a typical village in CDZ which has been coping with scarce rainfall by using traditional farming methods.</td></tr>
</table>

Soil in the Village

Processed Jujube

Jujube seeds and fruits

Village Survey in CDZ

<table>
<tr><td>Date</td><td>May 20, 2013</td></tr>
<tr><td>Village name</td><td>Taung Shae</td></tr>
<tr><td>Village Tract</td><td>Kuywar</td></tr>
<tr><td>Township</td><td>Nyaung U</td></tr>
<tr><td>Region</td><td>Mandalay</td></tr>
<tr><td>Location</td><td>Distant about 30 minutes by car from the center of Nyaung U</td></tr>
<tr><td>Interviewee</td><td>Contact farmer of DAR and a beneficiary of ACIAR project</td></tr>
<tr><td colspan="2">General information of the village：</td></tr>
<tr><td>Land form</td><td>Relatively flat</td></tr>
<tr><td>Population</td><td>680 persons (as of 2013)</td></tr>
<tr><td>Total households</td><td>135</td></tr>
<tr><td>Total farm households</td><td>85</td></tr>
<tr><td>Landless households</td><td>55（Farm labour）</td></tr>
<tr><td>Averaged family members</td><td>5.0/household</td></tr>
<tr><td colspan="2">Information about ACIAR：</td></tr>
<tr><td colspan="2">ACIAR project was implemented from 2005~2009. In this village, three farmers were beneficiaries including the interviewee. ACIAR provided villagers with seeds suitable for the village conditions such as pigeon pea, groundnut and chick pea, and no water-saving technology was done. The concept of ACIAR is to cultivate provided seeds using traditional cultivation methods. The seeds were procured from DAR in Nyaung U excluding chick pea from Monywa in Sagaing. For this village, only pigeon pea seeds were provided composed of the varieties of ①Tha Htay Kan, ②Nyaung Shwedinga, ③Imported seeds from India. The result of cultivation, ②showed best yield, and farmers in the village still cultivate this variety including farmers in neighboring villages. During the project period,, seven Australians were assigned with their office in DAR located at Yezin.</td></tr>
<tr><td colspan="2">Information on agriculture ：</td></tr>
<tr><td>Composition of the farmlands</td><td>Total cultivable area: 750 ac、100% Upland。</td></tr>
<tr><td>Irrigation water source & irrigation methods</td><td>None and no tube-well. Absolutely rely on rainfall</td></tr>
<tr><td>Water charge</td><td>None</td></tr>
<tr><td>Groundwater level</td><td>800 ft</td></tr>
<tr><td>Tube-well</td><td>It is necessary to dig 800 ft to make tube-well. There is one tube-well but only for domestic use.</td></tr>
<tr><td>Main crops and varieties in order</td><td>Sesame、 Groundnut、 Pigeon pea、 Green gram
Pigeon pea (6month variety) +sesame (3month variety) are for intercropping. Pigeon pea, sesame, and groundnut are main crops. Mixed cropping of Sorghum+Green gram is done sometimes. Farmers consider sesame cultivation as risky in other word “ gamble” because it may bring them good income if rainfall is suitable, but once drought occur they can only harvest once every five years according to DAR and farmers.
Vegetables: Roselle, pumpkin for home consumption</td></tr>
<tr><td>Profitability of crops in order</td><td>Green gram, Pigeon pea, Groundnut, Sesame</td></tr>
<tr><td>Fruits</td><td>Tamarind, Jujube, Mango for home consumption</td></tr>
<tr><td>Purpose of cultivation</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Groundnut</td><td>50</td><td>50</td></tr>
<tr><td>Sesame</td><td>99</td><td>1</td></tr>
<tr><td>Pigeon pea</td><td>99</td><td>1</td></tr>
</table>
</td></tr>
</table>

	Green gram | 99 | 1
Varieties	Crop: Sesame — Variety: NA; Crop: Groundnut — Variety: NA; Crop: Pigeon pea — Variety: Nyaung U Shwedinga
Buyer	Villagers go to Mya Sein Yaung shop, broker, to sell
Soil	Sandy soil with middle fertility is dominant. No erosion because of flat land. Cow dung is input to improve soil, and green gram and cow pea with soil bacteria (rhizobium) are cultivated as green manure. Normally, only compost is used though they input chemical fertilizers when money is available.
Water-saving technology	Because of rainfed farming, no water-saving technology is practiced in the village. Embankment around farms is observed.
Land tax	Kyat 25/15 ac/year for over 50 years
Minimum farm size to feed a family	15 ac/farm household
Minimum income to feed a family	Kyat 150,000/family/month for 5 members
Findings :	It is a typical village in CDZ, relying on rainfall. Farmers consider sesame to be a gambling crop but still cultivate combined with other crops expecting higher income from sesame. Water is determining factor to decide crops and also affects farmer's income. Minimum farm size of 15 ac indicates that farming condition is hard compared to other villages. OPEC provided groundnut seeds in 2007-2008 for the farmers to produce seeds for the next cropping year, however, due to scarce rainfall the farmers are not positive about producing the seed..

Intercropping of Sesame+Pigeon pea

Jagary drying on backyard

Interview to a CF of DAR

Village Survey in CDZ

Date	May 20, 2013
Village name	Taung Ba
Village Tract	Taung Ba
Township	Nyaung U
Region	Mandalay
Location	30 minutes distant from the center of Nyaung U by car
Interviewee	Beneficiary ACIAR
General information of the village :	
Land form	Relatively flat

<table>
<tr><td>Population</td><td>1,200(as of 2013)</td></tr>
<tr><td>Total households</td><td>270</td></tr>
<tr><td>Number of farm households</td><td>150</td></tr>
<tr><td>Landless households</td><td>120（Farm labour）</td></tr>
<tr><td>Averaged family members</td><td>4.4/family</td></tr>
<tr><td colspan="2">Information about ACIAR：</td></tr>
<tr><td colspan="2">The project was implemented for 5 years from 2005~2009. Interviewee is a beneficiary of the project. ACIAR provided only pigeon pea seeds and no technical support on water-saving is done. Pigeon pea’s seed’s varieties are ①Nyaung U Shwedinga, ②ICPL88039, and ③others. The seeds are provided only in the first year but farmers used the variety of ①, which until now is being cultivated.</td></tr>
<tr><td colspan="2">Information on agriculture：</td></tr>
<tr><td>Composition of farmlands</td><td>Total cultivable area is not available because village chairman went to Yangon. 100% Upland</td></tr>
<tr><td>Irrigation water source & irrigation methods</td><td>No irrigation, no tube-well</td></tr>
<tr><td>Water charge</td><td>None</td></tr>
<tr><td>Groundwater level</td><td>700 ft</td></tr>
<tr><td>Tube-well</td><td>One tube-well only for domestic water</td></tr>
<tr><td>Main crops and varieties in order</td><td>Groundnut、 Green gram、 Sesame、 Pigeon pea
The reason for intercropping is because of the risk on sesame cultivation but expecting higher income from sesame depending on rainfall.
Vegetables: Roselle, pumpkin for home consumption</td></tr>
<tr><td>Profitability of crops in order</td><td>Groundnut, Sesame, Green gram, Pigeon pea</td></tr>
<tr><td>Fruits</td><td>Mango, Jujube is for selling. Tamarind for soup and salad for selling and home consumption.</td></tr>
<tr><td>Purpose of cultivation</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Groundnut</td><td>50</td><td>50</td></tr>
<tr><td>Sesame</td><td>99</td><td>1</td></tr>
<tr><td>Pigeon pea</td><td>99</td><td>1</td></tr>
<tr><td>Green gram</td><td>99</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Sesame</td><td>Malthila</td></tr>
<tr><td>Groundnut</td><td>Sin-11, Sin-6</td></tr>
<tr><td>Pigeon pea</td><td>Nyaung U Shwedinga</td></tr>
<tr><td>Green gram</td><td>Native variety</td></tr>
</table>
</td></tr>
<tr><td>Buyer</td><td>Farmers themselves go to broker in Nyaung U to sell products. But for groundnut the broker comes to the village.</td></tr>
<tr><td>Soil</td><td>Sandy with medium fertility</td></tr>
<tr><td>Water-saving technology</td><td>Drip irrigation using PET bottle was applied for nurseries of mango for one year, which are now grown bearing trees.</td></tr>
<tr><td>Land tax</td><td>Kyat 30/30 ac/year. Farmers pay to the village chairman and then the chairman to SLRD.</td></tr>
<tr><td>Minimum farm size to feed a family</td><td>15 ac/family</td></tr>
<tr><td>Minimum income to feed a family</td><td>Kyat 120,000family/month for 4members</td></tr>
<tr><td>Findings：</td><td>The village is relying on rainfall completely. Farmers in this village consider sesame to be a risky crop though it may bring them higher income depending on rainfall. PET bottle is effectively used to grow nurseries of mango, which is applicable only for intensive crops. Land tax is very</td></tr>
</table>

	cheap.	
		
Bearing mango trees grown by PET bottle irrigatiion		

Village Survey in CDZ

Date	May 20, 2013
Village	Myoe Hla
Village Tract	Ywarr Thar
Township	Nyaung U
Region	Mandalay
Location	About 30 minutes distant from the center of Nyaung U by car
Interviewee	CF of DAR/beneficiary of ACIAR
General information of the village：	
Land form	Relatively flat
Population	500(as of 2013)
Total households	85
Number of farm households	85
Landless households	0
Averaged family members	5.9/family
Information about ACIAR：	
The project of ACIAR was implemented for 5 years from 2005~2009. Interviewee is a beneficiary of the project. ACIAR provided only pigeon seeds and no support on water-saving technology. The varieties of pigeon pea are ①native variety in the first year and ②ICPL96058 in the second year. 10 farmers still cultivate ICPL96058.	
Information on agriculture：	
Composition of the farmlands	Total cultivable area: 100 ac. Upland:20 ac、Kyun:80 ac。
Irrigation water source & irrigation methods	For upland, tube-well and rainfed. In Kyun, Several tube-wells are used for furrow irrigation.
Water charge	None
Groundwater level	60~80 ft in upland, and about 40 ft in Kyun
Tube-well	60-80 ft in upland for which manual digging is applicable
Main crops and varieties in order	Groundnut、 Onion、 Green gram、 Pigeon pea Groundnut and Onion are iintercropped. One month after planting onion, groundnut is sown. In Kyun, tomato, pumpkin, Roselle, gourd and eggplant are cultivated for selling purpose. Farmers consider sesame as risky for

<table>
<tr><td></td><td>cultivation.</td></tr>
<tr><td>Profitability in order</td><td>Groundnut, Onion, Green gram, Pigeon pea</td></tr>
<tr><td>Fruits</td><td>Jujube for selling, and Mango, Tamarind for home consumption</td></tr>
<tr><td>Purpose of cultivation</td><td>
<table>
<tr><th>Crop</th><th>For sell (%)</th><th>For Home use +seeds (%)</th></tr>
<tr><td>Groundnut</td><td>80</td><td>20</td></tr>
<tr><td>Onion</td><td>100</td><td>0</td></tr>
<tr><td>Pigeon pea</td><td>99</td><td>1</td></tr>
<tr><td>Green gram</td><td>99</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Varieties</td><td>
<table>
<tr><th>Crop</th><th>Variety</th></tr>
<tr><td>Onion</td><td>Red variety</td></tr>
<tr><td>Groundnut</td><td>Sin-6, Sin11</td></tr>
<tr><td>Pigeon pea</td><td>ICPL96058</td></tr>
<tr><td>Green gram</td><td>Native variety</td></tr>
</table>
</td></tr>
<tr><td>Buyer</td><td>Broker comes to the village to purchase products from Myingyan, Seikhphyu, Yangon, Pakokku because the village produce crop in bulk.</td></tr>
<tr><td>Soil</td><td>Sandy in upland with medium fertility. The soil in Kyun is much better than that of upland. They input compost.</td></tr>
<tr><td>Water-saving technology</td><td>None</td></tr>
<tr><td>Land tax</td><td>Kyat 0.5 /ac for upland, and Kyat 3/ac for Kyun for which land user is selected by lottery every year.</td></tr>
<tr><td>Minimum farm size to feed a family</td><td>15 ac/family</td></tr>
<tr><td>Minimum income to feed a family</td><td>Kyat 150,000/family/month for 6 members</td></tr>
<tr><td>Findings：</td><td>Alluvial soil in Kaing accounts for 80%, and tube-well can be dug easily because of village is located nearby river. Vegetable can be cultivated using tube-wells. But no water-saving technology can be found. Broker comes to purchase products due to mass production of crops.</td></tr>
</table>

Kaing Land beside the river

Tube-well on river side

Furrow irrigation beside the river

Appendix-4 Minutes

Subject	About activities of Australian Centre for International Agricultural Research (ACIAR) in CDZ
Date	23 April 2013　16:30～17:30
Place	Park royal Hotel (Yangon)
Persons Met	Myo Thura (Program Coordinator, ACIAR Myanmar Research Program)
Study Team	Sanyu Consultants: Iriya,Kikuchi
Document Obtained	

(1) 5 area of research project

- 5 areas (rice, pulse, fisheries, livestock and extension program) research activities started when budget was provided in 2012. Rice and fisheries already started. They plan to dispatch experts for each of the five (5) areas.
- Purpose is to improve food security of small scale farmers and targeting CDZ to Irrawaddy area. Total operating cost is120 million US$. Project term is four (4) years. AusAID is source of financial assistance.
- DAR is in charge of rice, pulse and extension program as C/P. LBVD（Livestock Breeding and Veterinary Department）is in charge of fisheries and livestock.
  http://aciar.gov.au/country/Myanmar（project introduction. ACIAR Website）

(2) Research project of pulse

- ACIAR plans to undertake research on pulse in CDZ. The base to be used is the Yezin Agriculture University and Magway Agriculture University, ACIAR will undertake research and develop soil/water/crop with the cooperation of universities, DAR and DOA.
- In particular, training on measurement on soil moisture will be provided to extension workers, students and farmers.
- ACIAR conducted research on pulse 10 years ago in CDZ and tried to find high drought resistant variety. The project is extension of this research.

(3) Conserving water agricultural technology

- Terre des Homma Italia（TDH）, Italian NGO, did demonstration experiment of Hydroponic System at the Yezin University in its Magway Campus. Cultivated crop is watermelon and lettuce.
- http://www.mmtimes.com/index.php/national-news/4041-hydroponics-introduced-in-dry-zone-villages.html（TDH`s project introduction, Article of Myanmar Times (Feb.11, 2013). According to the article, the project is implemented in Yenangyaung and Natmau township of Magway Region in cooperation with REAM which is NGO of Myanmar.
  Contact person of Yezin university is Dr. Mi Mi Aung.

Subject	Introduction of inception report (DOA)
Date	April 25, 2013 (Thu) 10:00～11:00
Place	Department of Agriculture (DOA), MOAI (Nay Pyi Taw)
Persons Met	U Than Kyaing (Director General, Planning, Tel: 098304320) U Thi Wen (Diputy Director, Planning, Tel: 09420706983) Daw Pyone Pyone Mon (Staff Officer) Daw Nyein Nyein Kyaw (Deputy Staff Officer)
Study Team	Sanyu consultants: Mr Iriya, Mr Kikuchi
Document Obtained	・ List of Experimental Field under the DOA

(4) Inception Report

- The Study Team submitted Inception Report and presented outline of the study to DOA officials. Also the Study team submitted site survey schedule of the study and four (4) types of questioners to be used during the study.

(5) Site Survey

- DOA Accepted that the central office will issue official letter to the three (3) regional (Sagaing, Mandalay and Magway) offices and three (3) township (Myingyan, Nyaung Oo and Magway) offices concerned so that they will be informed in advance prior to the Team's visit.
- Also, the DOA officials accepted that they will inform the 3 township offices that the Study Team will send a Survey Team to conduct farm household survey for a total of 240 households from April 26 in Nyaung Oo Township. For this purpose, the DOA promised that they will ask township office to select four (4) survey sites in each township considering regional balance and requirement of the project.

(6) List of Experimental Field

- The Study Team asked DOA to provide a list of experimental field under the DOA, The DOA provided the list during the meeting.

Subject	Introduction of inception report (DAR)
Date	April 25, 2013 (Thu) 14:00～15:00
Place	Department of Agricultural Research (DAR), MOAI (Nay Pyi Taw)
Persons Met	Dr. Thein Lwin (Director General) Dr. Aung Kyi (Deputy Director General) Dr. Tun Shwe (Head, Food Legumes Crop Section) U Maung Maung Then (Director, Soil, Water Utilization and Agricultural Engineering Division) Dr. Khin Mar Htay (Assistant Research Officer, Water Utilization Research Section) Dr. Aung Moe Myo Tint (Section Head, Other Cereal Crop Section) Dr. Ye Tin Tin (Section Head, Planning Section) U Kyaw Myaing (Water Management Section) Daw Mint Thidar (Water Management Section) Daw Khaing Khaing Htwe (Planning Section) Daw Myint Myint San(Planning Section) Daw Khin Mar Mar New (Oil Seed Crop Section)
Study Team	Sanyu consultants: Mr Iriya, Mr Kikuchi
Document Obtained	・

1) Inception Report

- The Study Team submitted Inception Report and presented outline of the study to DOA officials. Also the Study team submitted site survey schedule of the study.

2) Soil and Water Analysis

- DAR accepted Total Carbon in the list of analysis.
- Both side confirmed that soil analysis will be undertaken in one (1) month for 50 samples, and water quality analysis requires 2 to 3 weeks for 50 samples.
- 500g/ sample are necessary for the soil analysis whereas 1 litter/ sample is necessary for the water

quality analysis. Sample for the soil test shall be taken from 20 parts of the field and mixed in a plastic bag. While water samples for quality analysis shall be taken from the tube well, canal and creek using plastic bottle.

3) Potential Crops

- DAR accepted the Study Teams' suggestion on the priority crops for market chain survey which included cereal (maize), oil crops (sesame, sunflower, groundnut), pulses (green gram, chick pea, pigeon pea), and vegetables and fruit (onion, dragon fruits).
- Magway is famous for Groundnut and Sesame, whereas Sagaing is famous for Sesame and sunflower.
- In addition, DAR introduced that some fruits are produced in the CDZ including grapes (Mandalay, Meiktila), Mango (Kyaukse in Mandalay), Tamarind (Magway).

4) Others

- Soil map will be provided by Land Use Department of DOA-Yangon (Dr. Yet Tin Tin)
- DAR promised to provide Technical Report of the AICARs project which was completed in 2010 (a 4-year project from 2007).
- As for marketing issue, DAP is appropriate office to collect data and information.
- DAR' understanding of the water saving agricultural technology includes water harvesting, drip irrigation, and sprinkler irrigation.

Subject	Introduction of inception report (DAP)
Date	April 26, 2013 (Fri) 17:00～18:00
Place	Department of Agricultural Planning (DAP), MOAI (Nay Pyi Taw)
Persons Met	U Aung Hlaing (Deputy Director General)
Study Team	Sanyu consultants: Mr Iriya, Mr Kikuchi
Document Obtained	・ Market Price Information Report 2011 (Market Information Service, DAP, MOAI)

1) Inception Report

- The Study Team submitted Inception Report and presented outline of the study to DOA officials. Also the Study team submitted site survey schedule of the study.

2) Official Letter

- DAP was worried about arrangement at the site survey by DOA and DAR since they do not have enough time to confirm the arrangement and asked to JICA Study Team that site survey schedule be submitted at least two(2) weeks before actual conduct.

3) Market Information

- DAP collects market price information on a daily basis from Market Information Center (or crop exchange center), established in Yangon, Pakokku (Magway), **Mandalay (Mandalay)**, and **Myingyan (Mandalay).** Also weekly base market information are collected at **Monywa**

(Sagaing), Mawlamyine, Pathein, Pyay, Taunggyi,(Shan), Thegone, Innlay, and Aungbang, Nay Pyi Taw, and Larshoe.

- The market information service was started on May 1999, under technical support by FAO, namely "Agricultural Market Information Service Project", which was completed on 2001. Prices of the MIS are wholesale buying prices for Thegone, Aungban and Innlay, and
- Monthly Price Bulletin is one of output of the project and was issued since January 2000. Commodities covered by the Bulletin are Rice, Maize, Cooking Oil, Oilseed Crops, Pulses, Culinary (Kitchen Crops), Vegetables and Fruits.

4) Others

- DAP had conducted a technical cooperation project for marketing with FAO from 1999.

Subject	Farm Household Survey
Date	April 28 (Sun), 2013
Place	Thant Sin Kyae Village, Nyaung Oo TS, Mandalay Region
Persons Met	Upland Farmers
Study Team	Sanyu Consultants Inc. Kikuchi
Document Obtained	・ non

1) Farmer A

- The farmer produces sesame for cash crop and groundnut for home consumption.
- The farmer brings sesame to Nyaung Oo by tractor (5 miles away from village) and sells to broker, namely **Mya Sein Yaung Co, Ltd.** (Emerald Green Color) which was established a few years ago. The person in charge of procurement is U Ma Than Than Nu.
- The trading company brings sesame to Mandalay for export.
- Price of sesame last year is 1,700 K/viss while this year is 2,000 K/Viss.

2) Farmer B

- The farmer plants pulses (groundnut and green gram) and sesame under rainfed condition, in a total of 32 acre farmland (sesame in 12 acre, groundnut and green gram in 20 acre). Groundnut and green gram is more drought tolerant than sesame. Yield of are groundnut and green gram (130-140 viss/acre), and sesame (0-450 viss/acre). If rain comes late (before the end of May), yield of sesame is zero, which usually happens every 3 to 4 years.
- Price of groundnut and green gram are 1,700-1,800 K/viss and 700 – 800 K/viss, respectively.
- Marketing rates of his products are groundnut (80%), green gram (100%), and sesame (80%). The farmer bring product to Nyaung Oo and sell them to **Mya Sein Yaung Co, Ltd.**
- The trader provides seed, fertilizer, and pesticide to farmers who in turn pays back the money after harvest. The trader also provides storage facility where the farmer can store their product until an appropriate price is reached that will make the farmer sell.

Subject	Data and Information Collection at Mandalay Region
Date	April 29 (Mon), 2013　10:00am～12:00am
Place	DOA Regional Office in Mandalay Region (Mandalay)
Persons Met	U Hla Myint Aung (Deputy Director) Daw Khin Soe Htay (Staff Officer, Project Planning) Daw Htay Htay Yi (Staff Officer, Marketing)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Completion Report for Market Price Trend in 2012, Mandalay Region (March, 2013) ・ Questionnaire No. 3

1) Potential Crops

- Rice is not sufficient to meet domestic demand and needs further enhancement for production. Whereas pulses and oil crops has high potential which are mostly planted in upland area.
- Potential fruits in the CDZ are Mango (Nyaung Oo, Myingyan), Banana (Sagaing), Dragon Fruits, Grapes (Meiktila), and Plum.

2) Land size classification

- Officially recognized land size classification is; large size (more than 50 acre), middle size (10 to 50 acre), and small size (less than 10 acre).

3) Market Information

- Market information is taken from three (3) major markets in Mandalay including 1) crop exchange market, 2) Kain Dan market for fruits, and 3) Thairi Marlar market for vegetables.
- Marketing officer visited these three (3) market every day to get price of commodity (wholesale price) and send the data to DAP in Nay Pyi Taw by fax on a daily bases.. For this purpose, the office has own form for daily price collection. The marketing office develop annual report for market price trend for each crops obtained, but all in Burmese.
- Market price report has been prepared　since 2000. It can be obtained at Nay Pyi Taw.

4) Others

- Out of 28 townships in Mandalay, 13 townships are located in the CDZ.

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Central Government						
Central Government	Department of Agricultural Planning (DAP), MOAI	U Aung Hlaing (Deputy Director General)	Building 15, Nay Pyi Taw	Tel: 9567-410109 (0), 9567-410406 (1)	aunghlaing7855@gmail.com	(Meeting on April 24, 2013) Introduced by JICA Office (Ms. Yamazaki)
Central Government	Department of Agriculture (DOA), MOAI	U Kyaw Win (Director General)	Bujilding No. 15, Nay Pyi Taw	Office: 9567-410007 HP: 959-8302464 Fax: 9567-410138	kyawwinhorti@gmail.com	Introduced by JICA Office (Ms. Yamazaki)
Central Government		U Aye Tun (Deputy Director General)	Office: Bujilding No. 15, Nay Pyi Taw Residence: Bujilding No. 5108, Room No.2, Wanathaithti Quarter, Nay Pyi Taw	Ph: 9567-401166 Mobile: 959-8302461	dydgdoa@gmail.com	(Meeting on May 16, 2013) Introduced by JICA Office (Ms. Yamazaki)
Central Government		U Than Kyaing (Director of Project Planning, Management and Evaluation Division)	Bujilding No. 15, Nay Pyi Taw	Tel: 067-410515, 09830-4320 Fax: 067-410146	thankyaing164@gmail.com	(Meeting on April 25, 2013) 1st Contact Person of the Study, Introduced by JICA Office (Ms. Yamazaki)
Central Government		U Twi Whin (Deputy Director, Project Planning, Management and	Bujilding No. 15, Nay Pyi Taw	Tel: 067-410146, 067-410297		(Meeting on April 25, 2013)
Central Government		Daw Pyone Pyone Mon (Staff Officer)	Bujilding No. 15, Nay Pyi Taw	Tel: 067-410297		(Meeting on April 25, 2013)
Central Government		Daw Nyein Nyein Kyaw (Deputy Staff Officer)	Bujilding No. 15, Nay Pyi Taw	Tel: 067-410146, 067-410297		(Meeting on April 25, 2013)
Central Government		Daw Nilar Aung (Staff Officer)	Bujilding No. 15, Nay Pyi Taw	Tel: 067-410297		Contact Person of the Study, Introduced by JICA Office (Ms. Yamazaki)
Central Government		Dr. Thein Lwin (Director General)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Office: 9567-416533 Mobile: 094-485-37950 Fax: 9567-416535	dgdar@moai.gov.mm theinlwindar@gmail.com	(Meeting on April 25,2013)
Central Government		Dr. Aung Kyi (Deputy Director General)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Tel 094-3078726		(Meeting on April 25,2013)
Central Government		U Maung Maung Then (Director, Soil, Water Utilization and Agricultural Engineering Division)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Tel 9567-416505 Fax 9567-416535	mmthein5@gmail.com	(Meeting on April 25, 2013)
Central Government		U Thant Lwin Oo (Director, Maize & Other Cereal, Oil Seed Crops and Food Legumes Division)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Tel: 9567-416554 Fax: 9567-416535 Mobile: 95 (0) 9430-38467	thant2007@gmail.com	(Meeting on May 17, 2013)

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Central Government	Department of Agricultural Research (DAR), MOAI	Dr. Tun Shwe (Head, Food Legumes Crop Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Tel: 9567-416531 (ext.333) Res: 0943-129426	dtshwe@gmail.com	(Meeting on April 25, 2013) Ph.D (Agronomy) (ULBP, Philippines)
Central Government		Dr. Khin Mar Htay (Assistant Research Officer, Water Utilization Research Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Tel 9567-416532, 0943-159686 Fax 9567-416535	khinmarhtay2007@gmail.com	(Meeting on April 25, 2013) Water Quality Analysis
Central Government		Dr. Su Su Win (Section Head, Soil Science Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw	Tel: 9567-416531 (ext.388) Mob: 959-2024052 Fax: 9567-416535	susuwinmyanmar@gmail.com	(Meeting on May 13, 2013) Soil Analysis
Central Government		Dr. Aung Moe Myo Tint (Section Head, Other Cerial Crop Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government		Dr. Ye Tin Tin (Section Head, Planning Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government		U Kyaw Myaing (Water Management Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government		Daw Mint Thidar (Water Management Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government		Daw Khaing Khaing Htwe (Planning Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government		Daw Myint Myint San (Planning Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government		Daw Khin Mar Mar New (Oil Seed Crop Section)	C30, Cherry Myaing Avenue, DAR, Yezin, Nay Pyi Taw			(Meeting on April 25, 2013)
Central Government	Irrigation Department (ID), MOAI	U Tint Zaw (Deputy Director General)	Irrigation department, Thitsar Road, Yankin P.O, Yangon	Tel: 951-578109 (o), 959-8301935 Res: 959-5007652	dydgid@gmail.com dydg2-irr@myanmar.com.mm	(Meeting: April 23, 2013) Visited Sanyu HQ on March 2013
Central Government		U Tint Lwin (Director, Procurment Branch)	Building No. 43, Irrigation Department, Nai Pyi Taw	Tel: 095-67-410019, Mobile: 095-09-8301939 Fax: 095-67-410102	Tlwin4.irr@gmail.com	Visited Sanyu HQ on March 2013
Central Government		Soe Naing (Deputy Director, Mechanical)	Building No. 43, Irrigation Department, Nai Pyi Taw	Tel: 067-410507 Fax: 410100	snaingirm@gmail.com	Visited Sanyu HQ on March 2013

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Central Government	Department of Industrial Crop Development (DICD), MOAI	U Zaw Win (Director of Planning)	Department of Industrial Crop Development (DICD), MOAI, Nai Pyi Taw	Office: 9567-431113, Residence: 9501-685390, Mobile: 09-8303613, Fax: 9567-431262	zawwin1977@gmail.com dicd.moai@gmail.com	(Meeting on May 13, 2013)
Central Government		Daw Khin Khin Swe (Deputy Director of Planning)	Department of Industrial Crop Development (DICD), MOAI, Nai Pyi Taw		dicd.moai@gmail.com	(Meeting on May 13, 2013)
Central Government	Water Resources Utilization Department (WRUD), MOAI	U Kyi Htut Win (Director General)	No. 50, MOAI Pho Zaung Hill, Oak-ta-ra-thiri Town, Nay Pyi Taw, Myanmar http://www.waterresources.gov.mm	Tel: 9567-403414(res) 959-8602260 (mobile) Fax: 9567-431298	kyihtutwinpgmail.com win.kyi_htut@live.unigis.net	(Meeting on May 13, 2013)
Central Government		U Htay Lwin (Firector of Planning)	No. 50, MOAI Pho Zaung Hill, Oak-ta-ra-thiri Town, Nay Pyi Taw, Myanmar http://www.waterresources.gov.mm	Tel: 9567-431225 (res) 959-6520903 (mobile) Fax: 9567-431293	sehtaylwin@gmail.com	(Meeting on May 13, 2013)
Central Government		U Khin Zaw (Director of Civil Division)	No. 50, MOAI Pho Zaung Hill, Oak-ta-ra-thiri Town, Nay Pyi Taw, Myanmar http://www.waterresources.gov.mm	Tel: 9567-431228 (office) 9567-414349 (res) 959-6520571 (mobile)	khinzaw6378@gmail.com	(Meeting on May 13, 2013)
Central Government	Mnistry of Livestock and Fisheries	U Ohn Myint (Union Minister)	Building No. 36, Nay Pyi Taw	Tel: 95-98300400, 95-95400090, 95-9448548909 Fax: 9567-408049	ohnmyint54@gmail.com	(Meeting on May 14, 2013)
Mandalay Region						
Mandalay Region	DOA, Mandalay Region	U Hla Myint Aung (Deputy Director)	Mandalay Region Office, Thaikpan Street, Mandalay	Tel 095-02-78642, 65744 Fax 095-02-78656	hlamyint.aung.123@gmail.com	(Meeting on April 29,2013)
Mandalay Region		Daw Khin Soe Htay (Staff Officer, Project Planning)	Mandalay Region Office, Thaikpan Street, Mandalay			(Meeting on April 29,2013)
Mandalay Region		Daw Htay Htay Yi (Staff Officer, Marketing)	Mandalay Region Office, Thaikpan Street, Mandalay			(Meeting on April 29,2013) Collecting Wholesale Price from
Mandalay Region	ID, Mandalay Region	U Kyaw Thu (Deputy Director)	No.45/B, parame Street, Between 58X59 & 26X27 Street, Mandalay	Tel: 02-78662 Mobile: 09-2059209	kthu264@gmail.com	(Meeting on June 24,2013)
Mandalay Region		Daw Kyi (Head Officer) (BaAg-1982)	Myingyan Township Office, DOA, Mandalay Region	Tel 066-21076		(Meeting on May 3,2013)

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Mandalay Region	DOA, Myingyan TS	Daw Sandi Win (Sub-assistant Engineer) (Agronomist)	Myingyan Township Office, DOA, Mandalay Region			(Meeting on May 3,2013) Marketing in Charge
Mandalay Region		U Than Swe (ex-Assistant Manager)	Myingyan Township Office, DOA, Mandalay Region	Tel 09-2033460 (951)(066)01914/22086	Email moai@myanmar.com	(Meeting on May 4,2013)
Mandalay Region	Department of Industrial Crop Development (DICD), Myingyan Township Office, MOAI	U Tin Aung (Township Officer)	Myingyan Township Office, Department of Industrial Crop Development, Mandalay Region	Tel 09-402741250		(Meeting on May 6,2013)
Mandalay Region		Daw Ni Ni Win (Deputy Supertendent)	Myingyan Township Office, Department of Industrial Crop Development, Mandalay Region	Tel 09-43082718		(Meeting on May 6,2013)
Mandalay Region	Dryzone Agricultural Research Center, DAR-Nyaung Oo, MOAI	Daw Khin Myint Kyi (Research Officer, Farm Manager)	Nyaung oo Township, DAR, Mandalay Region	tel 09-6502910	kmkagridar@gmail.com	(Meeting on May 7,2013)
Mandalay Region	Livestock Breeding and Veterinary Department (LBVD), Mandalay Region, Ministry of Livestock and Fisheries	Dr. Yan Naing Soe (Director)	Livestock Breeding and Veterinary Department (LBVD), Mandalay Region Office, Mandalay	Tel: 09-8503077	yannaingvet@gmail.com	(Meeting on June 21,2013)
Mandalay Region		Dr. Aung Kyi Oo (Assistant Director)	Livestock Breeding and Veterinary Department (LBVD), Mandalay Region Office, Mandalay	Tel: 09-402514479	dr.aungkyioo@gmail.com	(Meeting on June 21,2013)
Mandalay Region		Dr. Hla Hla Mon (Research Officer)	Livestock Breeding and Veterinary Department (LBVD), Mandalay Region Office, Mandalay	Tel: 09-2009625		(Meeting on June 21,2013)
Sagaing Region						
Sagaing Region	DOA, Sagaing Region	U Thein Sin (Deputy Director)	Sagaing Region office, DOA, Monywa, Sagaing Region	Tel 09-2131842		(Meeting on May 2,2013)
Sagaing Region		Daw San San Myint (Staff Officer)	Sagaing Region office, DOA, Monywa, Sagaing Region	Tel 09-400453320		(Meeting on May 2,2013)
Sagaing Region		U Zaw Naing Win (Sub-assistant Officer, Marketing)	Sagaing Region office, DOA, Monywa, Sagaing Region	Tel 071-22542/ 071-22801		(Meeting on May 2,2013)
Sagaing Region		U Zaw Than Win (Temporally Staff)	Sagaing Region office, DOA, Monywa, Sagaing Region	Tel 09-400424074		(Meeting on May 2,2013)
Sagaing Region	Trade Promotion Department, Sagaing	U Aung Maung (Director, Sagaing Region)		Tel: 09-401670899 Fax: 071-22924	aungmgg.sinkyoe@gmail.com	(Meeting on June 25,2013)
Magway Region						

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Magway Region	DOA, Magway Region Office, MOAI	U Khin Maung Lay (Deputy Director, Head of Division)	DOA Magway Region Office, Magway			(Meeting on May 8,2013)
Magway Region		U Aung Myint (Assistant Director, Deputy Regional Chief Officer)	DOA Magway Region Office, Magway			(Meeting on May 8,2013)
Magway Region		Daw Khin May Thnit (Staff Officer), DOA Magway	DOA Magway Region Office, Magway			(Meeting on May 8,2013)
Magway Region		Daw Than Than Swe (Staff Officer), DOA Magway	DOA Magway Region Office, Magway			(Meeting on May 8,2013)
Magway Region		U Oo Than (Assistant Director), DOA Magway	DOA Magway Region Office, Magway			(Meeting on May 8,2013)
Magway Region	DOA, Magway TS	U Khaing Min (Township Officer)	Magway Township Office, DOA, Magway Region	Tel 09-43026674		(Meeting on May 8,2013)
Development Partners						
DP	JICA Myanmar Office	Yoko Yamazaki (Project Formulation Advisor, Agriculture and Rural	#701, 7th floor, Sakura Tower, No.339, Bogyoke Aung San Road, Kyauktada Township, Yangon	Tel: 951-255473-6 Fax: 951-255477 H.P.959-4320-8596	Yamazaki.Yoko@jica.go.jp	(Meeting: April 22, 2013)
DP	USAID	Luis Guzman (Agricultural Officer)	U.S. Agency for International Development, American Embarry, 110 University Avenue, Kamayut	(95-1) 536-509 Ext 4403	GuzmanL1@state.gov	(Meeting: May 23, 2013)
		Ma Yin Yin Aye (Administrative Assistant to the Mission Director)	U.S. Agency for International Development, American Embarry, 110 University Avenue, Kamayut	(95-1) 536-509 Ext 4862	AyeYY@state.gov	Contact Person by E-mail
DP	UNDP	U Win Htin (National Project Coordinator, CDRT Project)	No.8 (c), Bogyoke Museum Street, Bahan Township, Yangon, Myanmar	Tel: (951) 557896, 546718-21, Mobile: 09-8520122	win.htin@undpaffiliates.org	(Meeting: May 27, 2013)
		U Khaing Kyaw Htoo (Area Project Manager, Northern Rakhine State)	No.8 (c), Bogyoke Museum Street, Bahan Township, Yangon, Myanmar	Tel: (951) 557896, 546718-21		(Meeting: May 27, 2013)
DP	AUSAid	Jillian Ray (Ms.) (Second Secretary (Development Assistance))		Tel: + 95-1-251-810 (Ex. 203)	jillian.ray@ausaid.gov.au	Contact Person at Prereminary Survey (introduced by JICA Inoue-san)
DP	FAO	Bui Thi Lan (Representative in Myanmar)			Buithi.Lan@fao.org	Contact Person at Prereminary Survey (introduced by JICA Inoue-san)

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
DP	FAO	Maung Maung Lwin (Project Manager, ESFSP)			maungmaung.lwin@fao.org	Contact Person at Prereminary Survey (introduced by JICA Inoue-san)
DP	GIZ	Mr. Thomas Schneider (Senior Advisor,Myanmar-Germany Private Sector Development Programme)	No. 35 (B)/15 New University Avenue, Bahan Township, Yangon Website: www.giz.de	M +95 9 401 555 828	thomas.schneider@giz.de	Introduced by U Thant Zaw Soe
DP	KOICA	Shin, ManShik (Resident Representative)	Embassy of Republic of Korea, 97, University Avenue Road, Bahan Township, Yangon	Tel: 951-539572, 527142-4 Mobile: 09-8636831	msshin713@koica.go.kr	(Meeting on June 4, 2013)
		Jong Soo SHIN, Ph.D (ODA Specialist in Agriculture)	Embassy of Republic of Korea, 97, University Avenue Road, Bahan Township, Yangon	Tel: 951-539572, 527142-4 Mobile: 09-4199-5659	ploriano@gmail.com	Introduced by JICA Office (Ms. Yamazaki)
DP/ Research Institute	Australian Centre for International Agricultural Research (ACIAR) -AUSAid	Dr. Gamini Keerthisinghe			keerthisinghe@aciar.gov.au	Introduced by Mr. Yoshida, Coordinator of Regioonal Program in Myanmar
		Myo Thura (Program Coordinator, ACIAR Myanmar Research Program)	Left Office, Room 341, Inya Lake Hotel, Yangon Website: aciar.gv.au	Tel: 951-657703-06 Mobile: 959-4211-75942	Email: myo.thura@aciar.gov.au	(Meeting: April 23, 2013) 5 research program inc. legume project in CDZ, started from 2012 for 4 years.
Businbess Development Service (BDS) Providers						
BDS in Yangon	The Republic of the Union of Myanmar Federation of Chamber of Commerce & Industry (UMFCCI)	U Win Aung (President)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon www.umfcci.com.mm	Tel: 951-214341-2 Fax: 951-214484	dagon.winaung@gmail.com umfcci@mptmail.net.mm	Introduced by JICA Office (Ms. Yamazaki)
BDS in Yangon		Dr. Myo Thet (Secretary General)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon www.umfcci.com.mm		myothet.sywh@gmail.com	Introduced by U Ye Myint (ID)
BDS in Yangon	Myanmar Rice Federation (MRF)	Dr. Soe Tun (Central Executive Committee (CEC) Member)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon www.myanmarricefederation.org	Mobile: 959-5041934, 8516078 Tel: 951-218266-68, 2301128-29	soetun@gmail.com	(Meeting on May 28, 2013) MAPCO, President of Myanmar Farmers' Association (MFA)
BDS in Yangon		U Khin Soe (Technical Advisor)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon www.myanmarricefederation.org	Mobile: 959-8303472, 5007468 Tel: 951-255083-84	khinsoe@gmail.com	(Meeting on May 28, 2013) MAPCO

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
BDS in Yangon		Ms. Phyu Zin Aung (Researcher)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon www.myanmarricefederation.org	Mobile: 959-73234924 Tel: 951-218266-68, 2301128-29	phyuzinag@gmail.com	(Meeting on May 28, 2013) MAPCO
BDS in Yangon	Myanmar Fruit and Vegetable Producers and Exporters Association	U Hnin Oo (Vice President, MFVPEA)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon	Tel: 098-60-2484, 095-00-2717	nhninsapphire@gmail.com	(Meeting on May 22, 2013) Chairman of Myanmar Fisheries Federation
BDS in Yangon	Myanmar Food Processors and Exporters Association (MFPEA)	Dr. Aye Kyaw (Laboratory Manager, Food Industries Development Supporting Laboratory)	No. 29, Min Ye Kyaw Swar Road, Lanmadaw Township, Yangon	Tel: 09-73239280 Office: 951-214846 Residence: 951-537312 Fax: 951-214846	ayekyawmafpea@gmail.com	(Meeting on May 22, 2013)
BDS in Yangon	Myanmar Rubber Planters & Producers Association (MRPPA)	U Myo Thant (Vice President)	Room 1002, UMFCCI Tower, No.29, Minye Swar Road, Lanmadaw Township, Yangon	Tel: 09-5012997	myothan@gmail.com	(Meeting on May 30, 2013) Managing Director of Myo Myint Tharyar Rubber Estate (Delta
BDS in Yangon		U Hla Myint (Advisor)	Room 1002, UMFCCI Tower, No.29, Minye Swar Road, Lanmadaw Township, Yangon	Ph: 951-2301582 Res: 951-584238 Fax: 951-2301582	hmyint.mrppa@gmail.com	(Meeting on May 30, 2013) Former Director of Applied Research Center for Perennial
BDS in Yangon		Dr. Maung Maung Myint (Member Firm)	Room 1002, UMFCCI Tower, No.29, Minye Swar Road, Lanmadaw Township, Yangon	Tel: 229018/ 229019/ 229020 Fax: 220238	lighthouse90@gmail.com	(Meeting on May 30, 2013)Director of Lighthouse Enterprises Limited (largest rubber planter/ processor)
BDS in Yangon	Myanmar Fertilizer, Seed and Pesticide Entrepreneurs Association	U Thadoe Hein (President)	No (33), Shwe Padauk Yeikmon, Bayint Naung Road, Kamayut Tsp, Yangon	Ph: 951-538097, 5002152	thadoehein@awda-group.com	(Meeting on June 3, 2013) Managing Director of Myanmar Awba Group
BDS in Yangon		U Kyaw Tin Myint (Vice President)	G/60, Padauk Street, Nayint Naung, Mayangone Tsp, Yangon	Tel: 959-73022646, 8626347 Fax: 951-217093	kyawtinmyintbyn@gmail.com	(Meeting on May 29, 2013) Yangon Region Chamber of Commerce and Indusrties
BDS in Yangon	Myanmar Livestock Federation	Dr. Than Hla (Executive Advisor)	Bayint Naung Road, West Gyogone, Insen TS. Yangon	Tel: 01-644041 Mobile: 09-5152694 Fax: 01-644843	thn.hla@gmail.com myanmarlivestock@gmail.com	(Meeting on June 4, 2013)
BDS in Yangon	Yangon District Livestock Federation	Dr. Moe Myint (Chairman)	Room No. 195, Ground Floor, 34th Street, Kyauktada Tsp, Yangon	Phone: 951-387104 HP: 95-973115056	drmmyint@gmail.com	(Meeting on June 4, 2013) Managing Director of Pan Thazin Co., Ltd.

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Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
BDS in Yangon	Livestock Exporter Association, Myanmar Livestock Federation	U Win Sein (Vice Chairman, CEC Member)	No.524/B, Merchant Street, Kyauktada Tsp, Yangon	Tel: 951-246559 Mobile: 09-5003393 (local), 959-5003393 (oversea)	hoisoonco.ltd@gmail.com	(Meeting on June 4, 2013)
BDS in Yangon	Myanmar Fishery Products Producers & Exporters Association	U Moe Myint Kyaw (President)	Corner of Bayint Naung Road & Say War Yone Street, West Gyo Gone, Insen Township, Yangon	Tel: 951-644031, 644032, 09-8763283 Mobile: 09-5036069	mpea@myanmar.com.mm mpea2004@gmail.com	(Meeting on June 4, 2013)
BDS in Yangon	Myanmar Pulses, Beans & Sesame Seeds Merchants Association	U Myint Zaw (Excutive Committee Member)	UMFCCI Tower, No-29, Room No-803, Min Ye Kyaw Swar Street, Lanmadaw Township, Yangon	Tel: 951-214828, 214836 Mobile: 09-5002314 Fax: 951-214836	myintzaw,limfamily@gmail.com	(Meeting on June 5, 2013)
BDS in Yangon		Dr. Myat Soe (Central Executive Committee Member, News & Information)	UMFCCI Tower, No-29, Room No-803, Min Ye Kyaw Swar Street, Lanmadaw Township, Yangon	Tel: 951-214828, 214836 Mobile: 09-5008322, 73335577 Fax: 951-214836	noblesky@mptmail.net.mm	(Meeting on June 5, 2013)
BDS in Yangon		U Hein Htet San (CEC Member)	No. 92 (3rd Floor9, 94th Street, Kandawgalay, Mingalar Taung Nyunt Township, Yangon	Tel: 01-394280, 09-5148200	aungny65@gmail.com	(Meeting on June 5, 2013)
BDS in Yangon	JETRO Yangon	Tetsu Yamaguchi (Senior Advisor)	Sedona Hotel Business Suites #04-02, No.1, Kabar Aye Pagoda Road, Yankin Township, Yangon	Tel: 951-544051-53 HP: 95-942112-3964 Fax: 951-544048	tetsu.yamaguchi125@gmail.com	(Meeting on June 5, 2013)
BDS in Yangon	Myanmar Foreign Trade Bank (MFTB)	Daw San San Myint (Assistant General Manager, Import Department)	80-86, Maha Bandoola Garden Street, Yangon	Office: 095-01-382083 Resident: 095-01-651181 Fax: 095-01-254586	MFTB.HOYGN@mptmail.net.mm	(Meeting on May 21, 2013)
BDS in Yangon	Myanmar Investment and Commercial Bank (MICB)	Kyaw Min (Manager)	No.170-176, Bo Aung Kyaw Street, Yangon, Myanmar	Tel: (95)01-371020 Fax: (95)01-256871	mgrict-micbho@mofr.gov.mm	(Meeting on May 23, 2013)
BDS in Yangon	Myanmar Agricultural Development Bank (MADB), MOAI	Thein Swe (Managing Director)	No. 26/42, Pansodan Street, Kyauktada Township, Yangon, Myanmar Website: http://madb.moai.gov.mm	Tel: 951-391016 HP: 09-5005313 Fax: 951-391002	madb@mptmail.net.mm	(Meeting on May 23, 2013)
BDS in Yangon		Daw Khin Nan Myint (Deputy General Manager, Loans Department)	No. 26/42, Pansodan Street, Kyauktada Township, Yangon, Myanmar Website: http://madb.moai.gov.mm	Tel: 951-391234 Mobile: 09-73134532 Fax: 951-391343	dkhinnanmyint@gmail.com madb@mptmail.net.mm	(Meeting on May 28, 2013)

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Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
BDS in Yangon	Myanmar Livestock and Fisheries Development Bank (Treasure Bank of Myanmar Ltd.)	Daw Than Than Nu (Deputy General Manager)	No. 653/699, Merchant Street, Pabedan Township, Yangon	Tel: 951-250642/ 9509-5185573 Fax: 951-377384	dgm.Foreignbanking@myanmalfdb.com	(Meeting on Jun 17, 2013)
BDS in Yangon		U Khin Ko Lay (Senior Executive Officer, Retd: Director General, Fisheries	No. 653/699, Merchant Street, Pabedan Township, Yangon	Tel: 095-01-377201 Mobile: 095-09-5014285 Fax: 095-01-377201	khinkolay@gmail.com	(Meeting on Jun 17, 2013)
BDS in Yangon		U Maung Maung Nyunt (Senior Executive Officer, Retd: Director General, Veterinary Department)	No. 653/699, Merchant Street, Pabedan Township, Yangon	Tel: 095-01-377201 Mobile: 095-09-5008132 Fax: 095-01-377201	MLFDBank-H.Q@mptmail.net.mm	(Meeting on Jun 17, 2013)
BDS in Yangon	Yangon Division Chambers of Commerce and Industries (Yangon Crop Exchange Center) Address: No. B81/82, Kant Kaw, Bayint Naung Wholesale Market, Mayangone Tsp, Yangon Tel 09-8611877/ 680421/680910 Fax: 683493 E-mail: ydccibyn@gmail.com Website: yangoncommodityexchange.com	U Ohn Saing (Chairman)	(New Golden Gate (1991) Co,. Ltd: No.46, 19th Street, Latha Tso, Yangon)	Hp: 95-95011918 Office: 951-382320, 382308 Fax: 951-382331	newgoldengate1991@gmail.com khitthit19@gmail.com	(Meeting on May 29, 2013) Chairman of Myanmar Onion, Garlic and Curlinary Production and Exporters Association
BDS in Yangon		U Hoke Kyi (Board Member)	(Htun Hla Trading: C/45, Aung ThaPyay Street, Bayintnaung Wholesale Broker Center, Mayangone Tsp, Yangon)	Ph: 01-680365/ 680382/ 683228 Hp: 09-5003469/ 09-9925052		(Meeting on May 29, 2013) Managing Director of Htun Hla Trading (chili, onion, garlic)
BDS in Yangon		Dr. Myo Lwin (Board Member)	(Arkar Oo Co,. Ltd.: No.124, Wetmsutt Wun Htaunt St., Industrial Zone (4), Hlaing Tharyar Tsp, Yangon)	Ph: 951-685313/ 685039/ 6850004/ 685744 Mobile: 959-50-13869	arkaroo@myanmar.com.mm arkarooco.ltd@gmail.com	(Meeting on May 29, 2013) Managing Director of Arkar Oo Co., Ltd.
BDS in Yangon		Dr. Myint Oo (Board Member)	(Thein Yarzar Co., Ltd.: C62, Aung Tha Pyay Street, Bayint Naung, Mayangone Tsp, Yangon)	Mobile: 0173009924, 095128424 Office: 680325/ 680965	drmoo2005@gmail.com drmoo@myanmar.com.mm	(Meeting on May 29, 2013) Managing Director of Thein Yarzar Co., Ltd.
BDS in Yangon		U Zin Myo Naing (Board Member)	(U Seinn Co., Ltd.: H/70, Ahthawka Road, Bayintnaung, Mayangone Tsp, Yangon)	Tel: 01-680781/ 681947 Mobile: 09-5104116/ 09-73226535		(Meeting on May 29, 2013) Managing Director of U Seinn Co., Ltd.
BDS in Yangon		U Kyaw Win (Board Member)	(Bright Light Co., Ltd.: No.F-44, Sein Pan Street, Bayint Naung Pwe Yone, Mayangone Tsp, Yangon)	Tel: 951-682246, 686131 Hp: 959-5009577 Fax: 951-682630	brightlight.co.ltd@gmail.com	(Meeting on May 29, 2013) Director of Bright Light Co., Ltd.
BDS in Yangon	SGS Myanmar Limited	U Aung Kyaw Htoo (Business Manager, Agricultural/ Mineral)	79/80, Bahosi Housing Complex, Wardan Street, Lanmadaw TS, Yangon	Mobile: 95-95130496 Office: 951-211562/ 211537/	aung-kyaw.htoo@sgs.com	(Meeting on May 30, 2013)
BDS in Yangon	PACT	Mr. Jason S. Meikle (Deputy Director)	No. 497, 1th Floor, Tower B, Diamond Condominium, Pyay Road, Ward 8, Kamaryut Township, Yangon	Tel: 951-501373, 501383 (ext 29) Mobile: 959-420188260	jmeikle@pactworld.org	(Meeting on June 5, 2013)

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Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
BDS in Mandalay	Broker, Miller and Traders Maha Kahtaintaw Association, Mandalay (Mandalay)	U Thein Tun (Chairman)	No.(8), 86th Street between 25th and 28th street, Eastern Thiribaymar	Tel 09-202-5396		(Meeting on April 29 and 30, 2013)
BDS in Mandalay		U Chun (Secretary-1)	No.(8), 86th Street between 25th and 28th street, Eastern Thiribaymar	Tel 09-510-0517, 09-680-6517		(Meeting on April 29 and 30, 2013)
BDS in Mandalay		U Khin Mg Kyaw (Accountant-1)	No.(8), 86th Street between 25th and 28th street, Eastern Thiribaymar			(Meeting on April 29 and 30, 2013)
BDS in Mandalay	Broker, Miller and Traders Maha Kahtaintaw Association, Myingyan TS	U Myo Aung (Chairman)		Tel 066-21669/ 09-2215065		(Meeting on May 4, 2013)
BDS in Mandalay		U Kyaw Aye (Vice-President)		Tel 09-2216282		(Meeting on May 4, 2013)
BDS in Sagaing	Broker, Miller and Traders Maha Kahtaintaw Association, Monywa (Sagaing)	U Myo Min (Chairman of Commodity Exchange Center)	Monywa, Sagain	Tel 09-681-9921 Office 071-21804/ 28067 Fax 071-28065	monywatrade@gmail.com tradecentermonywa@gm	(Meeting on May 1, 2013)
BDS in Sagaing		U Tun Tun (Secretary of MTC)	Monywa, Sagain	Tel 9509-2130445	tuntunoosocmadan@gmail.com	(Meeting on May 1, 2013)
BDS in Sagaing		U Palik Kyaw (Member)	Monywa, Sagain	Tel 9509-2130644		(Meeting on May 1, 2013)
BDS in Magway	Magway Branch, Chambars of Commerce and Industries	U Nay Lin Aung (Chairman of UMFCCI-Magway)	UMFCCI-Magway, Magway TS, Magway Region	Tel 09-5340870		(Meeting on May 9, 2013)
BDS in Magway		U Htein Win (Central Excutiv Committeee (CEC)	UMFCCI-Magway, Magway TS, Magway Region	Tel 09-5341637		(Meeting on May 9, 2013)
BDS in Mandalay	OISCA (The Organization for Industrial, Spiritual and Cultural Advancement-International)	Mr. Fujii Keisuke (Director)	Agroforestory Training Center, Pakhangyi, Yesagyo Township, Magway Region www.oisca-international.org	Tel: 959-6570265, 6570695 Mobile: 959-420779201	kfujii@oisca.org	(Meeting on June 28, 2013)
BDS in Mandalay		Ms. Yuko Saito (Coordinator)	Yangon Office, Room E-5, Shwe Sabai Yeikmon, Bayint Naung Rd., Kamaryut Township, Yangon	Tel: 951-515304, Mobile: 959-421138136	ysaito@oisca.org	(Meeting on June 28, 2013)
Agribusiness						
Agribusiness	MYANMAR AGRIBUSINESS PUBLIC	U Chit Khine (Chairman)	339, 3rd FL, Room No.(0303) , Sakura Tower, Bogyoke Aung San Road, Yangon Website: http://www.mapco.com.mm	Office: 01-255 083, 255 084, 255 085, 255 087	info@mapco.com.mm	Chairman of RSC Introduced by Ms. Okamoto (IDE-JETRO)
		Dr. Soe Tun (Exective Director of MAPCO)	Room No.(0303) , Sakura Tower, Bogyoke Aung San Road, Yangon Website: www.mapco.com.mm	Mobile 09-504-1934	soetun@gmail.com	(Meeting on May 28, 2013) CEC member of MRF, Introduced by Ms. Okamoto (IDE-JETRO)

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Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
(Yangon)	CORPORATION LIMITED (MAPCO)	U Khin Soe	Room No.(339), Level 3, Sakura Tower, Bogyoke Aung San Road, Yangon Website: www.mapco.com.mm	Mobile: 959-8303472, 5007468 Tel: 951-255083-84 Fax: 951-255083	khinsoe@gmail.com	(Meeting on May 28, 2013) MRF
		Ye Min Aung (Managing Director)	339, 3rd FL, Room No.(0303) , Sakura Tower, Bogyoke Aung San Road, Yangon Website: http://www.mapco.com.mm	Mobile: 959-862-3431, Tel/FAx: 951-255-083-85	md@mapco-ygn.com	Introduced by JICA Office (Ms. Yamazaki)
Agribusiness (Yangon)	Rice Specializing Company (RSC)	U Chit Khine (Chairman)				Chairman of MAPCO Introduced by Ms. Okamoto (IDE-JETRO)
		U Ye Min Aung		Mobile 09 505 8001 09 8623431	E-Mail yma.mm.ygn@gmail.com	Rice Introduced by Ms. Okamoto (IDE-JETRO)
		Dr. Soe Tun (Researcher, Exective Director of MAPCO)		Mobile 09-504-1934	soetun@gmail.com	Introduced by Ms. Okamoto (IDE-JETRO)
Agribusiness (Yangon)	Rudy Dragon Group of Companies	Nay Win Tun (President)	No.39 (A), 71/2 Mile, Pyay Road, MayangoneTownship, Yangon Website: www.rubydragoncompanies.com	Tel: 95-1-664158, 660312, 652662, 652705 Fax: 95-1-652793	ygnoffice@rubydragoncompanies.com	Mining, Grape and wineary, Sugar factory, Agriculture, Hotel, travel Agency, etc.
Agribusiness (Yangon)	Steelstone Group Company	U Than Lwin (Presindent)	501 (B) & F-20, Pearl Condo, Kabaraye Pagoda Road, Baha Tsp, Yangon Website: www.steelstonegroup.com	Tel: 95-1-551992, 557448 Fax: 95-1-551992, 573514	info@steelstonegroup.com	Infrastructure, Agriculture, Fisheries, Trade, Machinary
Agribusiness (Yangon)	Yuzana Company Ltd. (Yuzna Group of Companies)	U Htay Myint (President)	No.15 Dhamma Zedi Street, Sanchaung Township, Yangon Website: http://www.yuzanahotels.com/	Tel: 540745, 540746, 540747 Fax: 373790		Palm oil, Sugarcane, Rubber, Jetrofa, Shrimp, etc.
Agribusiness (Yangon)		Dr. Nyi Nyi (Agriculture Department)	Head Quarter: Yuzana Center, No. 130, Shwegondal Road, Bahan Township, Yangon	Mobile: 959-8629544 Office: 951-559031, 951-54072/7 Fax: 951-540741	yzn01@yuznagroup.com.mm mr.royallink@gmail.com	(Meeting on May 30, 2013)
Agribusiness (Yangon)		Daw Zar Chi Htay (Director)	Head Quarter: Yuzana Center, No. 130, Shwegondal Road, Bahan Township, Yangon	Office: 951-540742/559061 Mobile: 095-009221/ 09-73257934 Fax: 951-540741	zhtay1981@gmail.com steepmountain17@gmail.com	(Meeting on May 23, 2013)

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Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Agribusiness (Yangon)	Myanmar Awba Group	U Thadoe Hein (Managing Director)	No (33), Shwe Padauk Yeikmon, Bayint Naung Road, Kamayut Tsp, Yangon	Tel: 951-583231, 583097, 530678, 530763 Fax: 951-500025 Mobile: 959-5002152	thadoehein@awda-group.com	(Meeting on June 3, 2013) Agricultural Input Trader and Producer (fertilizers, pesticides, harvesticides, seeds, feeds, etc)
Agribusiness (Yangon)	C.P. Yangon Co., Ltd. (C.P. Seeds Myanmar)	Mr. Worasit Sittivichai (Vice President, Corn Seeds Business: Myanmar Area Fields Crop Integration	No.25(B) Thukhawady Street, Yankin Township, Yangon	Mobile: 959-507-9728	artistku52@hotmail.com	(Meeting on June 4, 2013)
Agribusiness (Yangon)		Mr. Amnat Mathong (Assistant Vice President, Marketing Project Zone II Crop Integration Business Group)	No.25(B) Thukhawady Street, Yankin Township, Yangon	Tel/Fax: 951-577407 Mobile: 959-450052605	amnat78@gmail.com	(Meeting on June 4, 2013)
Agribusiness (Yangon)	C.P. Yangon Co., Ltd. (Myanmar C.P. Livestock Co., Ltd.)	Dr. Soe Lwin (Advisor, South Area)	135, Pyay Road, 3 1/2 Mile, Mayangone Township, Yangon	Tel: 951-651325/ 651364/ 653417/ 660546/ 652081 Res: 951-505781	drsoelwin.mcpl@gmail.com	(Meeting on June 4, 2013)
Agribusiness (Yangon)	Eden Group Company Limited	U Chit Khine (Chairman)	Building No.30, Shwe Padauk Yeik Mon, Kamaryut Township, Yangon 44, Min Theddi Kyaw Swar St., Industrial Zone (2), HLTA Website:	Tel: 500980, 500981, 500982 Fax: 500980, 500981, 500979	thanhtut@myanmarededn.com WINMINKHINE@MPTMAIL.NET.MM	Agriculture (rice trade), construction, energy, hotel, bank, etc.
Agribusiness (Yangon)	Capital Diamond Star Group (CDSG)	U Ko Ko Gyi (Presindent)	256-260, Sule Pagoda Road, Kyauktada Township, Yangon Website: http://www.cdsg.com.mm/	Tel: 951-373388 Fax: 951-242663	info@cdsg.com.mm	trade (wheat, flour), retailing, agri-marketing, medicine, land development, construction, etc.
Agribusiness (Yangon)	Ayeyarhinthar Group of Company	U Zaw Win Shine (President)	1104/1105/1106, Ye Ta Khon Tower, 531, Lower Kyee Myin Daing Road, Kyee Myin Dain Twonship, Yangon, Hlaing Tharyer Office, Naypyidaw, Mandalay, Hinthada, Pyay etc. URL: www.ayeyarhinthar.com	Tel: 01-508070, 508071, 508232, 508233, 508234 Fax: 01508071		Trading Rice, construction, mining, etc.
Agribusiness (Yangon)	U Kyu Family Grains & Manufacturing Co. Ltd	U Kyu (President)	No.17/19 hledan Street, Lanmadaw Township, Yangon Website: www.uqfamilyflourmill.com	Tel: 951-226108, 211011 Fax: 951-226047, 227423	okgroup@okgroup.com.mm	Flour Mill, Beans and pulses trade
Agribusiness (Mandalay)	Mya Moe Agrochem Distribution Center	U Moe Hein (Plant Pathologist)	South of Zawgyi Bridge, Yangon-Mandalay Highway, Kyaukse, Mandalay	Tel: 09-2150792, 09-91031496	umoehein.mm@gmail.com	(Meeting on June 21, 2013) Pioneer of SAP (Super Absordent Polymar) user

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Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Agribusiness (Myingyan)	Triple Nine Great Integrity Trading Co., Ltd.	U Aung Kyaw Kyaw (Managing Director)	Wholesale Center of Pulses and Raw Material of Animal Feed No 6/63. 15 Road, Myingyan, Myanmar	Tel (95)66-22576 Mobile (95)9-2029969/ 47125877 Fax (95)66-21056	Triplenineoilmill@gmail.com	(Meeting on May 4, 2013) Oil Mill, Marketing of Pulses and Animal Feed A member of Broker, Miller and Traders Maha Kahtaintaw
Agribusiness (Myingyan)		Ma Thandar Aung	Wholesale Center of Pulses and Raw Material of Animal Feed No 6/63. 15 Road, Myingyan,	Tel (95)66-22576 Mobile (95)9-2029969/ 47125877	Triplenineoilmill@gmail.com	(Meeting on May 4, 2013) Oil Mill, Marketing of Pulses and Animal Feed
Agribusiness (Magway)	Ngway Hinn Thar	U Phoe Ni (General Manager)	No 80/81, B.E.H.S (1) Road, Yan Aung Qr., Magway	Mobile: 09-5340893, 09-5341461 Tel: 063-26071, 23896		(Meeting on July 1, 2013) Producer of Roasted Sesame Powder
Academe						
Academe	Myanmar Agriculture, Livestock and Fisheries Akademi	Dr. Myint Thein (Chairman)		Tel: 95-1-651416 / 95-9-430-200-92		Translator, Surveyor, etc.
		U Tin Maung Shwe (Executive Member)		Tel: 95-1-665579 / +95-1-665580		Translator, Surveyor, etc.
Academe	Yangon Technological University (YTU)	Daw Mya Myo Oo (Rector of YTU cum Mandalay Technology University)	Insein P.O., YTU campus, Insein Township, Yangon	Tel: 95-1-651717 / 665678	YIT.YANGON@pemail.net	Possible to get technical support
Academe	Yezin Agriculture University	Dr. Tin Htut (Rector)	Yezin, Nay Pyi Taw, Myanmar	Tel: 95-67-416-515 / 95-67-416-517	tinhtutagri@gmail.com	(Meeting on July 5, 2013)
Academe		Prof. Maung Maung Myint (Pro-Rector, Admin)	Yezin, Nay Pyi Taw, Myanmar	Tel: 9567-416518, Mobile: 959-43109843	mmmyint.yau@gmail.com	(Meeting on July 5, 2013)
Academe		Dr. Nang Hseng Hom (Professor, Department of	Yezin, Nay Pyi Taw, Myanmar	Tel: 95-67-416512, Mobile: 959-8357463,	nanghsenghom@gmail.com	(Meeting on July 5, 2013)
Academe		Dr. Soe Soe Thein (Professor, Department of	Yezin, Nay Pyi Taw, Myanmar	Tel: 9567-416512, Mobile: 95-5081470	soesoethein1@gmail.com	(Meeting on July 5, 2013)
Academe	Yezin Agriculture University (Magway Campus)	Dr. Mi Mi Aung	YAU-Magway Campus, Magway TS, Magway Region			(Meeting on May 9, 2013) Hydroponic System, Working with
Consulting Firm						
Consultant	National Engineering & Planning Services (NEPS)	U Cho Cho (Managing Director)	880, Yadanar Rd, SA/KHA QR., Thingangyun Township, Yangon	Tel: 95-1-562407	neps@myanmar.com.mm	Ex ID Official
Consultant	National Economic and Social Advisory Council	U Tin Htut Oo (Chairman)	No.2, U Yinn Street, Kamayut Township, Yangon	Mobile: 0950-62287	t.htut.oo@gmail.com t.htut.oo@nesac.org	Introduced by JICA Office (Ms. Yamazaki)

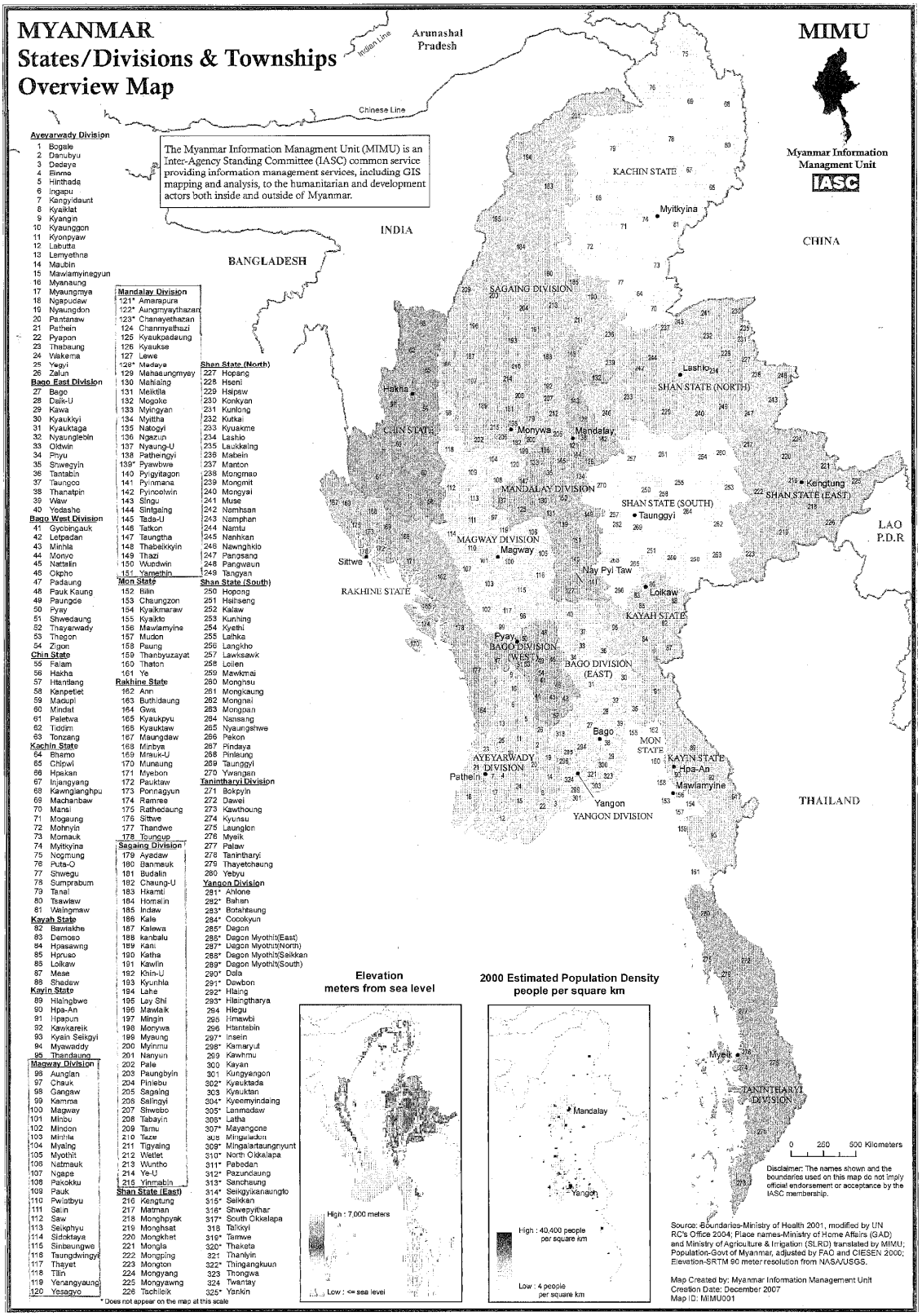
Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Consultant	Agribusiness and Rural Development Consultants	U Tin Htut Oo (Chief Executive Officer)	#502 FMI Center, No.380, Bogyoke Aung San Rd, Pabedan Township, Yangon	Tel: 95-1-240374	Thoo@ardconsult/com.mm	Former DAP Director general
Consultant	Sanyu Consultants Inc. (SCI) Yangon Office	Ms. Nilar Tun	c/o Irrigation department, Kanbe Road, Yankin Township, Yangon	Tel: 010-951-562985 Tel/Fax: 010-951-577161	nlt.sanyu@gmail.com	Sanyu Staff
Consultant	Freelance Consultant	Ms. Moe Moe	No. (1048), 22nd Street, Zarga Road, South Okkalapa Township, Yangon	Mobile: 09 430 24 835	mm.moemoe5@gmail.com	Study Team
Consultant	Freelance Consultant	Ms. Mar Win		Mobile: 09-450047092	thimarwin1999@gmail.com	Farm Household Survey (Consolidator)
Consultant	Development for Environmental-Friendly Agriculture and Rural Life of Myanmar (DEAR Myanmar)	Ko Phyo Lin Tun (Public Relationship Officer)	No. 29, 4th Floor, Yay Kyaw Road, 9th Ward, Pazuntaung Township, Yangon Website www.dearmyanmar.org	Tel 09-42172662 HP 959-425013952 Fax 951-392642	PR@dearmyanmar.org	http://www.dearmyanmar.org/profile.html
Travel Agent/ Hotels						
Travel Agent	WaaNeiZa World Wide Travels & Tours Co.,Ltd.	Myo Zaw Shein	#34, Manawhari Street, Dagon Township, Yangon, Myanmar Website: www.wnztravels.com	Mobile-0095-9-5085687 Office-01-223321, 02-68890	myozaw.shein@gmail.com	CDZ Development Study, Can speak and write Japanese
		Htet Aung (Assistant Manager)	#34, Manawhari Street, Dagon Township, Yangon, Myanmar	Mobile: +95-9-2151499 Office: +95-1-223321, 2-68890	htetaungm@gmail.com c2aung.friends@gmail.com	Study Team
		Ms.Khaing Su Mon	#34, Manawhari Street, Dagon Township, Yangon, Myanmar	Tel: +95-2-68890 Mobile: +95-9-402 706 260	waaneizatravels@gmail.com	
Hotel	Park Royal Hotel (Yangon)		33 Alam Pya Phaya Road, Dagon Township, 11191,Yangon, Myanmar	Tel: +95 1 250 388 Fax: +95 1 252 478	http://www.parkroyalhotels.com/en/hotels/myanmar/yangon/parkroyal/index.html	
Hotel	Central Hotel (Yangon)		335-337 Bogyoke Aung San Road, Pabedan Township, Yangon	Tel: 951-241007 (20lines) Fax: 951-248003	CENTRAL.YGN@mptmail.net.mm	
Hotel	Excel Treasure Hotel, Yangon		No.520, Kaba Aye Pagoda Road, Shwe Gon Dine, Bahan Township, Yangon, Myanmar	Tel:(Hotel)+95-1-559150(8 lines) (Shopping Mall):559377(8 lines)	excel@myanmar.com.mm	
Hotel	Junction Hotel (Nay Pyi Taw)		Yarza Thingaha Road, 22 Hotel Zone, Dekhina Thri Nay Pyi Taw www.junctionhotelnpt.com	Tel 95(67)-422001, 422003(~ 6) Fax: 95(67)-422002	reservation@junctionhotelnpt.com rm@junctionhotelnpt.com	Junction Hotel is 5 minutes' walk to the Junction Shopping Mall and 30 minutes' drive from the Nay Pyi Taw Airport.

Appendix-5 Contact Person of the Study (as of May 2013)

Category	Organization Name	Contact Person	Adress	Tel/ Fax	E-mail	Remarks
Hotel	Myint Mo Nann Hotel (Nay Pyi Taw)		No (1000), Yazarhtarni Road, Aung Thar Yar Quarter, Pobbathiri, Nay Pyi Taw	Tel: 067-23910/ 23997-98/ 0949264990 Fax: 094-9264990		
Hotel	Shweingyin Mandalay (Mandalay)	Mr. Tun (Group's General Manager, Consultant)	Conner of 30th Street & 78th Street, Mandalay, Myanmar	Tel: : 02-73464, 73465 Mob: : 09-49324003 Fax: : +95 1 252 478	shweingyinnhotel@gmail.com	(Meeting on June 20, 2013)
Hotel		U Thin @ Wong Kolo Kyan (Executive Director)	E18, Kaba AyeVilla, Kaba Pagoda Road, Mayangone Township, Yangon, Myanmar	Mobile: 959-2001911	wkkmm123@gmail.com	(Meeting on June 25, 2013)
Hotel	Thante Hotel Bagan (Bagan)		Myo Ma Ouarter, Nyaung Oo www.thantenyu.com, www.agoda.com, www.asiatravel.com	Tel 95-61-60315/ 95-61-61116	nyaunguthante@mptmail.net.mm nyaunguthante@gmail.com	Website : www.thantenyu.com
Hotel	Magway hotel (Magway)		No.1/Ka, Nutmouk Road, Pwekyo Qr, Magway	tel 063-23343, 23523, 27598		
Taxi (Nyaung Oo)	Kaung Htat Restaurant and Taxi Service	U Kaung Htat	South of Market, Main Road, Front of Eden Motel, Nyaung Oo	Tel 061-61026/ 09-2043347		Taxi 40,000k/day
Restaurant	Ichiban-kan (Japanese Traditional Style Restaurant)	Ms. Kahori Komaru	G17-18, Aung San Stadium (North Wing), Gyophyu Street, MINT T/S, Yangon	Tel: 394824, 393051 Mobile: 09-4200-77600 Fax: 252154	kahori.komaru@gmail.com	
Restaurant	Furusato (Japanese Restaurant)		No.137, Shwe Gon Dine Road, Bahan, Yangon	Tel: 556265, 09-73081914		Open Daily: 11:00am-2:00pm, 5:00pm-10:00pm

Appendix-6 Administrative boundary in Myanmar



Soil Science Section, Soil Science, Water Utilization and Agricultural Engineering Division, Department of Agricultural Research,
Yezin, Nay Pyi Taw.

Reference number: Soil Science 174/2013-2014
Date: 5th July 2013.

To.

JICA team
Water Saving Technology

Subject: **Reply letter for soil analysis results and interpretation**

Reference letter: **work sheet listed of soil samples sent by JICA team on 13th May, 2013 and 23rd May, 2013.**

We are pleased to send the interpretation and soil analysis data of the soil sample sent by the project for development of water saving agriculture technology in the Central Dry Zone of Myanmar herewith attached.

Thank you very much.

Sincerely,

Su Su Win
PhD (Soil Science)
Section Head
Soil Science Section
DAR, Yezin.

Interpretation of soil analysis data of the soil sample sent by the project for development of water saving agriculture technology in the Central Dry Zone

Results and discussion

1. Nyaung Oo Township

There are 10 soil samples from Nyaung Oo township. **Moisture** percent of the soil sample ranges from 1.0% to 7.0%. Soil samples from Nyaung Oo Township explained that the soil is loamy sand except Htee Pu village. **Soil textural class** of Htee Pu is sandy clay loam. **Soil organic matter** is found to be very low to low status with moderately alkaline condition while as soil sample of Kaung Pin Si has neutral condition and soil sample taken from Taung Shae and Myoe Hla has strongly alkaline condition. However the data of **Electrical Conductivity (EC)** are said to be non saline status. Percentage of **total N** in the soil ranges from 0.04% to 0.12%. Only in Dahat See village, **available N** is characterized as medium level. Available N for the rest of soil sample in this township could be rated as very low to low level. Regarding **available P**, the analysis result of Htee Pu is said to be high and Thant Zin Kyal and Myoe Hla can be found as medium level while as the others are characterized as low level. The rating of the **available K** in the soil is low except in Htee Pu and Taung Shae. They could be rated as medium and high level respectively. Very low status of **Cation Exchange Capacity** (CEC) is observed in Shwe Dwior, Taung Ba (Sr. No. from reference sheet 2), Thant Zin Kyal, Shwe Hlaing, and Kyaung Pin Si village although low level of CEC is noted in Dahat See, Taung Ba (Sr. No. from reference sheet 49), Taung Shae and Myoe Hla. **Base saturation** percent ranges from 95.8% to 99.8%. Among the basic cations, **Ca and Mg** content could be recognized as low to medium level. However, exchangeable Ca can be rated as high level in Htee Pu village. **Exchangeable Na** in Taung Ba (Sr. No. from reference sheet 49), Taung Shae and Myoe Hla is remarked as very high. Low to medium status of exchangeable Na is noted in the other villages. In connection with **extractable Cu,** adequate level is noted only in Htee Pu village while as it was noted as deficient level in the other village in Nyaung Oo Township.

Based on the soil analysis results of the submitted sample for Nyaung Oo Township, it would be suggested that annual application of cowdung or organic manure or green maure. Application of recommended rate of the macro nutrient fertilizers should also be advisable.

2. Magway Township

Total number of soil sample submitted for Magway Township is 19. **Moisture** percent of the soil sample ranges from 1.0% to 5.0%. The soil is said to be **non saline** soil. The properties of soils in the villages are **loamy sand with low in available P and K**. Sandy soil is observed in Saikya (Sr.No. from reference sheet 28) and Saig Kya (Sr.No. from reference sheet 34). **Available N** is found to be very low to low status except in Saikya (Sr. No. from reference sheet 28). It can be rated as medium status. **Total N** content ranges from 0.03% to 0.09%. There would be three groups of the village based on soil reaction. **Soil reaction** of Saig Kya (Sr. No. from reference sheet 32), Sharpanla (Sr. No. from reference sheet 35,36 & 37), Kone Gyi (Sr. No. from reference sheet 41), and Nyaung Kan (Sr. No. from reference sheet 46) is rated as neutral. Moderately alkaline status of soil reaction is found in Saikya (Sr. No. from reference sheet 28), Sai Kya (Sr. No. from reference sheet 30 & 31), Saig Kya (Sr. No. from reference sheet 34), Shaypanla (Sr. No. from reference sheet 38), Kone Gyi (Sr. No. from reference sheet 39), Mal Hla Taung, Si Pin Thar and Nung Kan (Sr. No. from reference sheet 48). The pH of Kone Gyi (Sr. No. from reference sheet 43 & 44), Nyaung Kan (Sr. No. from reference sheet 45), and Nyaung Pin (Sr. No. from reference sheet 47) can be characterized as slightly acid. **Soil organic matter (SOM)** in Kone Gyi (Sr. No. from reference sheet 44) explains as high. Medium status of SOM is found in Sharpanla (Sr. No. from reference sheet 37), Kone Gyi (Sr. No. from reference sheet 43), and Nyaung Kan (Sr. No. from reference sheet 46). SOM of the other villages in Magway Township is found to be very low to low level. **Cation Exchange Capacity (CEC)** of the villages could be noted as very low to low except in Saikya (Sr. No. from reference sheet 28) which explains as medium. **Base saturation percent** of the soil sample ranges from 91.0% to 99.6%. All soil samples from Magway Township could be considered as non saline. **Exchangeable Ca** in Saikya (Sr. No. from reference sheet 28) is found to be high where as Ex. Ca in Saikya (Sr. No. from reference sheet 31), Saig Kya (Sr. No. from reference sheet 34), and Shaypanla (Sr. No. from reference sheet 38) is noted as medium level. The rest sample is said to be low in Ex. Ca.

Exchangeable Na can be recognized as high in Kone Gyi (Sr. No. from reference sheet 43) but it can be rated as low in Shaypanla (Sr. No. from reference sheet 38), Mal Hla Taung, and Nyaung Kan (Sr. No. from reference sheet 45). As far as **Exchangeable Mg** is concerned, it can be rated as low in many of the villages but it is said to be high in Saikya (Sr. No. from reference sheet 28) and Saig Kya (Sr. No. from reference sheet 34). It can also be noted as medium in Sai Kya (Sr. No. from reference sheet 31 & 32), Sharpanla (Sr. No. from reference sheet 37), and Shaypanla (Sr. No. from reference sheet 38. All soil samples are deficient in **Cu**.

On account of low in SOM and available N, P and K, green manuring, the use of organic manures, application of macro nutrients should be practice to maintain the soil fertility status in the soil.

3. Myingyan Township

Moisture percentage of the 20 soil samples from Myingyan Township ranges from 2% to 7%. **Soil textural class** can be classified as sandy loam in Va Lone (Sr. No. from reference sheet 6), Chay Say (Sr. No. from reference sheet 10), Phon (Sr. No. from reference sheet 15), and Nyaung Pin (Sr. No. from reference sheet 17). Sandy clay loam is found in Va Lone (Sr. No. from reference sheet 7) where as clay loam is observed in Ywat Thar (Sr. No. from reference sheet 22). The rest of the soil sample in this township explains as loamy sand. The **soil reaction** of Nyaung Pin (Sr. No. from reference sheet 14, 16, & 18), and Zee Pin Kan (Sr. No. from reference sheet 20 & 23) is found to be neutral. However, the soil reaction explains as strongly alkaline in Va Lone (Sr. No. from reference sheet 7), Chay Say (Sr. No. from reference sheet 10, 11,12 & 13), and Phon (Sr. No. from reference sheet 15). The pH of the rest sample can be noted as moderately alkaline. **Soil Organic Matter (SOM)** is observed as very low to low level except in Zee Pin Kan (Sr. No. from reference sheet 23) and Tapinkan (Sr. No. from reference sheet 24). The rating of SOM for these villages is medium. **Electrical Conductivity (EC)** of the soil samples submitted for Myingyan Township is classified as non saline except Va Lone (Sr. No. from reference sheet 6) and Va Lone (Sr. No. from reference sheet 7). The rating of EC in these villages are very slightly saline and moderately saline resceptively. The amount of **total N** observed in the soil sample ranges from 0.03% to 0.19%. **Available N** is found to be very low to low but available N determined in Phon (Sr. No. from reference sheet 15) and Ywat Thar (Sr. No. from reference sheet 22) is

explained as medium status. Although the high level of **available P** is observed in Nyaung Pin (Sr. No. from reference sheet 17 & 18) and Ywat Thar (Sr. No. from reference sheet 22), low to medium level of available P is noted in the other villages. The property of the soil with **available K** can be categorized as low except in Va Lone (Sr. No. from reference sheet 7), Phon (Sr. No. from reference sheet 15), and Ywat Thar (Sr. No. from reference sheet 22). The rating of available K in these village can be noted as medium. The **Cation Exchange Capacity (CEC)** of the soil samples from Myingyan Township is widely ranged from very low to high. High CEC is observed only in Va Lone (Sr. No. from reference sheet 7) and low CEC is noted in Nyaung Pin (Sr. No. from reference sheet 18 & 19). CEC tested in Va Lone (Sr. No. from reference sheet 6), Chay Say (Sr. No. from reference sheet 10, 11,12, & 13), Phon (Sr. No. from reference sheet 15), Nyaung Pin (Sr. No. from reference sheet 17) and Ywat Thar (Sr. No. from reference sheet 22) is noted as medium. Very low CEC is observed in Va Lone (Sr. No. from reference sheet 8 & 9), Nyaung Pin (Sr. No. from reference sheet 14 & 16), Zee Pin Kan (Sr. No. from reference sheet 20,21, 23 & 25) and Tapinkan (Sr. No. from reference sheet 24). **Exchangeable Ca** is found to be low in Va Lone (Sr. No. from reference sheet 8 & 9), Nyaung Pin (Sr. No. from reference sheet 14, 16 & 19), Zee Pin Kan (Sr. No. from reference sheet 20,21, 23 & 25) and Tapinkan (Sr. No. from refernce sheet 24). It can be rated as high in the other villages of Myingyan Township except Nyaung Pin (Sr. No. from reference sheet 17 & 18) where there is noted as medium. **Exchangeable Mg** is observed as medium and high level. **Exchangeable Na** is classified as low to medium level except in Va Lone and Phon. The status of Exchangeable Na in Va Lone (Sr. No. from reference sheet 6) and Phon (Sr. No. from reference sheet 15) can be noted as high although it is very high status in Va Lone (Sr. No. from reference sheet 7). The level of **Cu** is deficient although it is found to be adequate in Chay Say (Sr. No. from reference sheet 13). Base saturation percentage ranges from 95.7% 99.9%.

The recommendation for soil fertility maintenance will be as the same as mentioned above for two townships. As far as soil salinity is concerned due to the characterization of EC as very slightly to moderately saline soil observed in Va Lone (Sr. No. from reference sheet 6 & 7 respectively), yield of onion grown there could be reduced because it is salt-sensitive crop. Deficiency of micro nutrients should also be concerned in high pH soil as nutrient availability is greatly influenced by soil acidity.

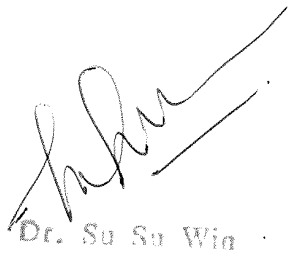
4

4. Chauk Towinship

There is one-and-only soil sample in Chauk Township. **Moisture** percentage of that sample is 1.3%. The property of the soil in Chauk Township is **loamy sand with moderately alkaline**. But it is classified as non saline soil based on **Electrical Conductivity** reading. Soil Organic Matter **(SOM)** content is low as well as **available N** is very low. Percentage of **total N** is 0.1%. **Available P and K** is also low. Cation Exchange Capacity **(CEC)** is observed as very low and **Exchangeable Ca and Mg** are found to be low. **Exchangeable Na** is said to be medium. It can be classified as deficient in extractable **Cu. Base saturation percentage** is calculated as 97.2%.

Soil analysis results describe to practice yearly application of macro nutrients along with organic manure. But awareness on the application of chemical fertilizers to the moisture deficit soil is also important.

Moisture status of soil condition must be taken into account at the time of fertilizer application in other Townships located in Central Dry Zone area. Moreover, it is very delicate issue to recommend for the additional supply of Cu to all soil sample analyzed here as the critical value of Cu for deficient and adequate is very closed.



Dr. Su Su Win
HEAD
Soil Section
Soil, Water Utilization And
Agricultural Engineering Division
Agricultural Research Department
Yezin Pyinmana
Myanmar

Soil Analysis Results from Nyaung Oo Township

Sr. No.	Sr. No. from Reference Sheet	Village Name	pH		EC		Total N %	Available N		Available P		Available K		Organic matter %	Organic carbon %	rating
			reaction	rating	dS/m	rating		mg/kg	rating	mg/kg	rating	mg/kg	rating			
1	1	Shwe Dwior	7.8	Moderately alkaline	0.11	Non Saline	0.08	53	Low	6	Low	47	Low	0.50	0.29	Very Low
2	2	Taung Ba	7.7	Moderately alkaline	0.06	Non Saline	0.05	31	Low	6	Low	63	Low	0.70	0.41	Low
3	4	Thant Zin Kyal	7.6	Moderately alkaline	0.06	Non Saline	0.07	45	Low	17	Medium	61	Low	0.80	0.47	Low
4	26	Shwe Hlaing	7.8	Moderately alkaline	0.04	Non Saline	0.04	25	Very Low	7	Low	33	Low	0.10	0.06	Very Low
5	27	Kaung Pin Si	7.3	Neutral	0.02	Non Saline	0.05	29	Very Low	9	Low	16	Low	0.50	0.29	Very Low
6	29	Dahat See	7.8	Moderately alkaline	0.07	Non Saline	0.04	64	Medium	5	Low	22	Low	0.50	0.29	Very Low
7	33	Htee Pu	7.8	Moderately alkaline	0.37	Non Saline	0.12	27	Very Low	26	High	187	Medium	1.90	1.10	Low
8	49	Taung Ba	7.8	Moderately alkaline	0.03	Non Saline	0.10	32	Low	8	Low	101	Low	0.85	0.49	Low
9	50	Taung Shae	8.9	Strongly alkaline	0.24	Non Saline	0.10	56	Low	9	Low	533	High	0.38	0.22	Very Low
10	51	Myoe Hla	8.8	Strongly alkaline	0.06	Non Saline	0.10	27	Very Low	11	Medium	108	Low	0.70	0.41	Low

Soil Analysis Results from Nyaung Oo Township

Sr. No.	Sr. No. from Reference Sheet	Village Name	Soil Texture (%)			Soil Textural Class	Moisture %	Exchangeable Ca		Exchangeable Na		Exchangeable Mg		Extractable Cu		CEC		Base Saturation %
			Sand	Silt	Clay			cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	
1	1	Shwe Dwior	85.0	11.0	4.0	Loamy Sand	1.0	3.3	Low	0.5	Medium	1.2	Medium	0.0005	Deficient	5.3	Very Low	97.1
2	2	Taung Ba	82.8	5.8	11.4	Loamy Sand	1.0	2.1	Low	0.3	Low	0.4	Low	0.0004	Deficient	3.1	Very Low	96.6
3	4	Thant Zin Kyal	87.4	4.8	7.8	Loamy Sand	5.0	3.0	Low	0.3	Low	0.9	Medium	0.0006	Deficient	4.5	Very Low	97.7
4	26	Shwe Hlaing	86.6	9.9	3.5	Loamy Sand	1.0	1.8	Low	0.4	Medium	0.3	Low	0.0006	Deficient	2.7	Very Low	95.8
5	27	Kaung Pin Si	87.0	6.9	6.1	Loamy Sand	6.0	1.7	Low	0.4	Medium	0.3	Low	0.0003	Deficient	2.5	Very Low	97.7
6	29	Dahat See	85.6	7.9	6.5	Loamy Sand	7.0	5.1	Medium	0.4	Medium	1.2	Medium	0.0001	Deficient	6.8	Low	98.8
7	33	Htee Pu	62.3	14.8	21.9	Sandy Clay Loam	7.0	14.5	High	0.5	Medium	1.4	Medium	0.0007	Adequate	17.0	Medium	99.8
8	49	Taung Ba	87.7	4.6	7.7	Loamy Sand	2.1	3.0	Low	2.8	Very High	0.5	Low	0.0001	Deficient	6.5	Low	98.7
9	50	Taung Shae	87.6	4.3	8.1	Loamy Sand	4.0	3.8	Low	3.0	Very High	0.6	Medium	0.0002	Deficient	8.9	Low	99.2
10	51	Myoe Hla	86.5	4.1	9.4	Loamy Sand	2.4	6.1	Medium	2.7	Very High	1.2	Medium	0.0003	Deficient	10.3	Low	99.1

Soil Analysis Results from Magway Township

Sr. No.	Sr. No. from Reference Sheet	Village Name	Soil Texture (%)			Soil Textural Class	Moisture %	Exchangeable Ca		Exchangeable Na		Exchangeable Mg		Extractable Cu		CEC		Base Saturatio %
			Sand	Silt	Clay			cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	
1	28	Saikya	76.6	6.2	17.2	Sandy Loam	4.0	15.8	High	0.4	Medium	2.68	High	0.0004	Deficient	19.3	Medium	99.6
2	30	Sai Kya	88.2	4.0	7.8	Loamy Sand	4.0	1.8	Low	0.4	Medium	0.38	Low	0.0002	Deficient	2.7	Very Low	96.8
3	31	Sai Kya	86.2	4.5	9.4	Loamy Sand	5.0	5.9	Medium	0.4	Medium	1.08	Medium	0.0004	Deficient	7.5	Low	99.1
4	32	Saig Kya	88.4	3.3	8.3	Loamy Sand	5.0	3.1	Low	0.7	Medium	0.81	Medium	0.0006	Deficient	4.9	Low	97.4
5	34	Saig Kya	79.5	5.5	15.0	Sandy Loam	3.0	5.7	Medium	0.4	Medium	2.19	High	0.0005	Deficient	8.4	Low	99.6
6	35	Sharpanla	83.6	11.7	4.7	Loamy Sand	1.0	2.2	Low	0.4	Medium	0.50	Low	0.0003	Deficient	3.3	Very Low	97.1
7	36	Sharpanla	85.5	5.9	8.6	Loamy Sand	1.0	3.2	Low	0.4	Medium	0.42	Low	0.0001	Deficient	4.1	Very Low	98.7
8	37	Sharpanla	87.4	7.3	5.3	Loamy Sand	1.0	3.5	Low	0.4	Medium	1.26	Medium	0.0003	Deficient	5.4	Very Low	98.2
9	38	Shaypanla	87.0	8.5	4.5	Loamy Sand	1.0	5.8	Medium	0.3	Low	0.73	Medium	0.0002	Deficient	7.0	Low	99.3
10	39	Kone Gyi	85.0	7.3	7.7	Loamy Sand	1.0	2.0	Low	0.4	Medium	0.19	Low	0.0001	Deficient	2.7	Very Low	98.4
11	40	Mal Hla Taung	85.5	9.5	5.0	Loamy Sand	1.0	0.6	Low	0.3	Low	0.03	Low	0.0002	Deficient	1.1	Very Low	95.7
12	41	Kone Gyi	85.8	7.0	7.2	Loamy Sand	1.0	0.7	Low	0.4	Medium	0.03	Low	0.0002	Deficient	1.1	Very Low	95.2
13	42	Si Pin Thar	80.4	16.9	2.7	Loamy Sand	2.0	0.8	Low	0.4	Medium	0.02	Low	0.0003	Deficient	1.2	Very Low	96.4
14	43	Kone Gyi	77.3	16.3	6.4	Loamy Sand	2.0	1.8	Low	1.6	High	0.14	Low	0.0003	Deficient	3.6	Very Low	99.2
15	44	Kone Gyi	86.3	6.7	7.0	Loamy Sand	1.0	0.8	Low	0.4	Medium	0.02	Low	0.0003	Deficient	1.2	Very Low	97.2
16	45	Nyaung Kan	85.3	9.3	5.4	Loamy Sand	1.0	0.8	Low	0.3	Low	0.02	Low	0.0003	Deficient	1.2	Very Low	93.2
17	46	Nyaung Kan	86.7	6.0	7.4	Loamy Sand	1.0	0.8	Low	0.4	Medium	0.01	Low	0.0005	Deficient	1.2	Very Low	91.0
18	47	Nyaung Pin	83.6	9.1	7.3	Loamy Sand	3.0	0.8	Low	0.4	Medium	0.01	Low	0.0004	Deficient	1.3	Very Low	92.4
19	48	Nung Kan	84.2	10.3	5.5	Loamy Sand	1.0	0.7	Low	0.4	Medium	0.004	Low	0.0003	Deficient	1.2	Very Low	92.8

Soil Analysis Results from Myingyan Township

Sr. No.	Sr.No.from Reference Sheet	Village Name	pH		EC		Total N %	Available N		Available P		Available K		Organic matter %	Organic carbon %	rating
			reaction	rating	dS/m	rating		mg/kg	rating	mg/kg	rating	mg/kg	rating			
1	6	Va Lone	7.8	Moderately alkaline	0.53	Very Slightly Saline	0.09	42	Low	5	Low	118	Low	0.10	0.06	Very Low
2	7	Va Lone	8.9	Strongly alkaline	0.81	Moderately Saline	0.06	56	Low	5	Low	224	Medium	2.00	1.16	Low
3	8	Va Lone	7.4	Moderately alkaline	0.04	Non Saline	0.1	52	Low	5	Low	61	Low	0.80	0.47	Low
4	9	Va Lone	7.4	Moderately alkaline	0.02	Non Saline	0.06	30	Very Low	14	Medium	37	Low	0.90	0.52	Low
5	10	Chay Say	8.5	Strongly alkaline	0.12	Non Saline	0.12	31	Low	15	Medium	135	Low	1.50	0.87	Low
6	11	Chay Say	8.5	Strongly alkaline	0.11	Non Saline	0.07	46	Low	8	Low	62	Low	1.10	0.64	Low
7	12	Chay Say	8.7	Strongly alkaline	0.09	Non Saline	0.1	40	Low	9	Low	68	Low	1.80	1.05	Low
8	13	Chay Say	8.5	Strongly alkaline	0.11	Non Saline	0.19	41	Low	6	Low	40	Low	0.90	0.52	Low
9	14	Nyaung Pin	7.2	Neutral	0.05	Non Saline	0.1	40	Low	13	Medium	55	Low	0.10	0.06	Very Low
10	15	Phon	8.9	Strongly alkaline	0.33	Non Saline	0.08	69	Medium	9	Low	199	Medium	1.20	0.70	Low
11	16	Nyaung Pin	7.1	Neutral	0.05	Non Saline	0.12	38	Low	14	Medium	62	Low	0.60	0.35	Very Low
12	17	Nyaung Pin	7.7	Moderately alkaline	0.08	Non Saline	0.05	58	Low	22	High	147	Low	0.90	0.52	Low
13	18	Nyaung Pin	7.1	Neutral	0.22	Non Saline	0.09	54	Low	30	High	134	Low	0.20	0.12	Very Low
14	19	Nyaung Pin	7.4	Moderately alkaline	0.06	Non Saline	0.06	40	Low	13	Medium	97	Low	0.30	0.17	Very Low
15	20	Zee Pin Kan	7.3	Neutral	0.07	Non Saline	0.08	35	Low	12	Medium	49	Low	0.40	0.23	Very Low
16	21	Zee Pin Kan	7.6	Moderately alkaline	0.10	Non Saline	0.05	35	Low	6	Low	102	Low	0.50	0.29	Very Low
17	22	Ywat Thar	8.1	Moderately alkaline	0.26	Non Saline	0.07	64	Medium	23	High	202	Medium	1.00	0.58	Low
18	23	Zee Pin Kan	7.1	Neutral	0.07	Non Saline	0.08	52	Low	11	Medium	45	Low	2.10	1.22	Medium
19	24	Tapinkan	7.6	Moderately alkaline	0.05	Non Saline	0.07	55	Low	12	Medium	27	Low	2.40	1.40	Medium
20	25	Zee Pin Kan	7.7	Moderately alkaline	0.03	Non Saline	0.03	41	Low	4	Low	33	Low	0.20	0.12	Very Low

Soil Analysis Results from Myingyan Township

Sr. No.	Sr.No.from Reference Sheet	Village Name	Soil Texture (%)			Soil Textural Class	Moisture %	Exchangeable Ca		Exchangeable Na		Exchangeable Mg		Extractable Cu		CEC		Base Saturatio %
			Sand	Silt	Clay			cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	cmol (+)/kg	rating	
1	6	Va Lone	71.5	11.8	16.8	SandyLoam	3.0	11.1	High	1.7	High	3.7	High	0.0004	Deficient	16.8	Medium	99.2
2	7	Va Lone	48.8	27.4	23.8	Sandy Clay Loam	3.0	18.4	High	4.0	Very High	3.8	High	0.0006	Deficient	26.9	High	99.6
3	8	Va Lone	84.6	9.7	5.8	Loamy Sand	3.0	3.2	Low	0.3	Low	1.3	Medium	0.0005	Deficient	5.2	Very Low	96.8
4	9	Va Lone	83.1	13.3	3.7	Loamy Sand	2.0	1.8	Low	0.3	Low	0.6	Medium	0.0002	Deficient	2.9	Very Low	95.7
5	10	Chay Say	76.8	12.7	10.6	Sandy Loam	3.0	15.2	High	0.4	Medium	2.4	High	0.0005	Deficient	18.4	Medium	99.5
6	11	Chay Say	78.9	15.3	5.8	Loamy Sand	3.0	15.3	High	0.3	Low	1.9	High	0.0005	Deficient	17.8	Medium	99.6
7	12	Chay Say	82.9	11.1	7.0	Loamy Sand	2.0	15.0	High	0.3	Low	1.8	High	0.0005	Deficient	17.4	Medium	99.6
8	13	Chay Say	79.0	14.6	6.3	Loamy Sand	3.0	16.4	High	0.4	Medium	2.3	High	0.0008	Adequate	19.2	Medium	99.6
9	14	Nyaung Pin	86.1	7.9	6.1	Loamy Sand	2.0	2.6	Low	0.4	Medium	0.6	Medium	0.0003	Deficient	3.8	Very Low	98.8
10	15	Phon	59.9	23.0	17.1	Sandy Loam	6.0	16.4	High	1.4	High	3.8	High	0.0006	Deficient	22.2	Medium	99.8
11	16	Nyaung Pin	85.2	10.7	4.1	Loamy Sand	2.0	2.4	Low	0.3	Low	0.7	Medium	0.0004	Deficient	3.6	Very Low	99.6
12	17	Nyaung Pin	73.6	13.4	13.0	Sandy Loam	3.0	8.8	Medium	0.3	Low	3.3	High	0.0005	Deficient	12.9	Medium	99.6
13	18	Nyaung Pin	78.5	11.4	10.1	Loamy Sand	3.0	5.8	Medium	0.3	Low	2.0	High	0.0005	Deficient	8.4	Low	99.5
14	19	Nyaung Pin	82.6	16.5	0.9	Loamy Sand	2.0	4.1	Low	0.4	Medium	1.5	Medium	0.0003	Deficient	6.2	Low	99.6
15	20	Zee Pin Kan	85.5	6.5	8.0	Loamy Sand	2.0	2.3	Low	0.3	Low	1.0	Medium	0.0001	Deficient	3.8	Very Low	98.2
16	21	Zee Pin Kan	85.7	8.7	5.7	Loamy Sand	2.0	3.0	Low	0.5	Medium	1.1	Medium	0.0002	Deficient	4.8	Very Low	99.3
17	22	Ywat Thar	36.8	31.9	31.3	Clay Loam	7.0	15.4	High	0.4	Medium	3.3	High	0.0002	Deficient	19.7	Medium	99.9
18	23	Zee Pin Kan	89.0	2.4	8.6	Loamy Sand	2.0	2.3	Low	0.4	Medium	0.9	Medium	0.0002	Deficient	3.8	Very Low	97.7
19	24	Tapinkan	85.0	7.1	7.9	Loamy Sand	2.0	2.3	Low	0.3	Low	1.0	Medium	0.0006	Deficient	3.7	Very Low	99.0
20	25	Zee Pin Kan	87.6	4.3	8.0	Loamy Sand	2.0	2.3	Low	0.3	Low	1.1	Medium	0.0003	Deficient	3.8	Very Low	99.2

Soil Analysis Results from Chauk Township

Sr. No.	Sr.No. from Reference Sheet	Village Name	pH		EC		Total N %	Available N		Available P		Available K	
			reaction	rating	dS/m	rating		mg/kg	rating	mg/kg	rating	mg/kg	rating
1	52	Min Kan	7.6	Moderately alkaline	0.05	Non Saline	0.1	30	Very Low	4	Low	38	Low

Sr. No.	Sr.No. from Reference Sheet	Village Name	Organic matter %	Organic carbon %	rating	Moisture %	Soil Texture (%)			Soil Textural Class
							Sand	Silt	Clay	
1	52	Min Kan	0.90	0.55	Low	1.3	84.1	10.9	5.0	Loamy Sand

Sr. No.	Sr.No. from Reference Sheet	Village Name	Exchangeable Ca		Exchangeable Na		Exchangeable Mg		Extractable Cu		CEC		Base Saturation %
			cmol $_{(+)}$/kg	rating	cmol $_{(+)}$/kg	rating	cmol $_{(+)}$/kg	rating	cmol $_{(+)}$/kg	rating	cmol $_{(+)}$/kg	rating	
1	52	Min Kan	2.3	Low	0.4	Medium	0.3	Low	0.0005	Deficient	3.2	Very Low	97.2

Analytical item	Analytical method	Apparatus used
pH	1:2.5 w/v soil : water	pH meter F-51 HORIBA
EC	1:2.5 w/v soil : water	Cond meter DS-51 HORIBA
Total N	Kjeldahl distillation method	Gerhardt Vapodest 20s
Available N	Alkaline permanganate method	-
Available P	Olsen's method	UV Vis Spectrophotometer PD-303 UV
Available K	1N Ammonium acetate extraction	Atomic Absorption Flame Emission Spectrophotometer AA-6200, SHIMADZU
Organic matter	Tyurin's method	-
Soil Texture	Pipette method	-
Exchangeable Ca, Na, Mg and Extractable Cu	1N Ammonium acetate extraction	Atomic Absorption Flame Emission Spectrophotometer AA-6200,SHIMADZU
Cation Exchange Capacity, CEC	Leaching method	-

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Water Utilization Research Section

July, 2013

The Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Department of Agricultural Research
Soil Science, Water Utilization and Agricultural Engineering Division
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Yezin, Naypyitaw

Phone: 067-416531 Fax: 067-416535

Letter No.ı DaKa/2013-2014/80

Date ı June 17, 2013

Description ıı **ıı The results of soil and water samples.**

The results of fifty water samples from JICA Project are submitted to you.

Dr. Khin Mar Htay
Section Head
Water Utilization Research Section
Department of Agricultural Research
Yezin, Naypyitaw

JICA Project

Copy

- Office received.

Table (1) Water Samples from JICA Project

Sr.No.	Water Sample	Township	Sr.No.	Water Sample	Township
1.	W-1	Nyaung U	26.	W-26	Nyaung Oo
2.	W-2	Nua Htoe Gyi	27.	W-27	Magway
3.	W-3	Myingyan	28.	W-28	Magway
4.	W-4	Nyaung U	29.	W-29	Yae Nan Chaung
5.	W-5	Myingyan	30.	W-30	Magway
6.	W-6	Myingyan	31.	W-31	Netmauk
7.	W-7	Myingyan	32.	W-32	Netmauk
8.	W-8	Magway	33.	W-33	Netmauk
9.	W-9	Magway	34.	W-34	Netmauk
10.	W-10	Magway	35.	W-35	Netmauk
11.	W-11	Sagaing	36.	W-36	Netmauk
12.	W-12	Myin Mu	37.	W-37	Netmauk
13.	W-13	Myin Mu	38.	W-38	Nay Pyi Taw
14.	W-14	Taung Thar	39.	W-39	Tat Kone
15.	W-15	Nyaung Oo	40.	W-40	Tat Kone
16.	W-16	Nyaung Oo	41.	W-41	Tat Kone
17.	W-17	Nyaung Oo	42.	W-42	Yamaethin
18.	W-18	Nyaung Oo	43.	W-43	Yamaethin
19.	W-19	Nyaung Oo	44.	W-44	Yamaethin
20.	W-20	Nyaung Oo	45.	W-45	Yamaethin
21.	W-21	Nyaung Oo	46.	W-46	Yamaethin
22.	W-22	Nyaung Oo	47.	W-47	Yamaethin
23.	W-23	Nyaung Oo	48.	W-48	Tat Kone
24.	W-24	Nyaung Oo	49.	W-49	Yamaethin
25.	W-25	Magway	50.	W-50	Yamaethin

Table (2) Analytical method and apparatus used

Sr. No.	Analytical item	Analytical method	Apparatus used
1	pH	Electrometric Method	pH meter (F-51, HORIBA)
2	EC	Electrometric Method	Conductivity meter (DS-51, HORIBA)
3	CO_3, HCO_3, Cl	Titrimetric Method	Titrator
6	SO_4	Turbidimertric Method	UV- VIS Spectrophotometer, PD – 303 UV
7	K, Na, Mg, Ca, Fe, Mn, Cu, Zn, SAR	Spectrophotometric Method	Atomic Absorption Spectrophotometer NovAA 400

No.	Date		Location			Water source
	Day	Month	Region	TS	Village	
1.	2	May	Mandalay	Nyaung U	Maye Noe Lay	Canal
2.	3	May	Mandalay	Nua Htoe Gyi	Kan	Tube – well
3.	4	May	Mandalay	Myingyan	Phone	Tube – well
4.	5	May	Mandalay	Nyaung U	Own Nae Chaung	Canal
5.	5	May	Mandalay	Myingyan	Ywar Thar Yar	Tube – well
6.	5	May	Mandalay	Myingyan	Zee Pi Kan	Tube – well
7.	6	May	Mandalay	Myingyan		Tube – well
8.	9	May	Magway	Magway	Si Pin Thar	Tube – well
9.	9	May	Magway	Magway	Myin Kin	Canal
10.	9	May	Magway	Magway	Si Pin Thar	Creek
11.	16	May	Sagaing	Sagaing	Kone	Farm pond
12.	16	May	Sagaing	Myin Mu	Pyaw Ywar	Cannel
13.	16	May	Sagaing	Myin Mu		Cannel
14.	17	May	Mandalay	Taung thangi	Kyaw Zi	Cannel
15.	17	May	Mandalay	Nyaung U	A Htet Nyit	Cannel
16.	18	May	Mandalay	Nyaung U	Ayerawady river water	Thu kaung Te
17.	18	May	Mandalay	Nyaung U	Thu kaung Te	Tube – well
18.	18	May	Mandalay	Nyaung U	Thu kaung Te	Tube – well
19..	18	May	Mandalay	Nyaung U	Thu kaung Te	Tube – well
20.	18	May	Mandalay	Nyaung U	Anauk Palinn	Tube – well
21.	18	May	Mandalay	Nyaung U	Myae Nae lay	Tube – well
22.	18	May	Mandalay	Nyaung U	Wat kyi Inn	Tube – well
23.	20	May	Mandalay	Nyaung U		Tube – well
24.	20	May	Mandalay	Nyaung U	Myoe Hla	Tube – well
25.	21	May	Magway	Magway		Tube – well
26.	18	May	Magway	Nyaung U	Thu kaung Te	Tube – well
27.	22	May	Magway	Magway		Tube – well
28.	22	May	Magway	Magway	Down Nay	Tube – well
29.	22	May	Magway	Yaw Nan Chaung	San Kan Gyi	Tube – well
30.	23	May	Magway	Magway	Naung Pin	Tube – well
31.	23	May	Magway	Net Mauk	Ta Kun daing	Wadi
32.	23	May	Magway	Net Mauk	Inn Kone	Tube – well
33.	23	May	Magway	Net Mauk	Inn Kone	Tube – well
34.	23	May	Magway	Net Mauk	Lay Eain	Wadi
35.	23	May	Magway	Net Mauk	Ywar Mon	Stream
36.	23	May	Magway	Net Mauk	Naboo Kwe	Farm pond
37.	23	May	Magway	Net Mauk	-	Farm pond
38.	23	May	Nay Pyi Taw	Nay Pyi Taw	-	Cannel
39.	24	May	Nay Pyi Taw	Tat Kone	Oatshit Kone	Cannel
40.	24	May	Nay Pyi Taw	Tat Kone	Tha Htay Gone	Tube – well
41.	24	May	Nay Pyi Taw	Tat Kone	Kyar thay eine	Tube – well
42.	24	May	Mandalay	Yamaethin	Aung chan thar	Tube – well
43.	24	May	Mandalay	Yamaethin	Kin Moon Chone	Tube – well
44.	24	May	Mandalay	Yamaethin	Out Downt	Tube – well
45.	24	May	Mandalay	Yamaethin	Inn Zinn	Tube – well
46.	24	May	Mandalay	Yamaethin	Hlwe Oo	Tube – well
47.	24	May	Mandalay	Yamaethin	Nyaung lay Pin	Tube – well
48.	24	May	Nay Pyi Taw	Tat Kone	Nyaung lay Pin	Cannel
49.	24	May	Mandalay	Yamaethin	Shwe Dar	Tube – well
50.	24	May	Mandalay	Yamaethin	Si Pi Research Farm (DAR)	Tube – well

Tube-well - 32
canal - 10
Farm pond - 3
stream - 2

Table (3) Water Sample results from JICA Project

Sr.No.	Water Sample	SAR	pH	EC (dS/m)	Ca (ppm)	Mg (ppm)	Na (ppm)	K (ppm)	CO_3 (ppm)	HCO_3 (ppm)	Cl (ppm)	SO_4 (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
1.	W-1	0.28	6.65	0.149	16.28	4.63	4.94	1.48	Nil	114.19	34.16	40.5	10.8500	0.1898	0.2131	0.0675
2.	W-2	0.74	7.87	0.794	73.57	39.73	31.98	4.01	Nil	603.90	40.99	28.5	5.5850	0.1561	0.1579	0.0522
3.	W-3	2.53	7.46	1.110	28.77	41.51	90.93	1.51	Nil	614.88	72.42	124.5	1.5560	0.1535	0.1437	0.0366
4.	W-4	0.23	7.70	0.192	19.16	7.13	4.74	1.44	Nil	109.80	40.99	28.5	0.5349	0.0299	0.1239	0.0673
5.	W-5	1.08	7.56	0.891	42.75	74.18	50.80	3.32	Nil	636.84	81.99	72.0	0.0664	0.0211	0.1412	0.0708
6.	W-6	2.94	7.01	1.252	12.32	27.86	81.88	31.45	Nil	779.58	75.16	39.0	1.1140	0.1310	0.0639	0.0212
7.	**W-7**	24.42	7.18	3.510	21.11	34.52	787.70	5.50	Nil	801.54	245.97	424.5	0.8032	0.1154	0.1095	0.0209
8.	W-8	7.92	7.80	0.728	13.60	19.22	15.44	4.67	Nil	439.20	88.82	27.0	0.2152	0.0611	0.0433	0.0273
9.	W-9	18.33	7.89	0.554	14.00	13.39	401.75	3.47	Nil	285.48	95.66	58.5	Nil	0.0489	0.0376	0.0293
10.	**W-10**	43.51	7.82	0.333	4.63	5.14	574.75	10.03	Nil	219.60	68.33	46.5	7.4030	0.2695	Nil	Nil
11.	W-11	2.79	7.24	0.530	59.90	8.40	87.18	2.44	1.35	258.00	81.99	141.0	0.3319	3.257	Nil	0.0158
12.	W-12	0.87	7.25	0.460	59.25	11.71	27.95	6.18	1.62	219.60	92.92	129.0	0.1569	0.5560	Nil	0.0344
13.	W-13	1.48	7.21	0.412	47.23	10.37	43.21	7.77	1.73	192.15	116.15	121.5	0.1998	0.6242	Nil	0.0414
14.	W-14	0.63	7.55	0.107	15.91	4.04	10.91	6.59	Nil	91.13	68.33	121.5	0.2304	0.5573	Nil	0.0458
15.	W-15	1.34	7.53	0.100	23.81	6.30	28.45	10.85	Nil	79.06	68.33	127.5	0.2972	0.4467	Nil	0.0509
16.	W-16	2.04	7.35	0.100	26.68	6.92	45.82	13.36	Nil	74.66	61.49	121.5	0.3567	0.4955	Nil	0.0698
17.	W-17	2.02	6.92	0.560	53.66	24.08	71.23	23.92	4.59	269.00	65.59	139.5	0.1601	0.5178	Nil	0.0609
18.	W-18	16.02	6.78	1.460	17.90	22.01	430.55	4.88	4.97	516.06	204.98	184.5	1.2300	0.1376	0.0253	0.1121
19.	W-19	8.87	6.62	0.940	24.78	21.79	252.00	4.95	4.86	439.20	109.32	145.5	0.2820	Nil	0.0379	0.1154
20.	W-20	3.86	6.59	1.720	83.35	18.78	235.23	15.73	4.86	296.46	202.24	367.5	0.2387	0.1012	0.0201	0.1263

Table (3) Water Sample results from JICA Project (continued)

Sr.No.	Water Sample	SAR	pH	EC (dS/m)	Ca (ppm)	Mg (ppm)	Na (ppm)	K (ppm)	CO_3 (ppm)	HCO_3 (ppm)	Cl (ppm)	SO_4 (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
21.	**W-21**	16.51	6.52	1.540	10.28	35.80	502.00	3.93	3.83	655.51	225.47	243.0	0.2163	0.0581	0.0321	0.2094
22.	**W-22**	33.01	6.47	1.890	15.33	3.12	544.00	1.73	8.91	395.28	232.31	169.5	0.1715	0.0925	0.0211	0.1488
23.	**W-23**	28.47	6.61	1.230	10.87	2.24	395.75	2.53	3.67	631.35	229.57	Nil	0.2180	0.0702	0.0350	0.2229
24.	W-24	0.47	6.82	0.690	9.69	15.62	10.29	26.15	1.73	301.95	281.49	4.5	0.2382	0.0244	0.0284	0.0086
25.	W-25	6.88	6.52	1.250	14.86	24.73	187.40	5.76	2.16	570.96	215.91	24.0	0.3962	0.0346	0.0024	0.0189
26.	W-26	7.40	6.75	0.749	13.78	14.59	166.18	4.50	2.05	428.22	125.72	Nil	0.1648	0.0130	0.0295	0.0155
27.	W-27	4.41	7.25	1.090	33.24	31.84	148.95	5.45	2.16	472.14	226.84	138.0	0.1398	0.0176	0.0029	0.0298
28.	W-28	4.01	7.54	0.410	19.94	6.08	80.01	3.33	2.27	199.84	99.75	Nil	0.1054	0.0186	0.0267	0.0244
29.	W-29	1.99	7.52	0.680	79.98	17.60	75.76	5.58	1.51	285.48	239.14	Nil	0.1512	0.0157	0.0217	0.0373
30.	W-30	1.96	7.26	0.970	96.93	24.60	83.75	9.50	2.38	519.35	157.15	76.5	0.2473	0.0205	0.0165	0.0373
31.	W-31	2.42	7.47	0.560	33.15	43.03	89.89	10.50	3.89	209.72	168.08	43.5	0.4023	0.0080	0.0155	0.0473
32.	W-32	9.75	7.12	1.120	25.08	12.47	240.2	1.05	4.86	721.39	95.66	19.5	0.1230	0.0078	0.0098	0.0580
33.	W-33	6.05	7.24	0.930	33.09	25.90	192.13	1.16	3.29	623.66	157.15	30.0	0.1049	Nil	0.0222	0.0601
34.	W-34	3.94	7.29	0.895	41.04	24.52	129.65	5.10	4.21	554.49	151.68	150.0	0.1973	0.0231	0.0142	0.0673
35.	W-35	5.81	7.42	0.760	16.66	8.24	116.58	5.30	4.32	247.05	101.12	274.5	0.1769	0.0140	0.0221	0.0748
36.	W-36	1.06	7.87	0.265	33.75	4.73	24.91	3.81	1.13	171.29	117.52	142.5	0.5470	0.0668	Nil	0.1017
37.	W-37	2.82	7.63	0.305	23.07	3.27	54.84	1.65	1.94	120.78	68.33	198.0	0.3202	0.0605	Nil	0.0785
38.	W-38	3.86	7.74	0.129	20.59	1.81	68.15	2.62	0.65	88.94	97.02	145.5	0.3110	0.0608	Nil	0.0500
39.	W-39	1.27	7.33	0.464	25.79	20.27	35.59	3.02	2.38	192.15	101.12	240.0	0.5600	0.0273	Nil	0.1084
40.	W-40	2.68	7.18	0.569	76.70	16.23	99.23	2.11	1.19	373.32	87.46	150.0	0.2129	0.1614	Nil	0.0985

Table (3) Water Sample results from JICA Project (continued)

Sr.No.	Water Sample	SAR	pH	EC (dS/m)	Ca (ppm)	Mg (ppm)	Na (ppm)	K (ppm)	CO_3 (ppm)	HCO_3 (ppm)	Cl (ppm)	SO_4 (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
41.	W-41	3.40	6.97	0.951	89.75	33.22	149.10	0.47	2.16	503.98	91.56	187.5	0.4060	0.1057	Nil	0.0988
42.	W-42	2.43	7.00	0.619	78.53	22.37	95.15	0.36	3.89	376.61	83.36	168.0	1.6500	0.5492	Nil	0.1356
43.	W-43	2.94	6.55	1.098	38.42	18.31	88.69	0.41	4.37	633.55	105.22	151.5	3.5500	0.1057	0.0068	0.1208
44.	W-44	2.24	6.90	0.632	43.47	23.04	73.56	4.01	2.92	171.29	95.66	138.0	0.4662	0.0402	Nil	0.1119
45.	W-45	7.60	6.51	1.035	27.54	17.11	207.00	0.62	4.97	468.85	72.42	135.0	0.5384	0.0359	Nil	0.1426
46.	**W-46**	11.95	6.54	1.345	31.77	17.39	338.70	0.63	4.97	685.15	122.99	171.0	0.5862	0.0451	Nil	0.1802
47.	W-47	4.49	7.56	0.961	46.15	24.58	152.28	0.38	3.78	579.74	113.42	139.5	4.8770	0.1822	0.0052	0.0031
48.	W-48	1.96	7.67	0.489	5.80	18.95	43.49	14.30	2.43	188.86	90.19	240.0	0.2207	0.0421	0.0024	0.0012
49.	**W-49**	20.97	7.15	1.940	11.54	25.91	564.06	0.70	9.29	1015.65	143.48	183.0	0.2345	0.0540	0.0062	0.0016
50.	W-50	5.98	7.17	1.390	54.98	28.39	219.80	0.72	4.32	737.86	121.62	214.5	0.2338	0.0634	Nil	0.0126

Suggestion and Recommendation:

Among the 50 water samples,

W_{10}, W_{22} and **W_{23}** are very high **Sodium Adsorption Ratio (SAR)** and **W_{22}** and **W_{23}** are high amount of **carbonate (CO_3)** concentration.

W_7 and **W_{49}** are high **Sodium Adsorption Ratio (SAR)**. **W_7** is severe **Electrical Conductivity (EC)** and high amount of **bicarbonate (HCO_3)** concentration. **W_{49}** is moderate **Electrical Conductivity (EC)** and high amount of both **carbonate (CO_3) and bicarbonate (HCO_3)** concentrations.

W_{21} and **W_{46}** are medium **Sodium Adsorption Ratio (SAR) value.** These water are high amount of both **carbonate (CO_3) and bicarbonate (HCO_3)** concentrations.

The source of these 7 water samples are tube well, except W_{10} (Creek).

The samples are collected from Myingyan (**W_7**), Magway (**W_{10}**), Nyaung Oo (**$W_{21, 22, 23}$**), Yamaethin (**$W_{46, 49}$**). If possible, these 7 water samples cannot be used for irrigation. Commonly, they are high SAR and high CO_3 and HCO_3. Bicarbonate could increase the SAR of the soil water by precipitating calcium and magnesium. Carbonate is associated with the level of alkality.

But, if **W_{21}** and **W_{46}** will be used for irrigation, these water samples are suitable for soil types with high infiltration rate and you should do irrigation and drainage regularly, you can use suitable irrigation practices. Salt tolerant variety must be cultivated. Moveover, frequent application of Gypsum ($CaSO_4.7H_2O$) and organic matter can be incorporated into irrigation water or soil surface to decrease SAR and bicarbonate.

Irrigated Water Quality Standard and Comments

Sr No.	Description	Unit	Usual range in irrigation water	Comments
1	pH	-	6.0 - 8.5	-
2	EC	dS/m	0.75 - 3	Plant growth is primarily limited by the salinity (EC_w) level of the irrigation water with a sodium unbalance can further reduced yield under certain soil texture condition.
3	Ca^{++}	ppm	0 - 401	If the calcium in the soil-water taken up by the crops is less than 2 me/L, there is a strong probability that the crop yield will be reduced.
4	Mg^{++}	ppm	0 - 60.75	Toxic to a number of crops at few-tenths to a few mg/L in acid soils.
5	Na^{+}	ppm	0 - 920	Typically toxicity symptoms are leaf burn, scorch and dead tissue along the outside edges of leaves in contrast to symptoms of chloride toxicity which normally occur initially at the extreme leaf tip.
6	K^{+}	ppm	0 - 2	*
7	$CO_3^{=}$	ppm	0 - 3	Carbonates are associated with the level of alkalinity.
8	HCO_3^{-}	ppm	0 - 610	Bicarbonate could increase the SAR of the soil water by precipitating calcium and magnesium. This can be corrected by frequent application of gypsum in soil surface.
9	Cl^{-}	ppm	0 - 1065	If there toxic ions accumulate to excessive concentrations, they cause chlorosis, bronzing and leaf burn primarily at the leaf top, leaf edges to mid-leaf area.
10	$SO_4^{=}$	ppm	0 - 960	The sulphates tend to combine with some of the calcium and aluminium compounds in the hardened cement and from calcium aluminate- sulphate or gypsum, which causes the concrete to swell.
11	Fe^{++}	ppm	0 - 5	Not toxic to plants in a aerated soils, but can contribute to soil acidification and loss of essential phosphorus and molybdenum.
12	Mn^{++}	ppm	0 - 0.2	Toxic to a number of crops at a few-tenths to a few mg/L but usually only in acid soil.
13	Cu^{++}	ppm	0 - 0.2	Toxic to number of plants at 0.1 to 1.0 mg/L in nutrient solution.
14	Zn^{++}	ppm	0 - 2	Toxic to many plants at widely varying concentrations, reduced toxicity at increase pH (6 or above) and in fine-textured or organic soils.
15	SAR	-	0 - 15	Sodium Adsorption Ratio **

*General guidelines for salinity hazard of irrigation water based upon conductivity.

(dS/m at 25°C = mmhos/ cm)

Limitation for Use	Electrical Conductivity (dS/m)
None	≤ 0.75
Some	0.76 – 1.5
Moderate	1.51 – 3.00
Severe	≤ 3.00

- Leaching required at higher range.
- Good drainage needed and sensitive plants may have difficulty at germination.

**SAR= Sodium Adsorption Ratio

At a given SAR, infiltration rate increases as water salinity increases.

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

ds/m = decisiemen / meter (equivalent to 1 mmho/cm= 1 millimmho/unit metre)

mg/L = milligram per litre ≈ parts per million (ppm)

me/L = milliequivalent per litre (mg/L ÷ equivalent weight = me/L)

The sodium hazard of water based on SAR value

SAR Value	Sodium hazard of water	Comments
1-10	Low	Use on sodium sensitive crops such as avocados must be cautioned
10-18	Medium	Amendments (such as Gypsum) and leaching needed.
18-26	High	Generally unsuitable for continuous use.
› 26	Very high	Generally unsuitable for use.

Relative Salt Tolerance of Various Crops at Germination

Sr No.	Crops	50 % germination reduction (EC ds/m)
1	Barley	16.24
2	Cotton	15.50
3	Sorghum	13.00
4	Sunflower	12.30
5	Wheat	14.0- 16.0
6	Alfalfa	8.2 – 13.4
7	Tomato	7.6
8	Rice	18.0
9	Cabbage	13.0
10	Maize	21.0 – 24.0
11	Lettuce	11.4
12	Onion	5.6 – 7.5
13	Bean	8.0

Relative Tolerance of selected crops to exchangeable sodium

Sr No.	Sensitive	Semi-tolerant	Tolerant
1	Avacado	Carrot	Alfalfa
2	Nuts	Lettuce	Barley
3	Bean	Sugarcane	Cotton
4	Maize	Oat	Paragrass
5	Peas	Onion	Wheatgrass
6	Grapefruits	Raddish	Karnalgrass
7	Orange	Rice	
8	Mung bean	Rye	
9	Groundnut	Sorghum	
10	Cowpeas	Tomato	
11		Wheat	

Appendix-8 Analysis for soil of concerned DAR experiment stations

Under DAR, there are 17 experiment stations, and 7 branches located in the whole the country. The result of "Soil analysis in experiment stations", which were implemented in 16 experiment stations from 2008 to 2010, is shown below. This document includes the result of Nayung U and Myingyan, however, does not include the Magway experiment station. The 50-soil sampling results are shown for better understanding of soil condition.

Reference: An Assessment of Soil Test Results for Research Stations under Department of Agricultural Research (DAR)

(1) Nyaung U Research Center

The soil analysis of submitted soil samples from Nyaung U shows that the soil is loamy sand with moderately alkaline condition. Soil organic matter were found to be very low and primary macronutrients could also be characterized as low level. Insufficiency of water soluble SO4-S and DPTA extractable Zn is also observed. Not only annual application of macro-and micro-nutrients but also regular application of FYM (farm yard manure) or compost should be practiced and alternative way of green manuring with either mimosa or horse gram should be considered in this area for soil fertility maintenance.

	pH	SOM%	Avai.N (ppm)	Avai. P (ppm)	Avai. K (ppm)	Water soluble SO4-4(ppm)	DPTA Zn (ppm)	Soil texture class
Average	7.38	0.54	44	5	64	3	1	Loamy sand
Standard deviation	0.35	0.44	13	2	21	-	-	

(2) Myingyan Research Station

The soil in Myingyan, situated in dry zone are sandy loam silt with approximately neutral in soil acidity. The available N is just about to reach the maximum level but the amount of SOM is pretty low. Available p, K and water soluble SO4-S can be rated as low level. The recommendation for soil fertility maintenance will be the same as in Nyaung U Research Station which is the application of organic and inorganic fertilizers and also the establishment of glyricidia, mimosa, and hoursegram for the purpose of green manuring.

	pH	SOM%	Avai.N (ppm)	Avai. P (ppm)	Avai. K (ppm)	Water soluble SO4-4(ppm)	Soil texture class
Average	7.18	0.55	63	5	60	6	Sandy loam
Standard deviation	0.4	0.2	14	2	37	3	

Appendix-9 Contents of basic information of GAD

The basic information prepared by General Administrative Office in village tract (Myingyan)

Village General Administration Office
Zee Pin Kan Village Tract
Myingyan Township
Subject; Basic Information of Village Tract
Date; 2013 April 15
Contents

1. Preface
2. Summary of the village tract history
3. Location
4. Area
5. Boundary
6. Name of village locating in village tract
7. Administration
   (a) Village GAD office address
   (b) Number of Household
   (c) Population
   (d) Chairman and leader of 100 households
   (e) Leader of 10 households
8. Economic
   (a) Retail shop
   (b) Animal Husbandry
   (c) Status of Agriculture
   (d) Local Food Security
   (e) Farm ponds
   (f) Status of Growing Tree for Village Greening
9. Society
   (a) Primary School
   (b) Condition of School Building
   (c) School Manage by Monks
   (d) Number of Teacher
   (e) Students per Grade
   (f) Status of Teachers and Students
   (g) Rooms for Learning in School
   (h) Status of Application to School
   (i) Health
   (j) Headmaster in order to Year
   (k) Number of Students Attend to University (Zee Pin Kan)
   (l) Number of Students Attend to University (Kyauk Kan)
   (m) Health
   (n) Religion
10. Status of Human Resources
11. Member of Social Association (village level)
12. Electricity
13. Communication
14. Car and Machinery
15. General Report
16. Conclusion

Appendix-10

1. Basic Information Survey

A. Administarative Organization

Division Mandalay **District** : Myingyan

Township Myingyan	
A1. Number of Village Tracts:	66
A2. Number of Wards:	19
A2. Number of Villages:	186

Source. GAD TS office:Year:2013

B. Organization Chart of the DOA Township Office

Refer to the organizational chart attached

C. Township's Administarative Boundary Map

Refer to the map attached

D. Population and Household

D.1 Population (Year: 2013)

Urban	Rural	Total
79,215	191,770	270,985

Source. GAD TS office:Year:2013

D.2 Population by race (persons)

Kachin	Kayah	Kayin	Chin	Bamar	Mon	Rakhine	Shan	Others	Total
2	0	8	17	77,420	6	36	19	1,708	79,216
0.00%	0.00%	0.01%	0.02%	97.73%	0.01%	0.05%	0.02%	2.16%	100%

Source. GAD TS office:Year:2013

D.3 Popualtion by Sex (Year:2013)

Male	Female	Total
128,405	147,580	270,985

Source. GAD TS Office:Year:2013

D.4 Population Working in Agriculture Sector (above 18 years old)

Persons	%
186,144	69

Source. GAD TS office:Year:2013

D.5 Population Density (Year:2013)

279 persons/㎢

D.6 Number of Households (Year:2013)

Farm Households*	Landless Households		Others	Total
	Non-Farm	Casual Labor		
38,240	19,320		0	57,560
66%	34%		0%	100%

Note. Number of farm household with cultivation right

Source. DOA TS office:Year:2013

Average Family Size per HH
4.71 Persons

D.7 Economically Active Population

above 18	% to the Total
181,839	67

Source. GAD TS office:Year:2013

D.8 Wage of Farm Work and Non-Farm Work as of May 2((Kyat/day/person)

Farm Work	Non-Farm Work
2,500	3,000

Source:Personnel Interview

D.9 Distance from Division Captital: 156.8 km

D.10 Number of Farm household by Farm Size (2013)

Less than 5 ac	5 to 10 ac	10 to 20 ac	Above 20 ac	Total
24,058	9,091	2,214	411	35,774

Source. SLRD

Note. No, of farm households on D.6 &D.10 is different

E. Land Type in the Township (year:2012-13)

(unit:acre)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
241,598	0	1,739	164,970	1,027	1,027	18,777	54,058

Source: SLRD Office in TS

TS DOA Budget (2012/13)
Kyat 38.3 million

F. Breakdown of the cultivated land in the Township

Unit:Acre

Total Cultivated	Total Paddy	Total Yar Land *	Total Kaing *	Total Kyun *	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
164,970	24,386	122,768	0	0	17,816
100%	14.78%	74.42%	0.00%	0.00%	10.80%

Source: SLRD TS Office, DOA TS Office

Note: Yar: upland
Kaing: Cultivable land on River terrace
Kyun: Cultivable land on river bed

G. Irrigated Area

Paddy Field	Upland	Total
1,529	21,200	22,729

Ratio of Irrigated Area
13.8 (%)

Source:DOA TS Office

H. Crop Production (year: 2007-08)

Crop	Net Sown Area	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				
Summar paddy				
Pigeon pea				
Maize				
Sesame				
Groundnut				
Green Gram		NA		
Sorghum				
Chickpea				
Sunflower				
Soybean				
Wheat				

Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion				
Chili				
Potato				
Toddy				
Tomato		NA		
Cucumber				
Carrot				
Okra				
Vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2008-09)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	19,623	19,623	1,489,835	75.9
Summer paddy	3,460	3,460	310,362	89.7
Pigeon pea	25,695	23,695	312,965	13.2
Maize	5,014	5,014	378,106	75.4
Sesame	52,475	52,475	290,583	5.5
Groundnut	14,275	14,275	712,435	49.9
Green Gram	5,124	5,124	43,249	8.4
Sorghum	11,078	11,078	120,639	10.9
Chickpea	13,356	13,356	146,649	11.0
Sunflower	17,086	17,086	434,885	25.5
Soybean	8,145	8,145	89,269	0.0
Wheat	693	693	18,683	27.0

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	10,396	10,396	35,884,649	3,451.8
Chili	1,178	1,178	129,978	110.3
Potato				
Toddy	1,579	998	NA	NA
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	8,880	8,880	13,325,469	1,501
Eggplant				
Watermelon				

Crop Production (year: 2009-2010)

Crop	Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	11,448	11,448	873,711	76.3
Summar paddy	2,205	2,205	197,855	89.7
Pigeon pea	25,704	25,704	316,930	12.3
Maize	7,869	7,869	596,392	75.8
Sesame	54,980	54,980	308,519	5.6
Groundnut	14,474	14,474	722,832	49.9
Green Gram	10,064	10,064	89,997	8.9
Sorghum	14,318	14,318	158,787	11.1
Chickpea	15,314	15,314	177,489	11.6
Sunflower	16,821	16,821	427,727	25.4
Soybean	7,943	7,943	88,008	0.0
Wheat	676	676	18,235	27.0

Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	11,462	11,462	40,058,997	3,494.9
Chili	1,669	1,664	187,549	112.7
Potato				
Toddy	1,579	998	NA	
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	6,311	6,311	9,383,845	1,486.9
Eggplant				
Watermelon				

Crop Production (year: 2010-2011)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	16,917	16,917	1,291,444	76.3
Summar paddy	3,054	3,054	274,097	0.0
Pigeon pea	25,712	25,712	317,089	12.3
Maize	9,481	9,481	71,865	7.6
Sesame	53,478	53,478	260,989	4.9
Groundnut	14,787	14,787	73,846	5.0
Green Gram	8,345	8,345	79,131	9.5
Sorghum	14,324	14,324	159,710	11.1
Chickpea	15,082	15,082	194,859	12.9
Sunflower	16,819	16,819	427,975	25.4
Soybean	7,346	7,396	82,055	0.0
Wheat	674	674	18,171	27.0

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	10,816	10,816	37,935,279	3,507.3
Chili	1,613	1,613	183,602	113.8
Potato				
Toddy	1,579	998	NA	
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	6,302	6,302	9,369,978	1,486.8
Eggplant				
Watermelon				

Crop Production (year: 2011-2012)

Crop	Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	5,336	5,336	409,538	76.8
Summar paddy	2,361	2,361	211,947	89.8
Pigeon pea	25,711	25,711	319,017	12.4
Maize	10,851	10,851	823,048	75.8
Sesame	51,711	51,711	276,627	5.3
Groundnut	16,022	16,022	800,299	50.0
Green Gram	8,295	8,295	74,775	9.0
Sorghum	14,331	14,331	160,077	11.2
Chickpea	15,788	15,788	204,139	12.9
Sunflower	17,919	17,919	456,218	25.5
Soybean	7,345	7,345	82,117	0.0
Wheat	674	674	18,178	27.0

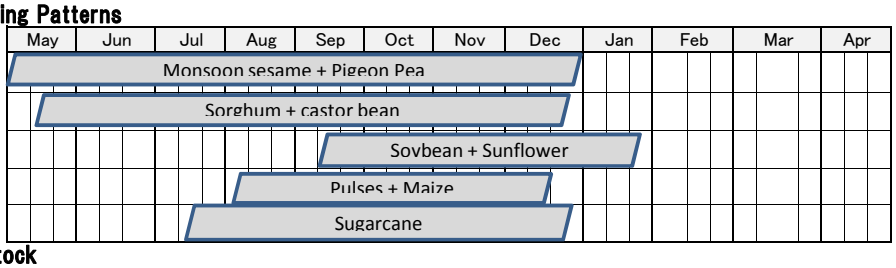
Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	14,907	14,907	52,706,829	3,535.7
Chili	1,689	1,689	191,539	113.4
Potato				
Toddy	1,579	998	NA	
Tomato				
Cucumber				
Carrot				
Okra				
Vegetbales	6,335	6,335	9,418,564	1,486.8
Eggplant				
Watermelon				

Crop Production (year: 2012-213)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	4,167	4,167	321,067	77.0
Summar paddy	1,366	NA	NA	0.0
Pigeon pea	14,591	14,591	182,388	12.5
Maize	11,734	11,739	884,955	75.4
Sesame	27,320	27,320	85,614	3.1
Groundnut	19,790	19,790	480,511	24.3
Green Gram	5,259	5,259	37,509	7.1
Sorghum	13,596	13,596	132,561	9.8
Chickpea	11,747	11,747	152,124	13.0
Sunflower	3,309	3,309	83,797	25.3
Soybean	5,671	5,671	63,515	0.0
Wheat	204	204	5,457	26.8

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	11,233	11,233	41,769,927	3,718.5
Chili	2,140	2,140	224,721	105.0
Potato				
Toddy	1,579	998		0.0
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	6,874	6,874	10,177,265	1,480.5
Eggplant				
Watermelon	702	702	702,000	1,000.0 fruit

I. Cropping Patterns



J. Livestock

J.1 Number of Livestock and Number of Households Raising Livestock (2012-13)

	Cattle/Buffalo	Sheep/Goats	Pig	Chicken	Duck
No. of Head	109,177	52,975	29,787	558,369	-

Source:LBVD TS Office

J.2 Animal Products Production per Year (20**)

	Meat (viss)	Milk (viss)	Egg (piece)
Production	NA	NA	NA

Source:LBVD TS Office

K. Land Classification and Soil Types in the Township

K.1 Land Types (1,000 ac)

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
2	130	-	18	16	-	-	-	-	-

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

Legend:

I	Deposit	VI	Dissected Plateau
II	Alluvial	VII	Plateau
III	Terrace	VIII	Hilly
IV	Footplain	IX	Mountain
V	Plateau	X	Bad land

K.2 Soil Types ←Refer to the Divisional Soil Characteristic Map (DOA) (1,000 ac)

Acreage by Soil Type (unit:Acre)									
Meadow Alluvial Soils	Meadow Carbonate Soils	Catena of Savanna Soils on slopes & Compact Soils in Depretion	Compact Soils (Vertisol)	Turfy Primitive Soils	Primitive Crushed Stones	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other	Total
-	-	174	8	-	4	-	10	2	198

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

L. Crops and its Varities Promoting in the Township (mainly upland crops)

1 Crop name Monsoon paddy — Variety: Ayeyamin, Shwebo Paw San
2 Crop name Groundnut — Variety: Sin Pada Thar
3 Crop name Green gram — Variety: Yezin-11
4 Crop name Chick pea — Variety: Yezin-8, Yezin-6
5 Crop name Pigeon pea — Variety: Monywa Shwedinga
6 Crop name — Variety:
7 Crop name: — Variety:
8 Crop name — Variety:

M Irrigation Water Sources in the Region

M.1 Number of farm ponds 44 places, of which, how many are innservice now NA places
M.2 Irrigated area by river 32,995 Acres, of which, how many acres are irrigated by gravity? NA Acres
M.3 Irrigated area by groundwate NA Acres (pump irrigation)
M.4 Irrigated area by farm ponds NA Acres

N. Irrigation Charge and Land Tax

N.1 Irrigation fee Paddy field: 9,000 Kyat/acre/year, Upland: 3,000 Kyat/ac/year,
N.2 Land tax Paddy field: Kyat/acre/year, Upland: Kyat/ac/year

O. Frequewncy of Damage in the Township

1 Drought: 1 times every 3 years
2 Flood: - times every - years
3 Insect damag - times every - years
4 Pest damage: 1 time every 15 years (rodent)

P. Precipitation and Temperature

P.: Fluctuation of the annual rainfall in the past 10 years (inch)

2003 yr.	2004 yr.	2005 yr.	2006 yr.	2007 yr.	2008 yr.	2009 yr.	2010 yr.	2011 yr.	2012 yr.	Average
NA	NA	22.70	30.74	30.66	20.88	15.32	34.75	34.42	20.08	26.19

P.2 Rainfall by month for 10 years (inch)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003					NA								
2004													
2005				0.20	1.65	3.64	2.79	1.82	7.44	3.00	0.51	1.67	22.72
2006				1.65	2.26	4.33	5.35	4.96	8.15	3.61	0.43		30.74
2007				0.24	8.46	3.98	1.34	3.34	2.99	6.18	4.13		30.66
2008	0.79			0.04	2.75	2.96	1.74	2.37	4.21	6.02			20.88
2009				0.83	2.87	1.30	0.43	3.94	4.49	1.46			15.32
2010			0.12	0.08	1.53	3.70	3.19	6.69	6.66	12.08		0.70	34.75
2011			0.24	1.23	4.96	2.60	1.18	11.25	2.53	9.96		0.47	34.42
2012	0.14		0.19	0.24	0.51	0.87	3.29	4.72	8.27	1.53	0.32		20.08

Source. DOA TS Office

P.3 Lowest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005						NA							
2006													
2007													
2008													
2009													
2010	11.98	14.05	20.15	25.75	26.84	23.28	24.90	25.16	24.82	23.34	21.65	12.85	21.23
2011	10.42	12.82	22.27	20.20	22.50	26.30	25.80	24.20	23.96	22.78	19.96	13.39	20.38
2012	10.00	11.20	15.00	19.60	23.20	25.40	25.00	24.80	23.50	19.40	17.00	11.10	18.77

P.4 Highest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006						NA							
2007													
2008													
2009													
2010	30.98	33.75	38.48	41.82	40.68	38.23	38.21	35.16	35.12	32.97	33.47	29.58	35.70
2011	30.15	33.66	36.79	38.38	37.66	36.30	36.79	34.47	34.85	32.79	31.97	30.24	34.50
2012	30.00	37.60	41.00	45.10	44.30	41.00	40.00	38.00	37.80	36.80	35.20	30.00	38.07

Q. Major markets in the TS

Name	Location	Managing Body	Public or private?
1 Aye Mya Thida	Center of the city	Municipality	Public
2 San Pga	Southern part	Municipality	Public
3 Myoma	Center of the city	Municipality	Public

R. Dessemiration Rate of Telephone

NA % (year:20**)

S. Donours and NGOs Working in the TS

Name	Sector	Project Name	Period
IDEA	Saving rain water	NA	2011
Pet Myanmar	Small loan	NA	2012
			to
			to
			to

Source: DOA TS Office

T. Number of Vehicles in the TS (year:20**)

	Number	Number per Household
Sedan	NA	########
Trucks	NA	########
Others		

Source:*****

U. Accessibility to Safe Water (year:20**) (Number of Households)

Tubewell	Shallow Tubewell	Lake/Pond	Others (Remarks)
2,327		NA	NA

V. Literacy Rate (above 15 years old)

(Year 20**)
NA %

Source:Ministry of Education (year:20**)

W. Numbers of Schools in TS and Numbers of Students and Teachers in Those School (2012-13)

Type of School	No. of School	No. of Students	No. of Teachers
Primary	178	22,255	567
Middle	9	12,916	1,154
High	5	3,873	157
Monastic Education			

Source:GAD TS Offfice

X. Number and Rate of Households (HH) by Electric Power Sources (2012/13)

Unit:HH

	Main Power Line	Biogass	Rice Husk	Mini-hydro Power	Own Generator	Battery	Candle
Urban				NA			
Rural				NA			
Total				NA			

	Main Power Line	Biogass	Rice Husk	Mini-hydro Power	Own Generator	Battery
Urban			NA			
Rural			NA			
Total			NA			

Source: GAD Office in TS

Y. Numbers of Health Facilities (2012)

Unit:Numbers

Hospital (More than 100 beds)	Other Hospitals	Clinic	Rural Health Center	Maternal and Child Care	Pharmacy
3	0	33	8	1	12

Source: GAD Office in TS

Z. Major Diseases for Death in the Township (Top. 3 diseases) (2012-13)

1	Diarrhea
2	Haemorrhagic fever
3	TB

Note: ARI:Acute Respiratory Infection
TB(Sputume+) : Tuberculosis (Sputum)

Source: District Hospital

AA. Number and Rate of Households by Type of Main Fuel for Cooking (20**)

Unit:HH

	Electricity	Firewood	Charcoal	Charcoal	Farm Waste	Gas	Bio Dies
Urban							
Rural			NA				
Total							

	Electricity	Firewood	Charcoal	Charcoal Briquettes	Farm Waste Products	Gas
Urban						
Rural			NA			
Total						

Source: GAD Office in TS

AB. Problems in the Agriculture in the Township

(mark all that apply)

■ Lack of irrigation w ■ Drough ☐ Low agricultural technol ☐ Low farmgate price of crops
☐ High cost of agricultural chemi ■ Soil erosion by rain ☐ Soil erosion by wind ■ Poor soil fertility
☐ High cost of fertilizers ☐ Monoculture ■ Lack of draft cattle ■ Poor agricultural credit system
☐ Inadequate production of quality s ■ Erratic rainfall

Other issues:

1
2
3
4
5

AC. Agricultural Development Plan in the Township

1 Disribution of hybrid varieties and HYV
2 Loan program managed by Regional Government
3
4
5

1. Basic Information Survey

A. Administarative Organization

Division Mandalay **District** : Nyaung U

Township Nyaung U	
A1. Number of Village Tracts:	74
A2. Number of Wards:	17
A3. Number of Villages:	219

Source. GAD TS office:Year:2013

B. Organization Chart of the DOA Township Office

Refer to the organizational chart attached

C. Township's Administarative Boundary Map

Refer to the map attached

D. Population and Household

D.1 Population (Year: 2013)

Urban	Rural	Total
40,330	147,971	188,301

Source. GAD TS office:Year:2013

D.2 Population by race (persons)

Kachin	Kayah	Kayin	Chin	Bamar	Mon	Rakhine	Shan	Others	Total
0	0	0	0	188,269	0	0	32	0	188,301
0.00%	0.00%	0.00%	0.00%	99.98%	0.00%	0.00%	0.02%	0.00%	100%

Source. GAD TS office:Year:2013

D.3 Popualtion by Sex (Year:2013)

Male	Female	Total
86,826	101,475	188,301

Source. GAD TS Office:Year:2013

D.4 Population Working in Agriculture Sector (above 18 years old)

Persons	%
110,933	59

Source. GAD TS office:Year:2013

D.5 Population Density (Year:2013)

127 persons/km²

D.6 Number of Households (Year:2013)

Farm Households*	Landless Households		Others	Total
	Non-Farm	Casual Labor		
27,391	10,341		0	37,732
73%	27%		0%	100%

Note. Number of farm household with cultivation right

Source. DOA TS office:Year:2013

Average Family Size per HH	
4.99	Persons

D.7 Economically Active Population

above 18	% to the Total
129,951	69

Source. GAD TS office:Year:2013

D.8 Wage of Farm Work and Non-Farm Work as of May 2((Kyat/day/person)

Farm Work	Non-Farm Work
1,500	2,500

Source:Personnel Interview

D.9 Distance from Division Captital: 220.8 km

D.10 Number of Farm household by Farm Size (2013)

Less than 5 ac	5 to 10 ac	10 to 20 ac	Above 20 ac	Total
13,967	6,700	5,563	2,166	28,386

Source. SLRD

Note. No, of farm households on D.6 &D.10 is different

E. Land Type in the Township (year:2013)

(unit:acre)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
280,622	4,588	7,378	164,478	0	66,936	37,242	0

Source: SLRD Office in TS

TS DOA Budget (2012/13)	
Kyat	65 million

F. Breakdown of the cultivated land in the Township

Unit:Acre

Total Cultivated	Total Paddy	Total Yar Land *	Total Kaing *	Total Kyun *	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
164,478	256	156,875	0	7,142	205
100%	0.16%	95.38%	0.00%	4.34%	0.12%

Source: SLRD TS Office, DOA TS Office

Note: Yar: upland
Kaing: Cultivable land on River terrace
Kyun: Cultivable land on river bed

G. Irrigated Area

Paddy Field	Upland	Total
3,184	26,428	29,612

Ratio of Irrigated Area	
18.0	(%)

Source:DOA TS Office

H. Crop Production (year: 2007-08)

Crop	Net Sown Area	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	9,324	9,329	662,649	71.0
Summar paddy	1,655	1,655	144,035	87.0
Pigeon pea	26,793	26,793	361,229	13.5
Maize	1,175	1,175	5,651,750	4,810.0
Sesame	59,086	59,086	248,396	4.2
Groundnut	61,543	61,543	215,816	3.5
Green Gram	30,018	30,018	391,393	13.0
Sorghum	10,367	10,367	121,131	11.7
Chickpea	418	418	2,550	6.1
Sunflower	137	137	2,891	21.1
Soybean	0	0	0	0.0
Cow pea	2,007	2,007	18,063	9.0
Rice bean	515	515	3,156	6.1
Cotton	3,313	3,313	5,121,407	1,545.9

Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	836	836	3,772,032	4,512
Chili	331	331	59,580	180
Potato				
Toddy	2,766	2,053	5,720,400	2,786
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	3,155	3,155	2,219,306	703
Eggplant				
Watermelon				

Crop Production (year: 2008-09)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	10,937	10,937	779,223	71.2
Summer paddy	1,801	1,801	157,667	87.5
Pigeon pea	30,602	30,602	427,305	14.0
Maize	1,175	1,175	6,227,500	5,300.0
Sesame	58,791	58,790	260,662	4.4
Groundnut	62,680	62,680	2,268,878	36.2
Green Gram	31,654	31,654	430,987	13.6
Sorghum	11,546	11,546	135,610	11.7
Chickpea	529	529	6,602	12.5
Sunflower	320	320	8,560	26.8
Soybean	0	0	0	0.0
Cow pea	2,091	2,091	33,456	16.0
Rice bean	519	519	6,747	13.0
Cotton	3,416	3,416	1,008,135	295.1

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	855	855	4,275,000	5,000
Chili	345	345	86,424	251
Potato				
Toddy	2,766	2,053	5,975,975	2,911
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,995	2,995	2,100,045	701
Eggplant				
Watermelon				

Crop Production (year: 2009-2010)

Crop	Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	10,931	10,930	819,055	74.9
Summar paddy	1,291	611	53,631	87.8
Pigeon pea	31,353	31,353	444,661	14.2
Maize	1,225	1,225	6,479,950	5,289.8
Sesame	58,815	58,815	224,056	3.8
Groundnut	59,714	59,714	2,435,258	40.8
Green Gram	369,423	36,423	628,560	17.3
Sorghum	11,630	11,630	1,384,424	119.0
Chickpea	525	525	3,701	7.0
Sunflower	311	311	6,220	20.0
Soybean	0	0	0	0.0
Cow pea	2,100	2,100	21,000	10.0
Rice bean	498	498	3,536	7.1
Cotton	3,317	3,308	1,020,655	308.5

Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	685	685	3085500	4,504.4
Chili	347	347	62460	180.0
Potato				
Toddy	2,766	2,053	5975775	2,910.8
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	3,175	3,175	2228956	702.0
Eggplant				
Watermelon				

Crop Production (year: 2010-2011)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	10,930	10,928	819,159	75.0
Summar paddy		0	0	0.0
Pigeon pea	32,951	32,981	500,715	15.2
Maize	1,300	1,300	6,890,000	5,300.0
Sesame	52,754	52,735	208,230	3.9
Groundnut	56,618	56,595	2,440,684	43.1
Green Gram	41,599	41,518	713,973	17.2
Sorghum	11,080	10,076	169,452	16.8
Chickpea	550	550	6,875	12.5
Sunflower	400	400	8,000	20.0
Soybean	0	0	0	0.0
Cow pea	2,000	2,000	32,000	16.0
Rice bean	370	370	3,145	8.5
Cotton	3,248	3,298	1,028,281	311.8

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	610	610	3,053,000	5,004.9
Chili	363	363	72,600	200.0
Potato				
Toddy	2,765	2,053	6,026,851	2,935.6
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,529	2,529	1781744	704.5
Eggplant				
Watermelon				

Crop Production (year: 2011-2012)

Crop	Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	3,214	3,214	236,272	73.5
Summar paddy	818	818	62,099	75.9
Pigeon pea	30,079	30,079	391,691	13.0
Maize	1,362	1,362	7,218,600	5,300.0
Sesame	46,308	46,173	241,367	5.2
Groundnut	74,098	74,098	2,416,041	32.6
Green Gram	29,401	29,401	367,398	12.5
Sorghum	11,068	11,068	151,168	13.7
Chickpea	540	590	6,750	11.4
Sunflower	1	1	7	7.0
Soybean	0	0	0	0.0
Cow pea	2,483	2,483	39,728	16.0
Rice bean	183	183	2,379	13.0
Cotton	912	912	266,998	292.8

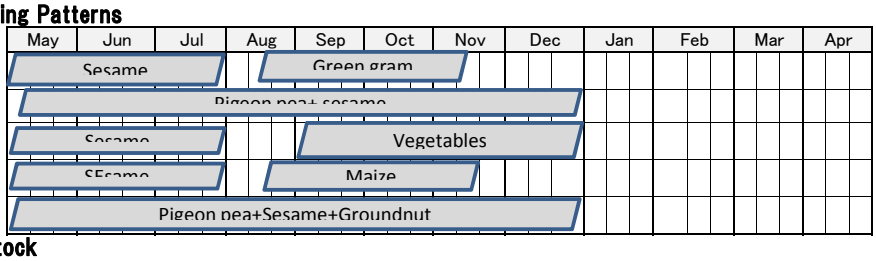
Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	636	636	2,864,000	4,503.1
Chili	514	514	102,800	200.0
Potato				
Toddy	2,765	2,053	6,026,850	2,935.6
Tomato				
Cucumber				
Carrot				
Okra				
Vegetbales	2,038	2,038	1,448,960	711.0
Eggplant				
Watermelon				

Crop Production (year: 2012-213)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	2,405	2,405	177,369	73.8
Summar paddy	0	0	0	0.0
Pigeon pea	27,968	27,968	341,747	12.2
Maize	1,256	1,256	6,656,800	5,300.0
Sesame	49,844	44,304	144,362	3.3
Groundnut	74,092	74,092	2,803,583	37.8
Green Gram	29,170	29,170	309,224	10.6
Sorghum	10,609	10,609	135,114	12.7
Chickpea	711	711	8,887	12.5
Sunflower	2	2	14	7.0
Soybean	0	0	0	0.0
Cow pea	2,231	2,231	35,696	16.0
Rice bean	0	0	0	0.0
Cotton	273	273	57,925	212.2

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	627	627	2,824,000	4,504.0
Chili	811	811	174,520	215.2
Potato				
Toddy	2,053	2,043	6,026,850	2,950.0
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	1,674	1,674	1,205,338	720.0
Eggplant				
Watermelon				

I. Cropping Patterns



J. Livestock

J.1 Number of Livestock and Number of Households Raising Livestock (2012-13)

	Cattle	Buffalo	Sheep/Goats	Pig	Chicken	Duck
No. of Head	98,051	192	90,550	20,355	575,638	459

Source:LBVD TS Office

J.2 Animal Products Production per Year (20**)

	Meat (viss)	Milk (viss)	Egg (piece)
Production	NA	NA	NA

Source:LBVD TS Office

K. Land Classification and Soil Types in the Township

K.1 Land Types (1,000 ac)

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
15	70	-	100	38	-	-	-	-	-

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

Legend:

I	Deposit	VI	Dissected Plateau
II	Alluvial	VII	Plateau
III	Terrace	VIII	Hilly
IV	Footplain	IX	Mountain
V	Plateau	X	Bad land

K.2 Soil Types ←Refer to the Divisional Soil Characteristic Map (DOA) (1,000 ac)

Acreage by Soil Type (unit:Acre)									
Meadow Alluvial Soils	Meadow Carbonate Soils	Catena of Savanna Soils on slopes & Compact Soils in Depretion	Compact Soils (Vertisol)	Turfy Primitive Soils	Primitive Crushed Stones	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other	Total
57	197	1,504	607	173	353	403	531	107	3,932

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

L. Crops and its Varities Promoting in the Township (mainly upland crops)

1 Crop name: Monsoon paddy — Variety: Sin Thu Kha, Manwa Thu Kha
2 Crop name: Summer paddy — Variety: Manaw Thu Kha
3 Crop name: Pigeon pea — Variety: Khwe Chan Shwedinga, Monywar Shwedinga
4 Crop name: Green gram — Variety: Yezin-11, Yezin-14
5 Crop name: Groundnut — Variety: Kyaung Kon, Magway-11, Myanmar Pin Pyant
6 Crop name: Sesame — Variety: Malthila, Red sesame
7 Crop name: Chick pea — Variety: Karachi, ICCV-2
8 Crop name: — Variety:

M Irrigation Water Sources in the Region

M.1 Number of farm ponds NA places, of which, how many are innservice now NA places
M.2 Irrigated area by river 29,612 Acres, of which, how many acres are irrigated by gravity? NA Acres
M.3 Irrigated area by groundwate NA Acres (pump irrigation)
M.4 Irrigated area by farm ponds NA Acres

N. Irrigation Charge and Land Tax

N.1 Irrigation fee Paddy field: 6,000 Kyat/acre/year, Upland: 3,000 Kyat/ac/y Summer paddy: 9,000 Kyat/ac
N.2 Land tax Paddy field: 1.5 Kyat/acre/year, Upland: 1.0 Kyat/ac/year

O. Frequewncy of Damage in the Township

1 Drought: 1 times every 2 years
2 Flood: - times every - years
3 Insect damag - times every - years
4 Pest damage: - times every - years

P. Precipitation and Temperature

P.1 Fluctuation of the annual rainfall in the past 10 years (inch)

2003 yr.	2004 yr.	2005 yr.	2006 yr.	2007 yr.	2008 yr.	2009 yr.	2010 yr.	2011 yr.	2012 yr.	Average
32.05	28.20	24.44	27.50	26.26	26.43	13.49	32.66	40.30	18.31	26.96

P.2 Rainfall by month for 10 years (inch)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003				0.12	7.02	4.77	2.87	3.31	6.03	7.85		0.08	32.05
2004				0.12	7.45	2.48	2.29	1.78	12.73	0.95	0.40		28.20
2005				0.20	1.54	3.87	1.38	1.63	9.32	4.45	0.20	1.85	24.44
2006				0.59	1.52	5.03	2.13	5.75	8.14	4.22	0.12		27.50
2007		0.08		0.71	12.02	2.80	0.64	3.12	1.75	4.62	0.48	0.04	26.26
2008	0.71	0.12			5.45	2.73	0.24	4.89	5.03	7.26			26.43
2009			0.91	0.32	3.08	1.78		1.86	3.13	2.41			13.49
2010				0.20	1.10	1.15	0.04	7.42	4.77	17.11		0.87	32.66
2011			0.43	0.87	4.81	3.43	0.55	9.26	5.22	15.29		0.44	40.30
2012			0.16	1.34	3.39	2.56	0.40	1.39	5.60	3.35	0.12		18.31

Source. DOA TS Office

P.3 Lowest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006													
2007						NA							
2008													
2009													
2010													
2011													
2012													

P.4 Highest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006						NA							
2007													
2008													
2009													
2010													
2011													
2012													

Q. Major markets in the TS

Name	Location	Managing Body	Public or private?
1 Mani Si Thu	Center of the city	Municipality	Public
2 Tax free market	Center of the city	Municipality	Public
3			

R. Dessemiration Rate of Telephone

NA % (year:20**)

S. Donours and NGOs Working in the TS

Name	Sector	Project Name	Period
KOICA	Environment	NA	to
PACT Myanmar	Loan	NA	to
			to
			to
			to

Source: DOA TS Office

T. Number of Vehicles in the TS (year:20**)

	Number	Number per Household
Sedan	NA	########
Trucks	NA	########
Others		

Source:*****

U. Accessibility to Safe Water (year:20**) (Number of Households)

Tubewell	Shallow Tubewell	Lake/Pond	Others (Remarks)
		NA	

V. Literacy Rate (above 15 years old)

(Year 20**)	
NA	%

Source:Ministry of Education (year:20**)

W. Numbers of Schools in TS and Numbers of Students and Teachers in Those School (2013)

Type of School	No. of School	No. of Students	No. of Teachers
Primary	114	22,735	834
Middle	4	13,424	356
High	5	4,213	125
Monastic Education			

Source:GAD TS Offfice

X. Number and Rate of Households (HH) by Electric Power Sources (2012/13)

Unit:HH

	Main Power Line	Biogass	Rice Husk	Mini-hydro Power	Own Generator	Battery	Candle
Urban	7,117			NA			
Rural	235			NA			
Total	7,352			NA			

	Main Power Line	Biogass	Rice Husk	Mini-hydro Power	Own Generator	Battery
Urban	18.86%			NA		
Rural	0.62%			NA		
Total	19.48%			NA		

Source: GAD Office in TS

Y. Numbers of Health Facilities (2012)

Unit:Numbers

Hospital (More than 100 beds)	Other Hospitals	Clinic	Rural Health Center	Maternal and Child Care	Pharmacy
1	1	5	35	2	5-10

Source: GAD Office in TS

Z. Major Diseases for Death in the Township (Top. 3 diseases)

1	Diarrhea
2	ARI
3	TB

Note: ARI:Acute Respiratory Infection
TB(Sputume+) : Tuberculosis (Sputum)

Source: District Hospital

AA. Number and Rate of Households by Type of Main Fuel for Cooking (20**)

Unit:HH

	Electricity	Firewood	Charcoal	Charcoal	Farm Waste	Gas	Bio Dies
Urban							
Rural			NA				
Total			0				

	Electricity	Firewood	Charcoal	Charcoal	Farm Waste Products	Gas
Urban						
Rural			NA			
Total						

Source: GAD Office in TS

AB. Problems in the Agriculture in the Township (mark all that apply)

■ Lack of irrigation w ■ Drough ☐ Low agricultural technol ■ Low farmgate price of crops
☐ High cost of agricultural chemi ☐ Soil erosion by rain ☐ Soil erosion by wind ■ Poor soil fertility
☐ High cost of fertilizers ☐ Monoculture ☐ Lack of draft cattle ■ Poor agricultural credit system
☐ Inadequate production of quality s ■ Erratic rainfall

Other issues:

1
2
3
4
5

AC. Agricultural Development Plan in the Township

1 Disribution of seeds (HYV, OPV)
2 Extension (training)
3 Research and development
4
5

1. Basic Information Survey

A. Administarative Organization

Division Magway **District** : Magway

Township Magway	
A1. Number of Village Tracts:	61
A2. Number of Wards:	15
A2. Number of Villages:	216

Source. GAD TS office:Year:2013

B. Organization Chart of the DOA Township Office
Refer to the organizational chart attached

C. Township's Administarative Boundary Map
Refer to the map attached

D. Population and Household

D.1 Population (Year: 2013)

Urban	Rural	Total
78,162	200,816	278,978

Source. GAD TS office:Year:2013

D.2 Population by race (urban only) (persons)

Kachin	Kayah	Kayin	Chin	Bamar	Mon	Rakhine	Shan	Others	Total
97	80	204	180	74,572	60	313	190	2,466	78,162
0.12%	0.10%	0.26%	0.23%	95.41%	0.08%	0.40%	0.24%	3.15%	100%

Source. GAD TS office:Year:2013

D.3 Popualtion by Sex (Year:2013)

Male	Female	Total
133,484	145,502	278,986

Source. GAD TS Office:Year:2013

Note: The totals of D.1 & D.3 are different

D.4 Population Working in Agriculture Sector (above 18 years old)

Persons	%
149,629	54

Source. GAD TS office:Year:2013

D.5 Population Density (Year:2013)

158 persons/㎢

D.6 Number of Households (Year:2013)

Farm Households*	Landless Households		Others	Total
	Non-Farm	Casual Labor		
41,727	12,060		0	53,787
78%	22%		0%	100%

Note. Number of farm household with cultivation right

Source. SLRD TS office:Year:2013

Average Family Size per HH	
5.19	Persons

D.7 Economically Active Population

above 18	% to the Total
202,747	73

Source. GAD TS office:Year:2013

D.8 Wage of Farm Work and Non-Farm Work as of May 2013 (Kyat/day/person)

Farm Work	Non-Farm Work
1,500	2,000

Source:Personnel Interview

D.9 Distance from Division Captital: 0 km

D.10 Number of Farm household by Farm Size

Less than 5ac	5 to 10 ac	10 to 20 ac	Above 20 ac	Total
14,015	7,484	4,845	1,193	27,537

Source. SLRD TS office:Year:20 Note : The total of D.10 & D.6 are different

E. Land Type in the Township (year:2012-13)

(unit:acre)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
436,623	5,600	0	201,175	0	1,978	174	227,696

Source: SLRD Office in TS

TS DOA Budget (2012/13)	
Kyat	34 million

F. Breakdown of the cultivated land in the Township

Unit:Acre

Total Cultivated	Total Paddy	Total Yar Land *	Total Kaing *	Total Kyun *	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
201,175	4,237	191,764	5,168	0	6
100%	2.11%	95.32%	2.57%	0.00%	0.00%

Source: SLRD TS Office, DOA TS Office

Note: Yar: upland
Kaing: Cultivable land on River terrace
Kyun: Cultivable land on river bed

G. Irrigated Area

Paddy Field	Upland	Total
9,084	0	9,084

Ratio of Irrigated Area	
4.5	(%)

Source:DOA TS Office

H. Crop Production (year: 2007-08)

Crop	Net Sown Area	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	6,364	6,364	456,494	71.7
Summar paddy	1,345	1,345	114,123	84.8
Pigeon pea	33,088	33,088	554,224	16.8
Maize (cob)	10,989	10,989	133,409,426	12,140.3
Sesame	187,693	187,693	2,320,026	12.4
Groundnut	42,886	42,886	2,491,045	58.1
Green Gram	62,591	62,591	735,596	11.8
Sorghum	0	0	0	0.0
Chickpea	2,169	2,169	35,788	16.5
Sunflower	16,347	16,347	298,813	18.3
Soybean	0	0	0	0.0
Black gram	63	63	1,027	16.3
Butter bean	984	984	23,510	23.9
Lablab bean	9,780	9,780	74,356	7.6

Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	1,881	1,881	11,474,100	6,100
Chili				
Potato	175	175	962,280	5,499
Toddy	1,605	814	2,945,500	3,619
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,406	2,406	NA	NA
Cotton	24,953	24,953	6,225,219	249
Niger	139	139	1,800	13

Crop Production (year: 2008-09)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	6,536	6,536	510,723	78.1
Summer paddy	1,428	1,428	NA	NA
Pigeon pea	33,112	33,112	579,460	17.5
Maize (cob)	7,805	7,805	76,594,315	9,813.5
Sesame	188,291	188,291	2,445,955	13.0
Groundnut	45,849	45,849	2,750,568	60.0
Green Gram	60,271	60,271	714,211	11.8
Sorghum	0	0	0	0.0
Chickpea	0	0	0	0.0
Sunflower	16,352	16,352	306,591	18.7
Soybean	0	0	0	0.0
Black gram	55	55	1,155	21.0
Butter bean	960	960	24,240	25.3
Lablab bean	4,791	4,791	82,345	17.2

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	1,882	1,882	12,045,007	6,400
Chili	253	253	113,481	449
Potato	173	173	968,845	5,600
Toddy	1,605	814	2,645,500	3,250
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,414	2,414	8,504,500	3,523
Cotton	23,765	23,765	9,409,326	396
Niger	141	141	2,115	15

Crop Production (year: 2009-2010)

Crop	Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	7,545	7,545	605,788	80.3
Summar paddy	1,337	1,337	135,171	101.1
Pigeon pea	33,675	33,675	590,996	17.5
Maize (cob)	10,484	10,484	136,874,865	13,055.6
Sesame	188,391	188,391	2,451,347	13.0
Groundnut	46,064	46,064	3,087,367	67.0
Green Gram	63,553	65,553	905,630	13.8
Sorghum	0	0	0	0.0
Chickpea	2,177	2,177	38,009	17.5
Sunflower	16,501	16,501	329,026	19.9
Soybean	0	0	0	0.0
Black gram	91	91	1,779	19.5
Butter bean	986	986	24,926	25.3
Lablab bean	6,229	6,229	107,361	17.2

Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	1,885	1,885	12,073,425	6,405.0
Chili	250	250	137,500	550.0
Potato	171	171	957,694	5,600.5
Toddy	814	814	2,604,800	3,200.0
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,890	2,890	10,472,780	3,623.8
Cotton	23,901	23,901	10,889,629	455.6
Niger	152	152	2,288	15.1

Crop Production (year: 2010-2011)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	7,545	7,545	612,805	81.2
Summar paddy	1,503	1,503	153,716	0.0
Pigeon pea	33,684	33,684	597,891	17.8
Maize (cob)	11,299	11,299	151,670,005	13,423.3
Sesame	188,391	188,391	2,453,891	13.0
Groundnut	46,470	46,470	3,116,899	67.1
Green Gram	63,905	63,905	910,646	14.2
Sorghum	0	0	0	0.0
Chickpea	2,170	2,170	37,975	17.5
Sunflower	15,835	15,835	341,774	21.6
Soybean	0	0	0	0.0
Black gram	100	100	1,955	19.6
Butter bean	1,002	1,002	25,351	25.3
Lablab bean	5,467	5,467	94,083	17.2

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	1,980	1,980	12,487,620	6,306.9
Chili	272	272	149,872	551.0
Potato	170	170	952,044	5,600.3
Toddy	1,609	814	26,048	32.0
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,954	2,954	NA	NA
Cotton	24,013	24,013	12,376,002	515.4
Niger	150	150	2,287	15.2

Crop Production (year: 2011-2012)

Crop	Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	7,546	7,447	629,035	84.5
Summar paddy	1,503	NA	NA	NA
Pigeon pea	33,750	33,750	568,687	16.8
Maize (cob)	11,455	11,455	139,878,513	12,211.1
Sesame	181,081	180,748	2,676,201	14.8
Groundnut	54,087	54,087	3,714,691	68.7
Green Gram	64,930	64,930	1,044,860	16.1
Sorghum	0	0	0	0.0
Chickpea	2,395	2,395	43,176	18.0
Sunflower	15,831	15,831	386,736	24.4
Soybean	0	0	0	0.0
Black gram	100	100	1,956	19.6
Butter bean	1,306	1,306	33,068	25.3
Lablab bean	5,403	5,403	92,890	17.2

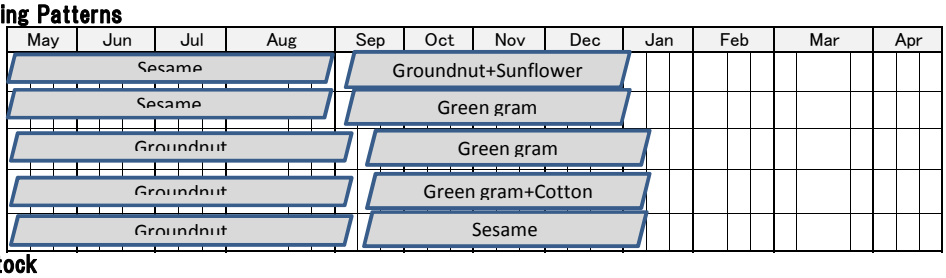
Crop	Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	2,054	2,054	13,191,873	6,422.5
Chili	284	284	156,839	552.3
Potato	201	201	1,126,605	5,605.0
Toddy	1,610	814	2,604,800	3,200.0
Tomato				
Cucumber				
Carrot				
Okra				
Vegetbales	2,956	2,956	10,868,251	3,676.7
Cotton	24,027	24,027	13,016,818	541.8
Niger	251	251	3,845	15.3

Crop Production (year: 2012-213)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	7,546	7,463	636,743	85.3
Summar paddy	1,532	NA	NA	NA
Pigeon pea	33,752	33,752	568,721	16.8
Maize (cob)	12,161	12,161	148,377,916	12,201.1
Sesame	186,471	186,471	2,763,747	14.8
Groundnut	54,301	52,304	3,584,259	68.5
Green Gram	64,856	64,856	1,047,310	16.1
Sorghum	0	0	0	0.0
Chickpea	2,297	2,297	40,243	17.5
Sunflower	9,647	9,647	213,466	22.1
Soybean	0	0	0	0.0
Black gram	100	100	1,956	19.6
Butter bean	1,308	1,308	20,038	0.0
Lablab bean	5,341	5,341	93,824	17.6

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	2,054	2,054	12,954,393	6,306.9
Chili	284	284	156,839	552.3
Potato	172	172	963,296	5,600.6
Toddy	1,610	814	2,604,800	3,200.0
Tomato				
Cucumber				
Carrot				
Okra				
Vegetables	2,972	2,017	10,615,272	5,262.9
Cotton	24,056	24,056	13,680,758	568.7
Niger	251	251	3,845	15.3

I. Cropping Patterns



J. Livestock

J.1 Number of Livestock and Number of Households Raising Livestock (20**)

	Cattle	Buffalo	Sheep/Goats	Pig	Chicken	Duck
No. of Head	148,909	698	120,600	71,288	2,152,294	4,273

Source:LBVD TS Office

J.2 Animal Products Production per Year (20**)

	Meat (viss)	Milk (viss)	Egg (piece)
Production	NA	NA	NA

Source:LBVD TS Office

K. Land Classification and Soil Types in the Township

K.1 Land Types (1,000 ac)

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
-	5	4	192	-	-	-	-	-	-

Source. JICA Report on Poverty Reduction for CDZ, MAS (former)

Legend:

I	Deposit	VI	Dissected Plateau
II	Alluvial	VII	Plateau
III	Terrace	VIII	Hilly
IV	Footplain	IX	Mountain
V	Plateau	X	Bad land

K.2 Soil Types ←Refer to the Divisional Soil Characteristic Map (DOA) (1,000 ac)

Acreage by Soil Type (unit:Acre)									
Meadow Alluvial Soils	Meadow Carbonate Soils	Catena of Savanna Soils on slopes & Compact Soils in Depretion	Compact Soils (Vertisol)	Turfy Primitive Soils	Primitive Crushed Stones	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other	Total
67	2	133	-	-	170	12	-	52	436

Source. JICA Report on Poveety Reduction for CDZ, MAS (former)

L. Crops and its Varities Promoting in the Township (mainly upland crops)

1 Crop name: Pigeon pea — Variety: Shwedinga, Nga San
2 Crop name: Groundnut — Variety: Toontani, Sin-11, Magway-11
3 Crop name: Sesame — Variety: Ba Pan, Shwe Ta Saak
4 Crop name: Green gram — Variety: Yezin-1, Yezin-4, Yezin-11
5 Crop name: Black gram — Variety: Yezin-3
6 Crop name: Cotton — Variety: Chi Myin Shay War, War Gyi
7 Crop name: Chick pea — Variety: Kara Chi
8 Crop name: — Variety:

M Irrigation Water Sources in the Region

M.1 Number of farm ponds NA places, of which, how many are innservice now NA places
M.2 Irrigated area by river 9,073 Acres, of which, how many acres are irrigated by gravity? NA Acres
M.3 Irrigated area by groundwate NA Acres (pump irrigation)
M.4 Irrigated area by farm ponds NA Acres

N. Irrigation Charge and Land Tax

N.1 Irrigation fee Paddy field: 9,000 Kyat/acre/year, Upland: 3,000 Kyat/ac/year,
N.2 Land tax Paddy field: 1.5 Kyat/acre/year, Upland: 2.75 Kyat/ac/year

O. Frequewncy of Damage in the Township

1 Drought: every year but not so serious
2 Flood: - times every - years
3 Insect damag - times every - years
4 Pest damage: - times every - years

P. Precipitation and Temperature

P.1 Fluctuation of the annual rainfall in the past 10 years (inch)

2003 yr.	2004 yr.	2005 yr.	2006 yr.	2007 yr.	2008 yr.	2009 yr.	2010 yr.	2011 yr.	2012 yr.	Average
34.70	32.75	36.86	47.78	37.76	35.49	31.51	44.36	41.45	30.86	37.35

P.2 Rainfall by month for 10 years (inch)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003	0.12			0.04	6.29	7.90	1.87	5.45	7.79	5.08	0.28		34.82
2004					5.05	3.59	6.79	5.81	7.52	2.80	1.19		32.75
2005			0.04		0.36	6.66	5.33	4.58	7.99	8.45	0.96	2.49	36.86
2006			0.16	2.24	5.56	3.40	8.46	4.77	9.41	13.15	0.63		47.78
2007				0.31	7.92	9.68	3.72	6.61	5.03	3.63	0.86		37.76
2008	1.14			0.39	5.30	4.36	6.49	1.94	8.24	7.81			35.67
2009			0.04	1.34	4.61	5.40	5.01	7.56	4.84	7.21			36.01
2010				0.43	4.30	6.27	3.27	6.85	5.20	17.29		0.75	44.36
2011	0.28	0.08	0.43	1.97	3.75	5.41	4.54	8.86	10.80	4.62		0.71	41.45
2012				1.42	1.69	7.51	5.41	4.07	5.99	4.09	0.28	0.40	30.86

Source. DOA TS Office

P.3 Lowest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006													
2007						NA							
2008													
2009													
2010													
2011													
2012													

P.4 Highest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006						NA							
2007													
2008													
2009													
2010													
2011													
2012													

Q. Major markets in the TS

Name	Location	Managing Body	Public or private?
1 Myo Ma	Center of the city	Municipality	Public
2 Kan Thar	Center of the city	Municipality	Public
3 Yanpal	Nothern part of the city	Municipality	Public

R. Dessemiration Rate of Telephone

NA % (year:20**)

S. Donours and NGOs Working in the TS

Name	Sector	Project Name	Period
CESVI	Livelihood improvement	NA	to
PACT Myanmar	Loan	NA	to
WFP			to
			to
			to

Source: DOA TS Office

T. Number of Vehicles in the TS (year:20**)

	Number	Number per Household
Sedan	NA	NA
Trucks	NA	NA
Others		

Source:*****

U. Accessibility to Safe Water (year:20**)

(Number of Households)

Tubewell	Shallow Tubewell	Lake/Pond	Others (Remarks)
		NA	

V. Literacy Rate (above 15 years old)

(Year 20**)
NA %

Source:Ministry of Education (year:20**)

W. Numbers of Schools in TS and Numbers of Students and Teachers in Those School (2013)

Type of School	No. of School	No. of Students	No. of Teachers
Primary	172	19,111	788
Middle	10	6,480	188
High	7	8,535	419
Monastic Education			

Source:GAD TS Offfice

X. Number and Rate of Households (HH) by Electric Power Sources (2012/13)

Unit:HH

	Main Power Line	Biogass	Rice Husk	Mini-hydro Power	Own Generator	Battery	Candle
Urban				NA			
Rural				NA			
Total				NA			

	Main Power Line	Biogass	Rice Husk	Mini-hydro Power	Own Generator	Battery
Urban				NA		
Rural				NA		
Total				NA		

Source: General Administration Office in TS

Y. Numbers of Health Facilities (2012)

Unit:Numbers

Hospital (More than 100 beds)	Other Hospitals	Clinic	Rural Health Center	Maternal and Child Care	Pharmacy
2	3	NA	49	1	NA

Source: GAD Office in TS

Z. Major Diseases for Death in the Township (Top. 3 diseases)

1 Diarrhea
2 TB
3 Dysentery

Note: ARI:Acute Respiratory Infection
TB(Sputume+) : Tuberculosis (Sputum)

Source: District Hospital

AA. Number and Rate of Households by Type of Main Fuel for Cooking (20**)

Unit:HH

	Electricity	Firewood	Charcoal	Charcoal Briquettes	Farm Waste	Gas	Bio Dies
Urban							
Rural			NA				
Total							

	Electricity	Firewood	Charcoal	Charcoal Briquettes	Farm Waste Products	Gas
Urban						
Rural			NA			
Total						

Source: GAD Office in TS

AB. Problems in the Agriculture in the Township

(mark all that apply)

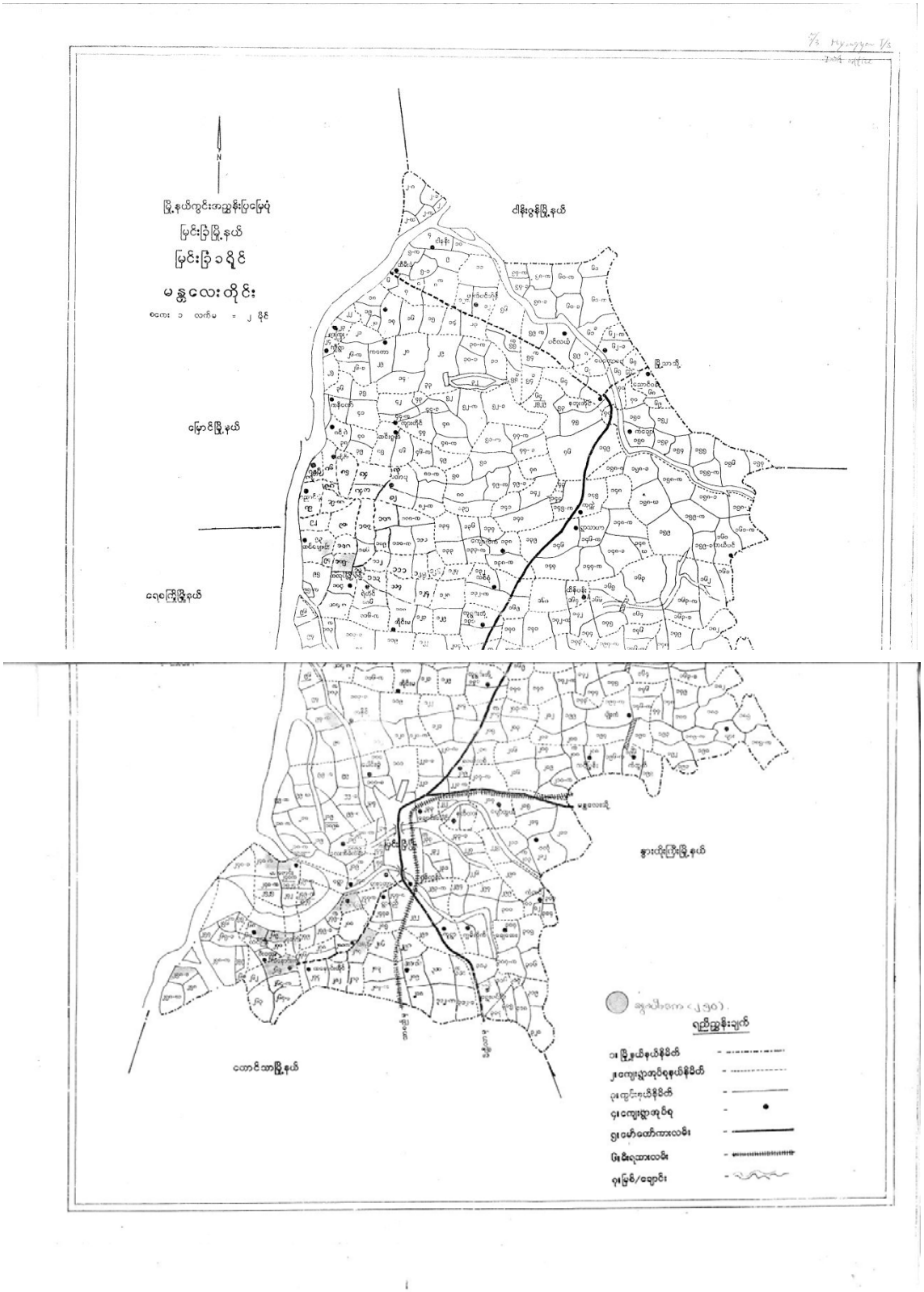
■ Lack of irrigation w ☐ Drough ☐ Low agricultural technol ■ Low farmgate price of crops
■ High cost of agricultural chemi ☐ Soil erosion by rain ■ Soil erosion by wind ■ Poor soil fertility
☐ High cost of fertilizers ☐ Monoculture ☐ Lack of draft cattle ■ Poor agricultural credit system
☐ Inadequate production of quality seeds ☐ Erratic rainfall

Other issues:

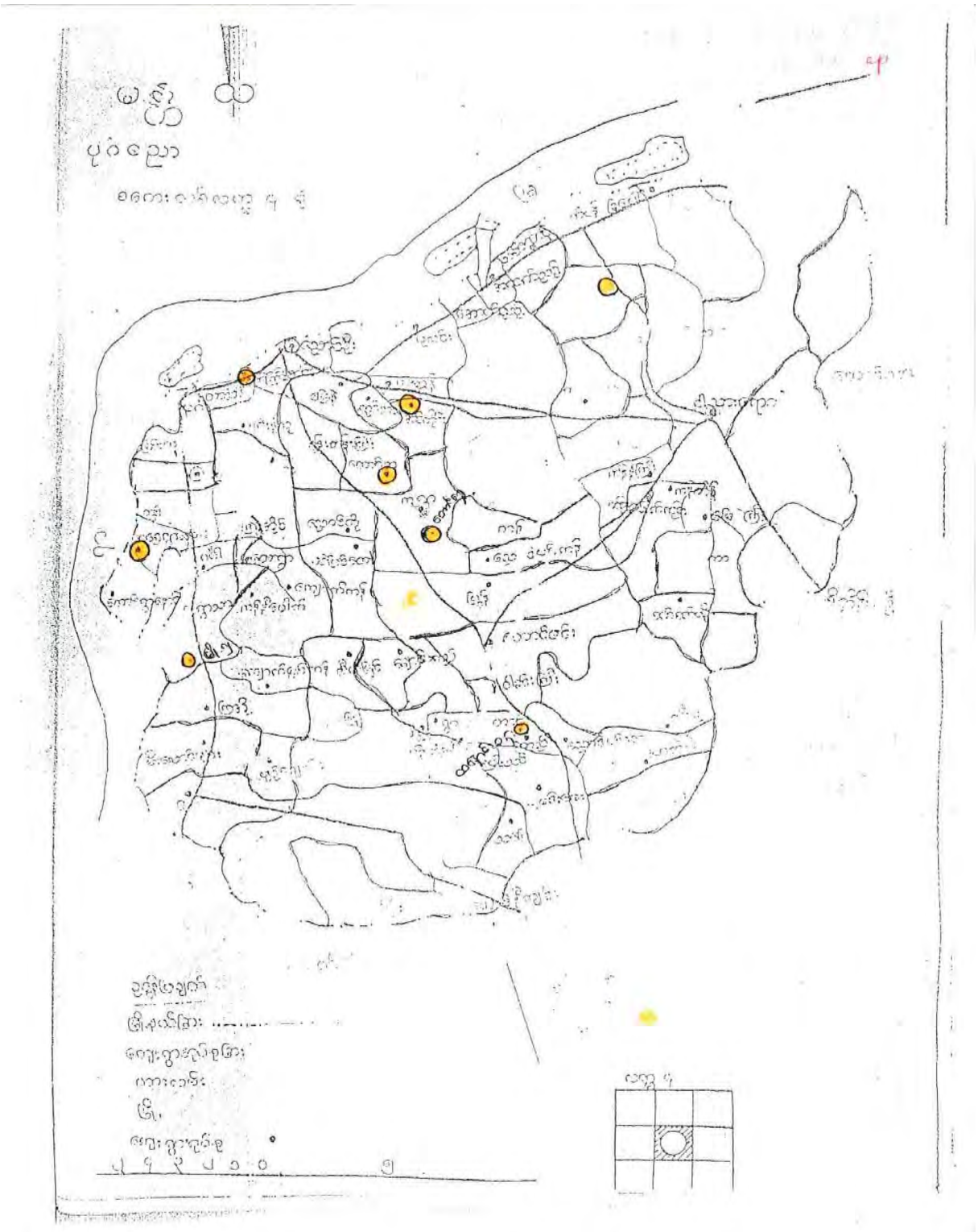
1
2
3
4
5

AC. Agricultural Development Plan in the Township

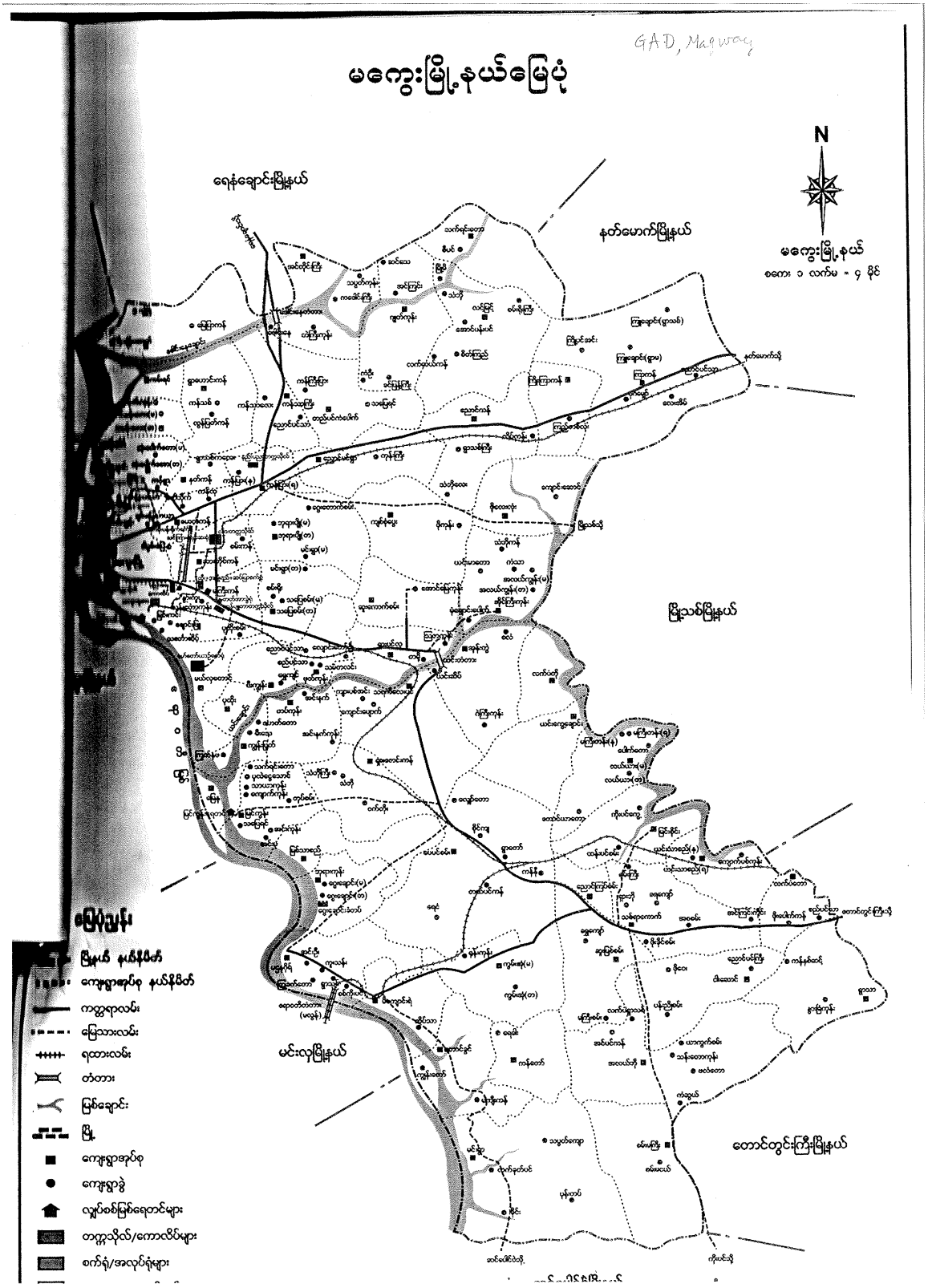
1 Disribution of seeds (HYV, OPV)
2 Extension (training and education)
3 Development of good agricultural practice (GAP)
4
5



Township Myingan



Township Nyaung U



Township Magway

Appendix-11 Summary Tables of the Individual farm Household Survey

6.1 Number of Samples by Village

	Sample Villages				Sample farmers	Contact farmers
	Name	Township	District	Region		
1	Shwe Twin	Nyaung U	Mandalay	Mandalay	20	2
2	Thant Sin Kyal	Nyaung U	Mandalay	Mandalay	20	7
3	Taung Ba	Nyaung U	Mandalay	Mandalay	20	7
4	Tett Ma	Nyaung U	Mandalay	Mandalay	20	3
5	Ba lone	Myingyan	Myingyan	Mandalay	20	7
6	Chay Say	Myingyan	Myingyan	Mandalay	20	9
7	Nyaung Pin	Myingyan	Myingyan	Mandalay	20	5
8	Zee Pin Tan	Myingyan	Myingyan	Mandalay	20	6
9	Sai Kya	Magway	Magway	Magway	20	6
10	Shar Pin Hla	Magway	Magway	Magway	20	7
11	Kone Gyi	Magway	Magway	Magway	20	6
12	Nyaung Kan	Magway	Magway	Magway	20	5
Total					240	70

6.2 Basic Information of Farmers

(1) Farm Size and Cultivation Right

Village	Ave. farm size (ac)	Upland(ac)	Paddy(ac)	Cultivation right(%)
Shwe Twin	9.2	6.6	2.6	85%
Thant Sin Kyal	17.2	16.9	0.3	100%
Taung Ba	16.0	16.0	0.0	100%
Tett Ma	11.1	11.1	0.0	100%
Ba lone	16.8	10.5	6.3	100%
Chay Say	19.6	19.6	0.0	100%
Nyaung Pan	13.2	11.7	1.5	100%
Zee Pin Kan	15.8	15.4	0.4	100%
Sai Kya	18.9	18.3	0.6	100%
Shar Pin Hla	15.3	15.0	0.3	100%
Kone Gyi	13.5	13.5	0.0	100%
Nyaung Kan	18.1	18.1	0.0	100%
Average	15.4	14.4	1.0	99%

(2) Income sources of Farmers

Agriculture	Farm work	Transp-ortation	Const. work	Livestock	Teacher	Official	Retail	Middl-eman	Carpe-nter	Rem-ittance	Others
94.2%	3.3%	0.8%	7.9%	4.2%	4.6%	7.1%	0.8%	0.8%	5.0%	10.4%	2.5%

(3) Annual Incomes

Agriculture	Farm work	Transp-ortation	Const. work	Livestock	Teacher	Official	Retail	Middl-eman	Carpe-nter	Rem-ittance	Others
88.4%	0.6%	0.2%	2.3%	0.5%	0.7%	2.3%	0.1%	0.1%	1.5%	3.0%	0.3%

(4) Status of Self-sufficiency of Foods

Months on self-sufficiency	Rice	Pulses	Cooking oils
3 months	1	-	-
6 months	3	30	8
7months		-	1
8 months	-	2	-
10 months	1	-	
12 months	234	208	231

6.3 Information about Agricultural Technologies

(1) Cropping Patterns

Cropping Pattern (Shwe Twin Village, Nyaung U Township.)

Crop	Variety	May	June	July	August	September	October	November	December	January	February	March	April
Monsoon rice													
Pigeon pea													
Maize													
Groundnut													
Green Gram													
Onion													

Cropping Pattern (Thant Sin Kyal Village, Nyaung U Township.)

Crop	Variety	May	June	July	August	September	October	November	December	January	February	March	April
Pigeon pea													
Sesame													
Groundnut													

Cropping Pattern (Taung Ba village)

Crop	Variety	May	June	July	August	September	October	November	December	January	February	March	April
Pigeon pea													
Sesame													
Groundnut													
Green Gram													

(2) Traditional Cultivation Methods

Township	Village	Intercropping Crops
Nyaung U	Shwe Twin	Green gram + Groundnut
		Groundnut + Pigeon pea
	Thant Sin Kyal	Green gram + Pigeon pea
		Sesame + Pigeon pea
		Groundnut + Pigeon pea
	Taung Ba	Pigeon pea + Sesame
	Tett Ma	Pigeon pea + Sesame
		Pigeon pea + Groundnut
Myingyan	Ba Lone	Groundnut + Pigeon pea
		Chick pea + Sunflower
		Pigeon pea + Sesame
	Chay Say	Pigeon pea + Green gram
		Pigeon pea + Cotton
		Pigeon pea + Sesame
		Pigeon pea + Maize
		Maize + Cotton
		Pigeon pea + Groundnut
	Nyaung Pan	Pigeon pea + Sesame
		Pigeon pea + Sorghum
		Pigeon pea + Groundnut
	Zee Pin Kan	Pigeon pea + Groundnut
Magway	Sai Kya	Pigeon pea + Groundnut
	Shar Pin Hla	Green gram + Sesame
		Pigeon pea + Sorghum
	Kone Gyi	Green gram + Sesame
		Pigeon pea + Sorghum
		Groundnut + Sesame
	Nyaung Kan	Groundnut + Sesame

(3) Renewal of Seeds

Frequency	Paddy	Oil crops	Pulses	Forage	Vegetables
Never	8	172	199	34	0
Every year	10	23	16	2	0
Every 2 years	10	13	15	1	0
Every 3 years	13	12	10	0	0

(4) Limitation in the Agricultural Production

	Pest & insect	Expensive fertilizer	Drought	Flood	Erratic rainfall	Lack of money	Poor soil	Lack in cattle	Water shortage	Soil erosion
No.	190	77	162	6	166	49	22	4	78	3

(5) Damages and Countermeasures

	Pest & insect	Drought	Flood	Erratic rainfall	Soil erosion	Others
No.	191	169	6	96	2	0

(6) Irrigation Facilities

Irrigated farmers	40 farms (16.7%)	
Irrigated area	Upland : 74.5 ac	Paddy : 116.5 ac

(7) Crop Varieties

Crops	Varieties(top 3)		
	1	2	3
Monsoon paddy	Manawthuka	Pearl Thwe	
Summer paddy	Manawthuka	Pearl Thwe	
Pigeon pea	Thetgyi	Thetyin	Shwedinga
Maize	CP		
Sesame	Khanshi	Black	Red
Groundnut	Tontarni	Kyaung Kone	Vietnam
Chick pea	B2		
Green gram	Zotkalay	Yezin-6	
Cotton	Ngwe Chi-6		
Onion	Kyaw Min	Shwephalar	

(8) Reasons for selecting their preferable varieties

Crop	Variety	Eating quality	Market-ability	Early maturity	Drought tolerant	Disease tolerant	High yield	No choice
Paddy	Manawthuka	38	36	1	2	3	1	1
	Pearl Thwe	19	20	–	–	–	–	–
Pigeon pea	Thetgyi	68	80	40	45	1	–	2
	Thetyin	92	132	78	103	12	1	6
Maize	CP	13	30	15	18	–	1	–
Sesame	Kanshi	86	105	73	22	1	–	2
	Black	49	64	39	37	2	–	–
	Red	71	83	63	32	6	–	–
Groundnut	Tontarni	152	171	134	133	1	4	1
	Vietnam	9	17	14	9	1	3	–
	Kyaung Kone	76	93	40	75	3	2	6
Green gram	Zotkalay	56	64	53	12	–	1	3
	Yezin-6	6	17	1	7	2	3	2
Sorghum	Kalar	40	48	19	30	21	2	4
Chick pea	B2	24	25	9	11	12	–	–
Onion	Kyaw Min	19	20	1	1	–	–	–
	Shwephalar	19	19	1	18	–	–	–
Tobacco	Burma	5	18	14	14	2	–	1

(9) Sown area by Crop

	Paddy	Pigeon pea	Sesame	Maize	Groundnut	Green gram	Sorghum	Chick pea	Onion	Potato	Tomato	Tobacco	Cotton
Sown area (ac)	106.3	464.6	1,425.0	180.5	1,206.0	391.0	182.0	70.0	59.0	0.0	0.0	70.0	106.0
Ranking	7	3	1	6	2	4	5	9	10	–	–	9	8

(10) Procurement of Seeds

Procured from	Paddy	Pigeon Pea	Sesame	Maize	Groundnut	Green Gram	Sorghum	Chick Pea	Onion	Potato	Tomato	Tobacco	Cotton
Own seeds	27	160	195	72	179	107	68	23	20	–	–	0	0
MAS/DOA	11	5	3	0	6	2	4	2	0	–	–	0	20
Local marke	2	19	49	1	52	11	1	1	0	–	–	0	0
Others	0	0	0	1	0	0	0	0	0	–	–	2	0
Total	40	184	247	74	237	120	73	26	20	0	0	2	20

6.4 Other Information about Farm Management

(1) Required Acreage of Farmland and Income to a Feed Family

Minimum farm size per farm (ac)	Largest 32ac, smallest 1.0ac, ave. 12.0 ac
Minimum income（Kyat/farm household/month）	Largest 600,000, smallest 30,000, ave.142,438

(2) Crop Yield

Yields of 12 villages

(Basket, viss/ac)

	Monsoon paddy	Summaer Paddy	Pigeon pea	Maize	Sesame	Gorundnut	Green gram	Sorghum	Chick pea	Onion	Potato	Tobacco	Cotton
2010	–	30.0	9.6	56.7	3.3	19.6	4.6	3.5	3.8	–	–	332.2	–
2011	–	–	11.6	62.7	32.1	18.1	4.2	2.7	3.8	–	–	332.2	–
2012	–	–	9.0	61.0	3.6	22.7	3.9	3.6	3.8	–	–	332.2	–

Yields of the Statistical Yearbook

(Basket, viss/ac)

	Paddy	Pigeon pea	Maize	Sesame (late)	Gorundnut (rain)	Green gram	Sorghum	Chick pea	Onion	Potato	Tobacco (dry)	Cotton (long)
2007/08	76	15	54	11	46	14	NA	16	3,596	3,579	302	242
2008/09	78	16	55	12	47	15	NA	17	3,755	3,662	341	368
2009/10	79	16	56	12	49	15	NA	17	3,800	3,658	332	441

Source : Statistical Yearbook, CSO

(3) Production Cost of Crops

(Kyat/ac)

Crop	Urea	TSP	Other ferti.	Agri-chemical	Labour	Seeds	Total
Monsoon paddy	23,476	12,700	0	4,084	74,983	15,780	131,023
	17.9	9.7	0	3.1	57.2	12.0	100.0
Pigeon pea	12,828	3,440	0	6,142	21,760	4,716	48,887
	26.0	7.0	0	12.6	44.5	9.6	100.0
Maize	7,007	0	3,887	2,585	23,401	4,518	41,397
	16.9	0	9.4	6.2	56.5	10.9	100.0
Sesame	8,457	5,088	1,047	4,517	31,383	7,606	58,098
	14.6	8.8	1.8	7.8	54.0	13.1	100.0
Groundnut	11,455	7,651	194	7,859	49,551	75,015	151,726
	7.5	5.0	0.1	5.2	32.7	49.4	100.0
Green gram	5,871	8,737	1,000	6,042	28,490	7,898	58,038

	10.1	15.1	1.7	10.4	49.1	13.6	100.0
Sorghum	9,643	1,235	955	2,083	20,825	10,819	45,560
	21.2	2.7	2.1	4.6	45.7	23.7	100.0
Chick pea	3,282	0	0	2,900	13,769	19,951	39,902
	8.2	0	0	7.3	34.5	50.0	100.0
Onion	10,667	10,333	0	4,667	26,000	23,000	74,667
	14.3	13.8	0	6.3	34.8	30.8	100.0
Tobacco	20,000	15,500	0	5,838	97,485	33,324	172,147
	11.6	1	0	3.4	56.6	19.4	100.0
Cotton	2,625	3,100	0	16,350	127,190	5,350	154,615
	1.7	2.0	0	10.6	82.3	3.5	100.0

(4) Net Profit of Crops

paddy	Pigeon pea	Maize	Sesame	Groundnut	Green gram	Sorghum	Chick pea	Onion	Tobacco	Cotton
56%	43%	51%	44%	41%	23%	19%	29%	53%	58%	76%

(5) Purpose of Cultivation

Crop	For sale（%）	For home use (%)
Paddy	31	69
Pigeon pea	97	3
Maize	67	33
Sesame	60	40
Groundnut	61	39
Green gram	73	27
Sorghum	20	80
Chick pea	86	14
Onion	98	2
Tobacco	100	0

(6) Annual Income

Village	Township	Estimated income (Kyat/year/household)
Ba Lone	Myingyan	3,937,500
Chay Say	Myingyan	1,801,500
Nyaung Pin	Myingyan	1,175,000
Zee Pin Kan	Myingyan	3,710,000
Sai Ka	Magway	9,726,000

(7) Agricultural Loans

Type	Reply	Interest (%/month)
Instituional	79	0.75
Private	3	4~8
Borrowing from relative	6	2.5~10
NGO’s loan	13	1.0
Others	3	2.5

(8) Promising Crops

Crops	Reply	Crop	Reply
Paddy	15	Honey melon	1
Onion	13	Rubber	1

Sugarcane	6	Tobacco	1
Cotton	5	Potato	1
Tomato	4	Maize	1
Chick pea	3	Wheat	1
Groundnut	3	Chili	1
Watermelon	2		

Appendix-12

3. Agricultural Production Survey

Region: Mandalay

A. Organization Chart of the Department of Agriculture in the Region Office→Refer to the organization chart

Was the number of staff in the DOA Division office changed after organizational change from MAS to DOA? ☐Yes, ■No

If Yes, how many staff increased or decreased? Inreased: - persons, Decreased: - persons

Annual budget of the DOA's Region office: 1,500 million Kyat/year (2013), 1,370 million Kyat/year (2012),

B. Land Type in the Region (year:2013) (unit:acre)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
7,792,843	1,546,691	160,231	3,317,508	0	2,070,198	628,330	69,885

Source: DOA's Land Use Division

C. Agricultural zoning of the Region

According to the Zoninig in Myanmar, in which zone the Region calsified: Refer to the zoning map

In the Region, is there any zoning about upland/paddy, soil, water sources by Township basis?: Refer to the soil characteristic map and acreage by land type

Result of the typology studied in the Development Study of JICA ←Refer to the JICA Report (map and table)

D. Breakdown of the cultivated land in the Region Unit:Acre

Total Cultivated	Total Paddy	Total Yar Land	Total Kaing	Total Kyun	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
3,317,508	916,828	2,200,780	169,064	0	30,836
100%	27.6%	66.3%	5.1%	0.0%	0.9%

Note: Yar: upland
Kaing: Cultivable land on River terrace
Kyun: Cultivable land on river bed

Source: Land Use Division, DOA Regional Office

E. Seed farm and experimenatl station in the Region

	Agent	Location (TS)
Seed farm	DOA	Sinkkaing, Mandalay, Ma Hlaing, Pyaw Bwe, Kyaunk Pa Daung (2)
State farm	DOA	Mandalay, Myitthar, Pyin Oo Lwin (5), Tharzi (5), Kyaunkpadaung (2), Patheingyi, Meikhtila, Nyaung U,
Research center & Satellite	DAR	Center: Nyaung U, Myitthar, Satellite:Kyaukse, Kyauktada, Myingyan, Sebin

Source: DOA HQ in Nay Pyi Taw and DAR in Yezin

F. Irrigated Area

Paddy Field	Upland	Total	Ratio of Irrigated Area
635,112	84,181	719,293	21.7 (%)

Source:DOA Regional Office

Irrigable area in the region on Map←Acquire existing Map of irrigated area in the region

Irrigated area by District/Township basis, if available (ac)

District	Paddy Field	Upland	Main water source
Mandalay	38,131	7,800	Dam, pum station, Tube-wel
Pyin Oo Lwin	79,959	4,511	Dam, pum station, Tube-wel
Kyaukse	154,389	59,370	Dam, pum station, Tube-wel
Meikhtila	69,613	2,500	Dam, pum station, Tube-wel
Myingyan	23,588	9,800	Dam, pum station, Tube-wel
Nyaung U	2,386	200	Dam, pum station, Tube-wel
Yamethin	18,610	0	Dam, pum station, Tube-wel

G. Existing Irrigation Water Sources in the Region←Acquire inventory of irrigation facilities if available at ID

G.1 Number of farm ponds 42 places, of which, how many are in service now? NA places

G.2 Number of pump stations 25 places, of which, how many are in service now? 25 places

G.3 Irrigated area by river water 71,929 Acres, of which, how many acres are irrigated by canal (gravity)? NA Acres

G.4 Irrigated area by groundwater 2,188 Acres (pump irrigation)

G.5 Irrigated area by farm ponds NA Acres

Source. ID provincial office

H. Irrigated crops in the Region

■ Paddy ■ Sesame ☐ Groundnut ☐ Pigeon pea ☐ Chick pea ☐ Onion ☐ Watermelon ☐ Maize ☐ Sorghum
☐ Chili ☐ Tomato ☐ Potato ☐ Other vegetables ( )

I. Irrigation method practiced in the Region

■ Canal (gravity) ■ Pump ☐ Sprinkling can ☐ Drip irrigation ■ Treadle pump

J. Utilization and management of irrigation water←ask at ID and WRUD

How the irrigation facilities are managed?

	Constructed by	Management body	Duty of water users	Management method
Irrigation cana	■ID, ☐WRUD	☐ID, ☐WRUD	water charge	
Pump station	☐ID, ■WRUD	☐ID ■WRUD	water charge	
Farm pond				

K. Water charge and Land Tax

K.1 Water charge Paddy field 6,000 Kyat/ac/year, Upland 3,000 Kyat/ac/year

K.2 Land Tax Paddy field 1.0 Kyat/ac/year, Upland 2.5 Kyat/ac/year

K.3 Collection rate of water charge NA %(20**) ←ID?

K.4 Collection rate of land tax NA %(21**) ←SLRD

L. Do farmers apply any kind of water-saving technologies in the Region? ☐ Yes, ■ No

If Yes, Please tell us the technologies.

☐Drip irrigation ☐Mulching ☐Treadle pump ☐ Water harvesting ( )

M. Is there any farmers who still apply Technologies introduced from outside (Donours etc) ☐ Yes, ■ No

If Yes, What is the reasons for sustainable practice of those technoligies?

N. Number of Farm Household by Farm Size (year:2013)

Less than 5 ac	5-10 ac	10-20 ac	Above 20 ac	Total
333,180	183,318	70,239	19,858	606,595
54.9%	30.2%	11.6%	3.3%	100 %

Source. TS DOA, different from the data from DOA Nay Pyi Taw

Average Farm Size per Farm Household		Source
6.42	ac	DOA, NPT
5.47	ac	DOA TS

O. Precipitation and Temperature

O.1 Fluctuation of the annual rainfall in the past 10 years (inch)

2003 yr.	2004 yr.	2005 yr.	2006 yr.	2007 yr.	2008 yr.	2009 yr.	2010 yr.	2011 yr.	2012 yr.	Average
34.05	31.59	32.71	45.59	39.15	11.89	27.11	42.16	43.45	24.19	33.19

O.2 Rainfall by month for 10 years (inch)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003		0.16	0.04	1.16	7.46	9.95	3.46	3.83	7.10	6.82	0.07	0.01	40.06
2004			0.04	1.17	6.77	5.17	4.36	2.02	9.75	2.09	0.25	0.07	31.69
2005			0.44	1.11	2.44	3.67	3.10	4.32	9.31	4.36	1.89	2.07	32.71
2006			0.14	2.84	6.06	4.79	4.90	7.87	11.55	6.85	0.88		45.88
2007		1.14		0.66	9.51	5.57	3.17	4.72	4.98	7.88	2.61	0.01	40.25
2008	0.75	0.01	0.05	1.02	6.28	5.35	2.20	2.69	5.58	8.84	0.26	0.04	33.07
2009			0.30	0.85	6.73	3.14	0.88	5.67	6.18	3.21	0.13		27.09
2010			0.10	0.24	3.64	3.58	3.47	7.28	6.67	15.50	0.01	1.70	42.19
2011	0.22	0.02	0.95	2.38	6.49	4.33	2.36	10.26	4.66	11.12	0.19	0.47	43.45
2012	0.07		0.21	1.64	2.19	3.05	1.99	3.44	7.57	3.16	0.67	0.17	24.16

O.3 Lowest Temperature by month for 10 years (F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006													
2007													
2008													
2009													
2010	58.1	61.5	72.4	81.0	82.4	80.8	80.8	79.0	78.3	76.4	68.7	60.3	73.3
2011	59.0	60.6	71.6	76.8	78.6	79.5	79.9	77.9	78.1	75.9	67.1	NA	NA
2012													

O.4 Highest Temperature by month for 10 years (F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006													
2007													
2008													
2009													
2010	88.9	93.9	100.6	107.1	103.8	97.9	97.5	93.2	93.9	91.6	91.0	82.9	95.2
2011	84.9	91.8	97.2	98.6	94.8	94.6	95.9	91.2	93.6	89.8	89.8	NA	NA
2012													

P. Crop Production (year: 2007)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				#DIV/0!
Summar paddy				#DIV/0!
Pigeon pea				#DIV/0!
Maize				#DIV/0!
Sesame				#DIV/0!
Groundnut		NA		#DIV/0!
Green Gram				#DIV/0!
Sorghum				#DIV/0!
Chickpea				#DIV/0!
Sunflower				#DIV/0!
Soybean				#DIV/0!
***				#DIV/0!
***				#DIV/0!

Crop	Net Sown Area (ac)	Harveste d Area	Production (biss)	Yield (biss/ac)
Onion				#DIV/0!
Chili				#DIV/0!
Potato				#DIV/0!
Toddy				#DIV/0!
Tomato	NA			#DIV/0!
Cucumber				#DIV/0!
Carrot				#DIV/0!
Okra				#DIV/0!
Leafy vegetables				#DIV/0!
Eggplant				#DIV/0!
Watermelon				#DIV/0!

Crop Production (year: 2008-2009)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				
Summer paddy				
Pigeon pea				
Maize				
Sesame				
Groundnut				
Green Gram				
Sorghum				
Chickpea				
Sunflower				
Soybean				
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harveste d Area	Production (biss)	Yield (biss/ac)
Onion				
Chili				
Potato				
Toddy				
Tomato				
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2009-2010)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				
Summer paddy				
Pigeon pea				
Maize				
Sesame				
Groundnut				
Green Gram				
Sorghum				
Chickpea				
Sunflower				
Soybean				
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion				
Chili				
Potato				
Toddy				
Tomato				
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2010-2011)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	603,105	603,017	50,091,440	83.07
Summer paddy	185,994	185,853	17,951,821	96.59
Pigeon pea	482,125	482,105	6,531,140	13.55
Maize	29,011	29,011	1,530,920	52.77
Sesame	#######	#######	6,583,695	5.64
Groundnut	324,756	324,739	15,744,894	48.48
Green Gram	333,060	332,979	4,077,742	12.25
Sorghum	144,470	144,458	1,683,135	11.65
Chickpea	226,262	226,262	3,311,765	14.64
Sunflower	320,265	320,265	8,267,075	25.81
Soybean	30,654	30,654	393,857	12.85
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	68,971	68,971	214,214,413	3,105.9
Chili	128,463	128,463	22,206,475	172.9
Potato	2,077	2,077	5,330,176	2,566.3
Toddy	36,317	24,204		0.0
Tomato	58,239	58,239	112,596,944	1,933.4
Cucumber				
Carrot	841	841	1,596,021	1,897.8
Okra				
Leafy vegetables				
Eggplant				
Watermelon	5,253	5,253	125,565	23.9

Crop Production (year: 2011-2012)

Crop	Net Sown Area (ac)	Harvested Area	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	620,061	618,390	48,369,782	78.2
Summer paddy	168,910	168,910	16,120,180	95.4
Pigeon pea	490,246	489,835	6,530,948	13.3
Maize	29,026	29,026	1,574,901	54.3
Sesame	#######	#######	6,986,948	6.0
Groundnut	342,334	342,249	15,148,126	44.3
Green Gram	305,802	305,788	3,101,293	10.1
Sorghum	140,389	140,220	1,622,683	11.6
Chickpea	213,134	213,134	3,100,297	14.5
Sunflower	196,575	196,575	4,982,820	25.3
Soybean	29,001	29,001	365,590	12.6
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	71,831	71,637	217,790,205	3,040.2
Chili	121,012	119,566	20,692,297	173.1
Potato	1,984	1,984	5,130,456	2,585.9
Toddy	36,339	24,264	NA	NA
Tomato	51,824	51,824	102,129,811	1,970.7
Carrot	862	862	1,609,796	1,867.5
Okra				
Leafy vegetables				
Eggplant				
Cucumber				
Watermelon	6,699	6,699	18,988,725	2,834.6

Source:DOA Regional Office

Crop Production (year: 2012-2013)

Crop	Net Sown Area (ac)	Harvested Area	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				
Summer paddy				
Pigeon pea				
Maize				
Sesame				
Groundnut				
Green Gram				
Sorghum				
Chickpea				
Sunflower				
Soybean				
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion				#DIV/0!
Chili				#DIV/0!
Potato				#DIV/0!
Toddy				
Tomato				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Cucumber				
Watermelon				

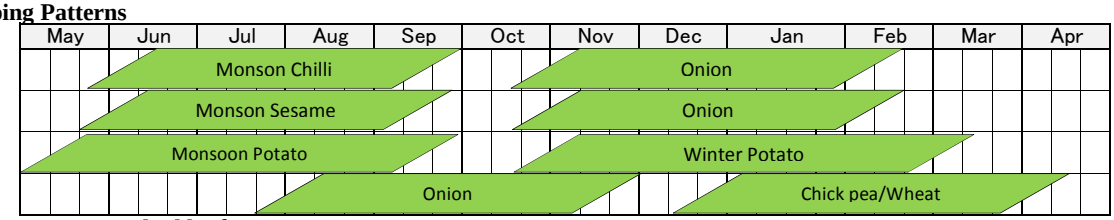
Q. Farmgate Price (year: 2012)

Crop	Farmgate Price	Crop	Farmgate Price
Monsoon paddy		Onion	
Summer paddy		Chili	
Pigeon pea		Potato	
Maize		Toddy	
Sesame		Carrot	
Groundnut		Leafy vegetables	NA
Green Gram	NA	Eggplant	
Sorghum		Okra	
Chickpea			
Sunflower			
Soybean			
***			
***			

R. Crop Varieties (Top 3 varieties)

Crop	1	2	3
Monsoon paddy	Manawthuka	Ayeramin	Shwethwe Yin
Summer paddy	Manawthuka	Shwethwe Yin	Sin Thu Kha
Pigeon pea	Shwedinga	Nga San Pac	Yezin-3
Maize	Yezin-4	CP888	
Sesame	Sin-4	Yoe Seinn	Kanshi
Groundnut	SP121	Magway-10	Sin-6, 7, 11
Green Gram	Yezin-5	Yezin-1	Yezin-4
Sorghum			
Chickpea	Yezin-3	Karachi	Yezin-4
Sunflower	Sin Shwe Kyar-2	Sin Shwe Kyar-3	
Soybean			
Black gram			
***			
Onion	Shwe Phalar		
Chili			
Potato			
Toddy			
Tomato			
Eggplant			
Carrot			
Eggplant			
Cucumber			
Watermelon			

S. Cropping Patterns



T. Farm management method by farmers

Crop	Plowing by	Harrowing by	Weeding by	Dosage of fertilizer/ac	Frequency of spraying	Harvesting by	Irrigated by
Monsoon paddy	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	0 kg/ac (15-15-15	3 to 5 times	Labour	Canal
Summer paddy	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour		-	Labour	Canal
Pigeon pea	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour		-	Labour	Rainfed
Maize	Bull/Buf.and tractor	Bull/Buf.and tractor				Labour	Rainfed
Sesame	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour		-	Labour	Canal
Groundnut	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour		-	Labour	
Green Gram	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour		-	Labour	
Sorghum	Bull/Buf.and tractor	Bull/Buf.and tractor				Labour	
Chickpea	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour		-	Labour	
Sunflower							
Soybean							
***							
***							
Onion							Pump
Chili							Pump
Potato							Pump
Toddy							
Tomato							
Carrot							
Eggplant							
Okra							
Leafy vegetables							
Cucumber							
Watermelon							

Note. Buf: Buffalo

U. How often do farmers in the Region renew seeds?

Paddy	☐ Never	☐ Every year	☐ Every 2 years	■ Every 3 years
Oil crops	■ Never	☐ Every year	☐ Every 3 years	☐ Every 4 years
Pulses/beans	■ Never	☐ Every year	☐ Every 2 years	☐ Every 3 years
Fodder crops	☐ Never	☐ Every year	☐ Every 3 years	☐ Every 4 years
Vegetables	☐ Never	■ Every year	☐ Every 4 years	☐ Every 5 years

V. Limiting factors on agricultural production (mark all that apply)

☐ Pest and insect control ■ High cost of chemicals ■ Drought ☐ Flood damage ■ Erratic rainfall
■ Lack of money ☐ Poor soil ☐ Lack of draft cattle ■ Water shortage ☐ Soil erosion

W. What kind of disaster or damage did the Region have experienced to date? (mark all that apply)

☐ Pest and insect control ■ Drought ☐ Flood damage ☐ Erratic rainfall ☐ Soil erosion ☐ Others ( )

Frequency of disasters

Disaster	Frequency	Season (month)	Years the disaster	Disease & Insect name	Crops damaged	How damaged in %
Pest						
Insect						
Drought	every 3 years		2012	-	Sesame, Groundnut	NA
Flood				-		
Soil erosion				-		

Disaster map →NA

Township name where disaster occurred

Disaster	TS name disaster occured
Pest	
Insect	
Drought	Whole TS area
Flood	
Soil erosion	

X. Livestock

X.1 Number of Livestock and Number of Households Raising Livestock (2013)

	Cattle	Buffalo	Sheep/Goats	Pig	Chicken	Duck
No. of Head	2,158,711	69,641	1,326,777	673,535	18,148,380	445,209

Source:LBVD

X.2 Animal Products Production per Year (2013)

	Beef (viss)	Mutton (viss	Pork (viss)	Chicken (viss	Duck (viss)	Milk (viss)	Chicken Egg (No.)	Duck Egg (No.)
Production	#######	6,331,010	24,290,430	50,117,580	#######	133,768,590	725,934,960	15,359,530

Source:LBVD

X.3 Unit Price of Live Animal per Head (2013)

Goat/Sheep	Pig	Chicken	Duck
50,000	62,000	2,500	3,000

Source:LBVD

Y. Land Classification and Soil Types

Y.1 Land Types ←Acquire the land classification map, if available

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
47	898	45	931	199	107	10	-	-	20

Source. JICA Report for Poverty Reduction in CDZ, MAS (former)

Legend:

I	Deposit	VI	Dissected Plateau
II	Alluvial	VII	Plateau
III	Terrace	VIII	Hilly
IV	Footplain	IX	Mountain
V	Plateau	X	Upland plateau

Y.2 Soil Types → Refer to the soil characteristics map

Acreage by Soil Type (unit:Acre)								
Meadow Alluvial Soils (Gleysol)	Meadow Carbonate Soils (Gleysol)	Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Compact Soils (Vertisol)	Turfy Primitive Soils (Lithosol)	Primitive Crushed Stones Soils	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other
114	394	3,008	1,214	346	706	806	1,062	214

Source. DOA Regional offfice

Z. Recommendable Countermeasures against Dry Climate and Sandy Soil

1 In rainfed area,tTo change varieties to drought tolerant ones
2 To change croping pattern: current sesame-pulses to pulses-sesame
3
4
5
6

Source. DOA Division office

Aa Frequewncy of Damage in the Region

1 Drought: every year
2 Flood: *** times every *** years
3 Insect damage: *** times every *** years
4 Pest damage: *** times every *** years

Ab Agricultural Development Plan in the Region

1 Seed production of sunflower and paddy by seed farm and contact farmers
2
3
4
5

Ac Crops and its Varities Promoting in the Region (mainly upland crops)

1	Crop name: Maize	Variety: Yezin-10	Objective Townships:	Myingyan district, Pyin Oo Lwin district
2	Crop name: Suflower	Variety: Yezin-1	Objective Townships:	Whole region
3	Crop name: Sesame	Variety: Sin-3	Objective Townships:	Whole region
4	Crop name:	Variety:	Objective Townships:	
5	Crop name:	Variety:	Objective Townships:	
6	Crop name:	Variety:	Objective Townships:	
7	Crop name:	Variety:	Objective Townships:	
8	Crop name:	Variety:	Objective Townships:	

Ad Problems in the Agriculture in the Region (mark all that apply)

■ Lack of irrigation water ■ Drought □ Low agricultural technology ■ Low farmgate price of crops
■ High cost of agricultural chemicals □ Soil erosion by rain □ Soil erosion by wind ■ Poor soil fertility
■ High cost of fertilizers □ Monoculture □ Lack of draft cattle ■ Poor agricultural credit system
□ Inadequate production of quality see □ Erratic rainfall

Other issues:

1
2
3
4
5

Ae Agricultural Development Plan in the Region←acquire document if available (mainly on upland crops)

1 To use HYV in all Townships
2 To transfer more technology
3 To mechnize farming practices
4
5

Af Agricultural Development Plan in the concerning TS ←Acquire document if available(mainly on upland crops)

1
2
3 NA
4
5

3. Agricultural Production Survey

Region: Magway

A. Organization Chart of the Department of Agriculture in the Region Office→Refer to the organization chart

Was the number of staff in the DOA Division office changed after organizational change from MAS to DOA? ☐Yes, ■No

If Yes, how many staff increased or decreased? Inreased: - persons, Decreased: - persons

Annual budget of the DOA's Region office: 112.25 million

B. Land Type in the Region (year:2013) (unit:acre)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
11,075,405	2,663,193	0	2,975,276	0	144,969	2,494,833	2,797,134

Source: DOA's Land Use Division

C. Agricultural zoning of the Region

According to the Zoninig in Myanmar, in which zone the Region calsified: Refer to the zoning map

In the Region, is there any zoning about upland/paddy, soil, water sources by Township basis?: Refer to the soil characteristic map and acreage by land type

Result of the typology studied in the Development Study of JICA ←Refer to the JICA Report (map and table)

D. Breakdown of the cultivated land in the Region Unit:Acre

Total Cultivated	Total Paddy	Total Yar Land	Total Kaing	Total Kyun	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
2,975,276	582,576	2,164,466	210,350	0	17,884
100%	19.6%	72.7%	7.1%	0.0%	0.6%

Note: Yar: upland
Kaing: Cultivable land on River terrace
Kyun: Cultivable land on river bed

Source: Land Use Division, DOA Regional Office

E. Seed farm and experimenatl station in the Region

	Agent	Location (TS)
Seed farm	DOA	Pwint phyu
State farm	DOA	Nga Phoe
Research center & Satellite	DAR	Center: Magway, Kenpontaung

Source: DOA

F. Irrigated Area

Paddy Field	Upland	Total
499,569	32,019	531,588

Ratio of Irrigated Area: 17.9 (%)

Source:DOA Regional Office

Irrigable area in the region on Map←Acquire existing Map of irrigated area in the region

Irrigated area by District/Township basis, if available (ac)

District	Paddy Field	Upland	Main water source
Gantgaw	32,757	1,331	Na
Pakokku	57,136	9,695	Na
Magway	117,432	2,442	Na
Minbu	245,510	18,177	Na
Thayet	46,739	374	Na

G. Existing Irrigation Water Sources in the Region←Acquire inventory of irrigation facilities if available at ID

G.1 Number of farm ponds NA places, of which, how many are in service now? NA places

G.2 Number of pump stations NA places, of which, how many are in service now? NA places

G.3 Irrigated area by river water 531,588 Acres, of which, how many acres are irrigated by canal (gravity)? NA Acres

G.4 Irrigated area by groundwater NA Acres (pump irrigation)

G.5 Irrigated area by farm ponds NA Acres

Source. ID provincial office

H. Irrigated crops in the Region

■ Paddy ■ Sesame ☐ Groundnut ☐ Pigeon pea ☐ Chick pea ☐ Onion ☐ Watermelon ☐ Maize ☐ Sorghum
☐ Chili ☐ Tomato ☐ Potato ☐ Other vegetables ( )

I. Irrigation method practiced in the Region

■ Canal (gravity) ☐ Pump ☐ Sprinkling can ☐ Drip irrigation ☐ Treadle pump

J. Utilization and management of irrigation water←ask at ID and WRUD

How the irrigation facilities are managed?

	Constructed by	Management body	Duty of water users	Management method
Irrigation cana	■ID, ■WRUD	■ID, ■WRUD	water charge	
Pump station	☐ID, ■WRUD	☐ID ■WRUD	water charge	
Farm pond				

K. Water charge and Land Tax

K.1 Water charge Paddy field 9,000 Kyat/ac/year, Upland 3,000 Kyat/ac/year

K.2 Land Tax Paddy field 1.5 Kyat/ac/year, Upland 2.75 Kyat/ac/year

K.3 Collection rate of water charge NA %(20**) ←ID?

K.4 Collection rate of land tax NA %(21**) ←SLRD

L. Do farmers apply any kind of water-saving technologies in the Region? ☐ Yes, ■ No

If Yes, Please tell us the technologies.

☐Drip irrigation ☐Mulching ☐Treadle pump ☐ Water harvesting ( )

M. Is there any farmers who still apply Technologies introduced from outside (Donours etc) ■ Yes, ☐ No

If Yes, What is the reasons for sustainable practice of those technoligies?

・to increase agricutural production
・to increase soil fertility
・to prevent drought by using recommended varieties

N. Number of Farm Household by Farm Size (year:2013)

Less than 5 ac	5-10 ac	10-20 ac	Above 20 ac	Total
458,935	132,089	52,594	11,171	654,789
70.1%	20.2%	8.0%	1.7%	100 %

Source. Regional SLRD

O. Precipitation and Temperature

O.1 Fluctuation of the annual rainfall in the past 10 years (inch)

2003 yr.	2004 yr.	2005 yr.	2006 yr.	2007 yr.	2008 yr.	2009 yr.	2010 yr.	2011 yr.	2012 yr.	Average
33.79	35.98	37.59	41.41	40.69	33.32	30.92	41.85	47.29	27.63	37.05

O.2 Rainfall by month for 10 years (inch)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003				0.15	5.97	7.49	3.40	4.51	6.01	6.12	0.12		33.77
2004				0.49	6.74	6.13	4.59	4.90	10.15	2.70	0.38	0.10	36.18
2005			0.03	0.54	1.03	5.56	3.49	6.06	12.38	5.48	0.86	2.12	37.55
2006			0.04	1.67	4.16	5.05	6.00	6.56	9.44	7.90	0.59		41.41
2007		0.09		0.35	11.12	5.23	3.09	5.23	7.19	7.02	1.37		40.69
2008	0.73		0.04	0.24	5.57	4.70	4.21	5.18	6.16	6.39	0.10		33.32
2009			0.06	0.93	3.57	4.70	3.58	5.53	7.06	5.48	0.01		30.92
2010			0.27	0.40	3.29	4.76	3.99	7.16	4.85	16.06	0.20	0.92	41.90
2011	0.48	0.03	0.31	1.72	4.08	5.79	4.35	11.65	7.03	11.08	0.03	0.64	47.19
2012	0.03		0.25	0.67	1.90	5.00	3.38	4.30	7.55	3.79	0.66	0.10	27.63

O.3 Lowest Temperature by month for 10 years (F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012	10.0	13.0	18.0	21.0	24.0	2.0	24.0	23.0	24.0	22.0	16.0	12.0	19.3

O.4 Highest Temperature by month for 10 years (F)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003													
2004													
2005													
2006													
2007													
2008													
2009													
2010													
2011													
2012	32	40	41	47	43	38	36	37	37	36	36	32	37.9

P. Crop Production (year: 2007)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				#DIV/0!
Summar paddy				#DIV/0!
Pigeon pea				#DIV/0!
Maize				#DIV/0!
Sesame				#DIV/0!
Groundnut		NA		#DIV/0!
Green Gram				#DIV/0!
Sorghum				#DIV/0!
Chickpea				#DIV/0!
Sunflower				#DIV/0!
Soybean				#DIV/0!
***				#DIV/0!
***				#DIV/0!

Crop	Net Sown Area (ac)	Harveste d Area	Production (biss)	Yield (biss/ac)
Onion				#DIV/0!
Chili				#DIV/0!
Potato				#DIV/0!
Toddy				#DIV/0!
Tomato	NA			#DIV/0!
Cucumber				#DIV/0!
Carrot				#DIV/0!
Okra				#DIV/0!
Leafy vegetables				#DIV/0!
Eggplant				#DIV/0!
Watermelon				#DIV/0!

Crop Production (year: 2008-2009)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	874,461	855,941	68,623,766	80.2
Summer paddy	151,023	150,996	14,491,452	96.0
Pigeon pea	420,670	420,670	6,520,385	15.5
Maize				
Sesame			14,021,360	10.4
Groundnut	383,763	383,763	22,812,360	59.4
Green Gram	649,091	649,091	7,561,910	11.6
Sorghum				
Chickpea	172,865	172,865	2,886,690	16.7
Sunflower	502,484	502,484	1,221,595	24.3
Soybean	12,659	12,659	169,884	13.4
Black gram	25,772	25,772	488,986	19.0
Butter bean	32,730	32,730	813,008	24.8

Crop	Net Sown Area (ac)	Harveste d Area	Production (biss)	Yield (biss/ac)
Onion	46,472	46,472	258,844,333	5,569.9
Chili	23,594	23,594	6,975,503	295.6
Potato	4,584	484	23,597,778	5,147.9
Toddy				
Tomato				
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2009-2010)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	889,598	876,602	71,453,998	81.5
Summer paddy	132,016	131,396	1,275,177	9.7
Pigeon pea	428,526	428,526	661,676	1.5
Maize				
Sesame			138,774	0.1
Groundnut	390,386	390,386	24,018,249	61.5
Green Gram	673,256	673,256	9,019,978	13.4
Sorghum				
Chickpea	194,258	194,258	32,337	0.2
Sunflower	537,277	537,277	12,914,869	24.0
Soybean	12,573	12,573	177,500	14.1
Black gram	26,041	26,041	477,079	18.3
Butter bean	32,965	32,965	856,714	26.0

Crop	Net Sown Area (ac)	Harveste d Area (ac)	Production (biss)	Yield (biss/ac)
Onion	48,567	48,567	274,828	5.7
Chili	25,443	25,443	745,435	29.3
Potato	4,797	4,797	248,066	51.7
Toddy				
Tomato				
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2010-2011)

Crop	Net Sown Area (ac)	d Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	892,150	889,586	73,079,600	82.15
Summer paddy	161,360	161,360	156,953	0.97
Pigeon pea	430,146	429,898	7,559,144	17.58
Maize				#DIV/0!
Sesame			14,011,525	#DIV/0!
Groundnut	396,256	396,256	24,765	0.06
Green Gram	689,990	689,989	98,630	0.14
Sorghum				#DIV/0!
Chickpea	184,011	184,011	3,164,361	17.20
Sunflower	534,674	534,674	1,391,821	2.60
Soybean	12,586	12,586	189,810	15.08
Black gram	30,020	30,020	621,628	20.71
Butter bean	33,614	33,614	903,967	26.89

Crop	Net Sown Area (ac)	Harveste d Area (ac)	Production (biss)	Yield (biss/ac)
Onion	49,124	49,124	1,837,566	37.4
Chili	25,577	25,577	7,512,517	293.7
Potato	4,797	4,797	2,519,227	525.2
Toddy				
Tomato				
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2011-2012)

Crop	Net Sown Area (ac)	Harveste d Area	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	893,271	885,766	74,191,760	83.8
Summer paddy	162,202	162,202	16,176,326	99.7
Pigeon pea	437,017	436,449	7,699,219	17.6
Maize				#DIV/0!
Sesame	#######	#######	151,050	0.1
Groundnut	435,363	435,285	276,062	0.6
Green Gram	696,361	696,314	1,102,057	1.6
Sorghum				#DIV/0!
Chickpea	194,667	194,667	359,744	1.8
Sunflower	517,769	517,755	142,627	0.3
Soybean	12,644	12,644	207,823	16.4
Black gram	32,257	32,257	682,803	21.2
Butter bean	3,377	33,771	921,442	27.3

Crop	Net Sown Area (ac)	Harveste d Area (ac)	Production (biss)	Yield (biss/ac)
Onion	49,162	49,082	29,145,480	593.8
Chili	25,928	28,828	7,802,233	270.6
Potato	5,258	5,258	30,509,689	5,802.5
Toddy				
Tomato				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Cucumber				
Watermelon	6,699	6,699	18,988,725	2,834.6

Source:DOA Regional Office

Crop Production (year: 2012-2013)

Crop	Net Sown Area (ac)	Harveste d Area	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	832,334	823,673	691,352	0.8
Summer paddy	115,094	115,094	115,787	1.0
Pigeon pea	437,034	437,034	77,876	0.2
Maize				
Sesame	#######	#######	149,367	0.1
Groundnut	456,657	456,657	290,537	0.6
Green Gram	736,578	736,578	107,426	0.1
Sorghum				
Chickpea	212,510	212,503	393,110	1.8
Sunflower	437,357	437,357	12,156,004	27.8
Soybean	12,648	12,648	212,184	16.8
Black gram	33,172	33,172	730,466	22.0
Butter bean	33,773	33,773	920,109	27.2

Crop	Net Sown Area (ac)	Harveste d Area (ac)	Production (biss)	Yield (biss/ac)
Onion	49,166	49,166	29,436,706	598.7
Chili	26,921	26,291	8,095,680	307.9
Potato	5,269	5,269	30,596,095	5,806.8
Toddy				
Tomato				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Cucumber				
Watermelon				

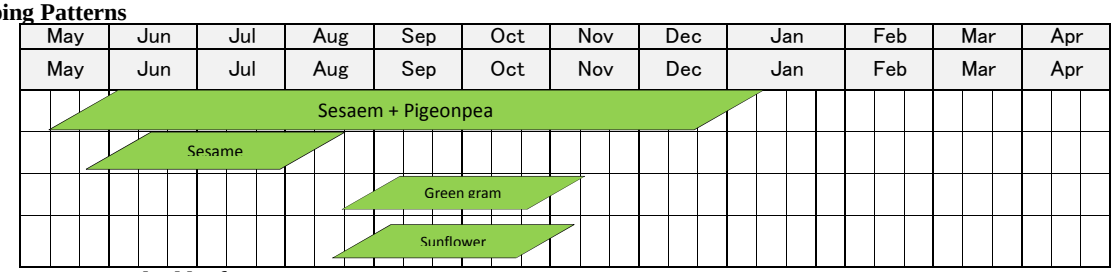
Q. Farmgate Price (year: 2012)

Crop	Farmgate Price	Crop	Farmgate Price
Monsoon paddy		Onion	
Summer paddy		Chili	
Pigeon pea		Potato	
Maize		Toddy	
Sesame		Carrot	
Groundnut		Leafy vegetables	NA
Green Gram	NA	Eggplant	
Sorghum		Okra	
Chickpea			
Sunflower			
Soybean			
***			
***			

R. Crop Varieties (Top 3 varieties)

Crop	1	2	3
Monsoon paddy	Yadanartoe	Manawthuka	Sinthuka
Summer paddy	Yadanartoe	Sinthuka	
Pigeon pea	Shwedinga		
Maize	Suwun-3		
Sesame	Ya Thae Kyaw	Shweta Soak	Samonnet
Groundnut	Yezin-1	Yezin-4	Yezin-5
Green Gram			
Sorghum			
Chickpea			
Sunflower	Sin Shwe Kyar-2	Than Palar	
Soybean			
Black gram	Moe Nyo Gyi		
***			
Onion			
Chili			
Potato			
Toddy			
Tomato			
Eggplant			
Carrot			
Eggplant			
Cucumber			
Watermelon			

S. Cropping Patterns



T. Farm management method by farmers

Crop	Plowing by	Harrowing by	Weeding by	Dosage of fertilizer/ac	Frequency of spraying	Harvesting by	Irrigated by
Monsoon paddy	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	3 to 5 times	Labour	Canal
Summer paddy	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	-	Labour	Canal
Pigeon pea	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	-	Labour	Canal
Maize							
Sesame	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	-	Labour	Canal
Groundnut	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	-	Labour	Canal
Green Gram	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	-	Labour	Canal
Sorghum							
Chickpea	Bull/Buf.and tractor	Bull/Buf.and tractor	Labour	30 kg/ac	-	Labour	canal
Sunflower							
Soybean							
***							
***							
Onion							
Chili							
Potato							
Toddy							
Tomato							
Carrot							
Eggplant							
Okra							
Leafy vegetables							
Cucumber							
Watermelon							

Note. Buf: Buffalo

U. How often do farmers in the Region renew seeds?

Paddy	☐ Never	☐ Every year	☐ Every 2 years	■ Every 3 years
Oil crops	☐ Never	☐ Every year	■ Every 3 years	☐ Every 4 years
Pulses/beans	☐ Never	☐ Every year	☐ Every 2 years	■ Every 3 years
Fodder crops	☐ Never	☐ Every year	☐ Every 3 years	☐ Every 4 years
Vegetables	☐ Never	■ Every year	☐ Every 4 years	☐ Every 5 years

V. Limiting factors on agricultural production (mark all that apply)

☐ Pest and insect control ■ High cost of chemicals ■ Drought ☐ Flood damage ☐ Erratic rainfall
☐ Lack of money ■ Poor soil ☐ Lack of draft cattle ☐ Water shortage ■ Soil erosion

W. What kind of disaster or damage did the Region have experienced to date? (mark all that apply)

☐ Pest and insect control ■ Drought ☐ Flood damage ☐ Erratic rainfall ☐ Soil erosion ☐ Others ( )

Frequency of disasters

Disaster	Frequency	Season (month)	Years the disaster	Disease & Insect name	Crops damaged	How damaged in %
Pest						
Insect						
Drought	every 2 years	May				
Flood				-		
Soil erosion				-		

Disaster map →NA

Township name where disaster occurred

Disaster	TS name disaster occured
Pest	
Insect	
Drought	Magwat, Chauk, Yeanungchaung, Myo Thit, Taungdwin Gyi
Flood	
Soil erosion	

X. Livestock

X.1 Number of Livestock and Number of Households Raising Livestock (2013)

	Cattle	Buffalo	Sheep/Goats	Pig	Chicken	Duck
No. of Head	2,487,752	138,978	2,532,875	-	28,918,533	261,537

Source:LBVD

X.2 Animal Products Production per Year (2013)

	Beef (viss)	Mutton (viss)	Pork (viss)	Chicken (viss)	Duck (viss)	Milk (viss)	Chicken Egg (No.)	Duck Egg (No.)
Production	NA							

Source:LBVD

X.3 Unit Price of Live Animal per Head (2013)

Goat/Sheep	Pig	Chicken	Duck
NA			

Source:LBVD

Y. Land Classification and Soil Types

Y.1 Land Types ←Acquire the land classification map, if available

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X
99	180	533	1648	146	214	-	-	-	-

Source. JICA Report for Poverty Reduction in CDZ, MAS (former)

Legend:

I	Deposit	VI	Dissected Plateau
II	Alluvial	VII	Plateau
III	Terrace	VIII	Hilly
IV	Footplain	IX	Mountain
V	Plateau	X	Upland plateau

Y.2 Soil Types → Refer to the soil characteristics map

Acreage by Soil Type (unit:Acre)								
Meadow Alluvial Soils (Gleysol)	Meadow Carbonate Soils (Gleysol)	Catena of Savanna Soils on slopes & Compact Soils in Depretion (Luvisol)	Compact Soils (Vertisol)	Turfy Primitive Soils (Lithosol)	Primitive Crushed Stones Soils	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other
485	647	2,144	92	736	1,819	677	1,422	465

Source. DOA Regional offfice

Z. Recommendable Countermeasures against Dry Climate and Sandy Soil

1 to use drought tolerant varieties
2 To improve soil quality by applying compost
3 Growing of windbreaker trees for prevention of win erosion
4
5
6

Source. DOA Division office

Aa Frequewncy of Damage in the Region

1 Drought: every year
2 Flood: *** times every *** years
3 Insect damage: *** times every *** years
4 Pest damage: *** times every *** years

Ab Agricultural Development Plan in the Region

1 Seed production (HYV)
2 Extension of useful technology of farmers
3 Demonstrate and growing with Good Agriculture Practice (GAP)
4
5

Ac Crops and its Varities Promoting in the Region (mainly upland crops)

1	Crop name: Groundnut	Variety: Hainan	Objective Townships: Magway	
2	Crop name: Green gram	Variety: Black	Objective Townships: Magway	
3	Crop name: Chick pea	Variety: Yezin-11 &14	Objective Townships: Magway	
4	Crop name: maize	Variety: ICCV-88202, 92944	Objective Townships: Pwintbyu, Salin, Minbu	
5	Crop name:	Variety: Yezin-7 & 14	Objective Townships: Taungdwin Gyi	
6	Crop name:	Variety:	Objective Townships:	
7	Crop name:	Variety:	Objective Townships:	
8	Crop name:	Variety:	Objective Townships:	

Ad Problems in the Agriculture in the Region (mark all that apply)

☐ Lack of irrigation water ■ Drought ☐ Low agricultural technology ■ Low farmgate price of crops
■ High cost of agricultural chemicals ■ Soil erosion by rain ■ Soil erosion by wind ■ Poor soil fertility
■ High cost of fertilizers ☐ Monoculture ☐ Lack of draft cattle ■ Poor agricultural credit system
☐ Inadequate production of quality see ☐ Erratic rainfall

Other issues:

1
2
3
4
5

Ae Agricultural Development Plan in the Region←acquire document if available (mainly on upland crops)

1
2
3
4
5

Af Agricultural Development Plan in the concerning TS ←Acquire document if available(mainly on upland crops)

1
2
3 NA
4
5

3. Agricultural Production Survey

Region: Nay Pyi Taw

A. Organization Chart of the Department of Agriculture in the Region Office→Refer to the organization chart

Was the number of staff in the DOA Division office changed after organizational change from MAS to DOA? ☐Yes, ■No

If Yes, how many staff increased or decreased? Inreased: - persons, Decreased: - persons

Annual budget of the DOA's Region office: 481 million Kyat/year (2012-13),

B. Land Type in the Region (year:2011-2012) (unit:acre)

Total Area	Reserved Forest s	Current Fallows	Net Sown Area	Occcupied Area	Cultivable waste	Other wood land	Others
(1) to (7)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1,494,184	793,596	0	27,740	0	8,289	298,398	366,161

Source: DOA's Land Use Division

C. Agricultural zoning of the Region

According to the Zoninig in Myanmar, in which zone the Region calsified Refer to the zoning map

In the Region, is there any zoning about upland/paddy, soil, water sources by Township basis? Refer to the soil characteristic map and acreage by land type

Result of the typology studied in the Development Study of JICA ←Refer to the JICA Report (map and table)

D. Breakdown of the cultivated land in the Region Unit:Acre

Total Cultivated	Total Paddy	Total Yar Land	Total Kaing	Total Kyun	Others
(1)+(2)+(3)+(4)+(5)	(1)	(2)	(3)	(4)	(5)
277,395	160,634	115,254	0	0	1,507
100%	57.9%	41.5%	0.0%	0.0%	0.5%

Note: Yar: upland
Kaing: Cultivable land on River terrace
Kyun: Cultivable land on river bed

Source: Land Use Division, DOA Regional Office

E. Seed farm and experimenatl station in the Region

	Agent	Location (TS)
Seed farm	DOA	None
State farm	DOA	None
Research center & Satellite	DAR	Satellite:Tatkon

Source: DOA HQ in Nay Pyi Taw and DAR in Yezin

F. Irrigated Area

Paddy Field	Upland	Total	Ratio of Irrigated Area
78,623	0	78,623	28.3 (%)

Source:DOA Regional Office

Irrigable area in the region on Map←Acquire existing Map of irrigated area in the region

Irrigated area by District/Township basis, if available (ac)

District	Paddy Field	Upland	Main water source
Tatkon	31,280	-	River water
Zayarthiri	9,213	-	River water
Pyinmana	11,658	-	River water
Lewe	20,842	-	River water
Oatayathiri	145	-	River water
Pobathiri	1,725	-	River water
Zabuthiri	1,114	-	River water
Datkhinathiri	2,646	-	River water

G. Existing Irrigation Water Sources in the Region←Acquire inventory of irrigation facilities if available at ID

G.1 Number of farm ponds NA places, of which, how many are in service now? NA places

G.2 Number of pump stations NA places, of which, how many are in service now? NA places

G.3 Irrigated area by river water 78,623 Acres, of which, how many acres are irrigated by canal (gravity)? NA Acres

G.4 Irrigated area by groundwater NA Acres (pump irrigation)

G.5 Irrigated area by farm ponds NA Acres

Source. ID provincial office

H. Irrigated crops in the Region

■ Paddy ☐ Sesame ☐ Groundnut ☐ Pigeon pea ☐ Chick pea ☐ Onion ☐ Watermelon ☐ Maize ☐ Sorghum
☐ Chili ☐ Tomato ☐ Potato ☐ Other vegetables ( )

I. Irrigation method practiced in the Region

■ Canal (gravity) ☐ Pump ☐ Sprinkling can ☐ Drip irrigation ☐ Treadle pump

J. Utilization and management of irrigation water←ask at ID and WRUD

How the irrigation facilities are managed?

	Constructed by	Management body	Duty of water users	Management method
Irrigation cana	■ID, ☐WRUD	■ID, ☐WRUD	water charge	
Pump station	☐ID, ☐WRUD	☐ID ☐WRUD		
Farm pond		☐Villagers		

K. Water charge and Land Tax

K.1 Water charge Paddy field 1,950 Kyat/ac/year, Upland - Kyat/ac/year

K.2 Land Tax Paddy field 6.5 Kyat/ac/year, Upland 3.25 Kyat/ac/year

K.3 Collection rate of water charge NA %(20**) ←ID?

K.4 Collection rate of land tax NA %(21**) ←SLRD

L. Do farmers apply any kind of water-saving technologies in the Region? ■ Yes, ☐ No

If Yes, Please tell us the technologies.

☐Drip irrigation ■ Mulching ☐Treadle pump ☐ Water harvesting ( )

M. Is there any farmers who still apply Technologies introduced from outside (Donours etc) ☐ Yes, ■ No

If Yes, What is the reasons for sustainable practice of those technoligies?

N. Number of Farm Household by Farm Size (year:2013)

Less than 5 ac	5-10 ac	10 -20 ac	Above 20 ac	Total
40,426	9,578	2,165	340	52,509
77.0%	18.2%	4.1%	0.6%	100 %

Source. DOA TS, difrent from the data from DOA Nay Pyi Taw

Average Farm Size per Farm Household		Source
4.57	ac	DOA, NPT
5.28	ac	DOA TS

O. Precipitation and Temperature

O.1 Fluctuation of the annual rainfall in the past 10 years (inch)

2003 yr.	2004 yr.	2005 yr.	2006 yr.	2007 yr.	2008 yr.	2009 yr.	2010 yr.	2011 yr.	2012 yr.	Average
47.01	49.67	53.70	57.05	51.38	50.08	33.19	52.99	63.74	36.65	49.55

O.2 Rainfall by month for 10 years (inch)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2003	0.98	1.69		2.37	4.09	9.48	2.52	7.78	9.18	8.98			47.07
2004				0.48	9.14	5.87	10.00	9.93	7.02	6.40	0.83		49.67
2005			0.08	0.63	1.73	8.07	8.27	15.63	10.71	5.35	2.21	1.02	53.70
2006				5.46	6.90	5.48	10.35	12.99	8.62	5.24	2.01		57.05
2007		0.83		0.08	8.30	8.51	8.58	8.42	6.11	6.81	3.74		51.38
2008	0.39		0.08	1.18	6.85	9.73	12.32	5.43	2.60	11.38	0.12		50.08
2009			0.16	1.34	5.43	4.05	6.78	9.37	3.15	2.91			33.19
2010	0.04		0.12		7.40	7.56	10.35	10.63	7.17	9.13		0.59	52.99
2011	1.77	0.12	1.14	2.95	6.93	9.53	3.94	12.91	14.65	9.37	0.19	0.21	63.71
2012				1.22	1.22	7.99	10.67	9.06	3.46	0.39	0.12	2.52	36.65

O.3 Lowest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003	15.6	17.2	21.1	25.6	25.0	24.4	25.0	24.4	24.4	24.4	18.3	20.0	22.1
2004	15.0	16.1	21.7	24.4	25.6	25.0	23.9	24.4	25.0	26.7	21.1	16.7	22.1
2005	16.1	18.3	23.3	25.0	26.1	25.0	25.0	24.4	25.0	24.4	21.7	19.4	22.8
2006	17.2	18.3	22.2	24.4	25.0	23.9	24.4	24.4	25.0	23.9	21.1	16.1	22.2
2007	15.6	17.2	20.6	25.0	23.3	25.0	24.4	24.4	24.4	23.3	21.1	18.9	21.9
2008	15.6	21.7	21.1	25.0	24.4	25.0	24.4	23.9	24.4	23.3	20.0	16.7	22.1
2009	16.7	17.8	21.7	25.6	26.1	24.9	24.4	24.4	25.0	24.4	20.6	14.4	22.2
2010	15.0	15.6	20.0	24.4	25.0	24.4	24.4	24.0	23.7	23.0	18.3	15.7	21.1
2011													
2012													

O.4 Highest Temperature by month for 10 years (℃)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2003	30.6	33.9	37.2	38.9	35.6	31.7	33.3	32.2	32.8	33.9	3.9	32.2	31.4
2004	32.2	35.6	38.3	40.0	35.0	32.8	31.1	30.6	31.7	31.7	34.4	32.2	33.8
2005	32.8	37.2	38.3	38.9	38.3	32.8	32.2	30.6	31.7	34.4	32.2	28.9	34.0
2006	31.1	35.0	38.3	37.8	33.9	33.3	31.1	31.7	32.8	33.3	32.2	31.1	33.5
2007	32.2	33.3	37.8	40.0	34.4	33.3	30.6	31.1	32.8	32.8	31.1	31.7	33.4
2008	32.8	33.9	37.8	39.4	33.3	32.2	30.0	31.7	32.8	32.8	32.8	31.7	33.4
2009	32.2	36.1	37.8	37.8	37.2	32.8	31.1	31.7	33.9	34.4	35.0	32.2	34.4
2010	33.9	36.7	38.3	41.7	38.3	33.9	33.3	32.4	33.2	32.5	32.9	31.2	34.9
2011													
2012													

P. Crop Production (year: 2007)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				#DIV/0!
Summar paddy				#DIV/0!
Pigeon pea				#DIV/0!
Maize				#DIV/0!
Sesame				#DIV/0!
Groundnut		NA		#DIV/0!
Green Gram				#DIV/0!
Sorghum				#DIV/0!
Chickpea				#DIV/0!
Sunflower				#DIV/0!
Soybean				#DIV/0!
***				#DIV/0!
***				#DIV/0!

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion				#DIV/0!
Chili				#DIV/0!
Potato				#DIV/0!
Toddy				#DIV/0!
Tomato		NA		#DIV/0!
Cucumber				#DIV/0!
Carrot				#DIV/0!
Okra				#DIV/0!
Leafy vegetables				#DIV/0!
Eggplant				#DIV/0!
Watermelon				#DIV/0!

Crop Production (year: 2008-2009)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				
Summer paddy				
Pigeon pea				
Maize				
Sesame				
Groundnut		NA		
Green Gram				
Sorghum				
Chickpea				
Sunflower				
Soybean				
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion				
Chili				
Potato				
Toddy				
Tomato		NA		
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2009-2010)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy				#DIV/0!
Summer paddy				#DIV/0!
Pigeon pea				#DIV/0!
Maize				#DIV/0!
Sesame				#DIV/0!
Groundnut		NA		#VALUE!
Green Gram				#DIV/0!
Sorghum				#DIV/0!
Chickpea				#DIV/0!
Sunflower				#DIV/0!
Soybean				#DIV/0!
Black gram				
Butter bean				

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion				#DIV/0!
Chili				#DIV/0!
Potato				#DIV/0!
Toddy				
Tomato		NA		
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2010-2011)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	157,378	157,284	13,537,184	86.1
Summer paddy	18,012	18,012	1,667,883	92.6
Pigeon pea	297	297	3,730	12.6
Maize	14,959	14,959	924,569	61.8
Sesame	60,276	60,192	494,969	8.2
Groundnut	46,029	46,020	2,283,470	49.6
Green Gram	70,957	70,957	1,060,193	14.9
Sorghum				#DIV/0!
Chickpea	1,447	1,447	25,293	17.5
Sunflower	13,968	13,968	309,036	22.1
Soybean	517	517	4,265	8.2
Black gram	65,659	65,659	1,248,062	19.0
Lablab bean	13,478	13,478	191,257	14.2

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	1,801	1,801	5,405,991	3,001.7
Chili	6,508	6,508	1,341,234	206.1
Potato	2,061	2,061	11,501,800	5,580.7
Toddy				
Tomato				
Cucumber				
Carrot				
Okra				
Leafy vegetables				
Eggplant				
Watermelon				

Crop Production (year: 2011-2012)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	163,206	163,104	13,962,863	85.6
Summer paddy	21,941	21,941	2,082,044	94.9
Pigeon pea	1,160	1,160	15,655	13.5
Maize	16,726	16,726	1,033,741	61.8
Sesame	59,005	59,005	480,546	8.1
Groundnut	46,853	46,853	2,348,934	50.1
Green Gram	67,402	67,402	1,107,375	16.4
Sorghum				#DIV/0!
Chickpea	1,686	1,686	28,576	16.9
Sunflower	11,027	11,027	244,387	22.2
Soybean	464	464	3,837	8.3
Black gram	67,778	67,767	1,302,218	19.2
Lablab bean	11,221	11,221	157,704	14.1

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	31,467	31,467	13,465,660	427.9
Chili	4,306	4,306	1,264,735	293.7
Potato	7,546	7,546	3,242,008	429.6
Toddy				
Tomato				
Carrot				
Okra				
Vegetables	14,105	14,105	20,674,581	1,465.8
Eggplant				
Cucumber				
Watermelon				

Source:DOA Regional Office

Crop Production (year: 2012-2013)

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (bskt)	Yield (bskt/ac)
Monsoon paddy	161,899	161,771	13,834,748	85.5
Summer paddy				0.0
Pigeon pea	1,097	1,097	15,227	13.9
Maize	16,088	16,088	1,008,895	62.7
Sesame	65,069	64,959	536,619	8.3
Groundnut	44,920	44,920	2,272,686	50.6
Green Gram	63,650	63,647	1,059,287	16.6
Sorghum				#DIV/0!
Chickpea	4,080	4,072	75,491	18.5
Sunflower	3,885	3,885	92,558	23.8
Soybean	393	393	3,225	8.2
Black gram	76,232	76,231	1,465,954	19.2
Lablab bean	12,364	12,364	181,663	14.7

Crop	Net Sown Area (ac)	Harvested Area (ac)	Production (biss)	Yield (biss/ac)
Onion	1,592	1,592	5,183,560	3,256.0
Chili	5,567	5,567	1,854,127	333.1
Potato	1,929	1,929	10,942,100	5,672.4
Toddy				
Tomato				
Carrot				
Okra				
Vegetables	14,685	14,685	20,240,332	1,378.3
Eggplant				
Cucumber				
Watermelon				

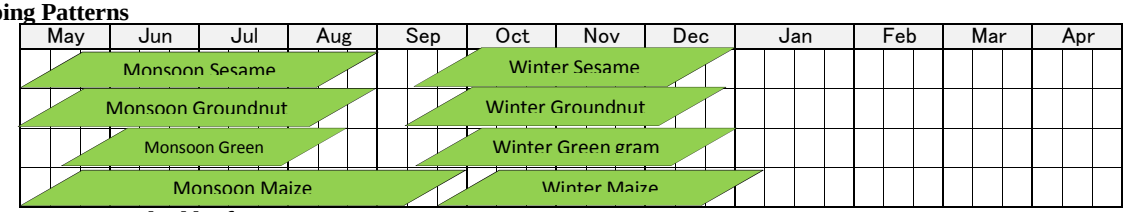
Q. Farmgate Price (year: 2012)

Crop	Farmgate Price	Crop	Farmgate Price
Monsoon paddy		Onion	
Summer paddy		Chili	
Pigeon pea		Potato	
Maize		Toddy	
Sesame		Carrot	
Groundnut		Leafy vegetables	
Green Gram	NA	Eggplant	NA
Sorghum		Okra	
Chickpea			
Sunflower			
Soybean			
***			
***			

R. Crop Varieties (Top 3 varieties)

Crop	1	2	3
Monsoon paddy	Manaw Thuka	Sin Thukha	Pearl Thwe
Summer paddy	Shwe Thwe Yin	Manaw Thuka	Sin New Yin
Pigeon pea	Shwe dinga		
Maize	CP888	008	
Sesame	Sinpadanar-3	Red seame	25/160
Groundnut	SP121	Sinpadanar-7	
Green Gram	Yezin-5	Yezin-9	
Sorghum			
Chickpea	ICCV-2	Yezin-4	
Sunflower	Sin Shwekyar-3	Yezin hybrid-1	
Soybean			
Black gram	LBG-17	Yezin-3	
Lablab bean	Shwe Yinmar	Shwe Kyun	
Onion			
Chili			
Potato			
Toddy			
Tomato			
Eggplant			
Carrot			
Eggplant			
Cucumber			
Watermelon			

S. Cropping Patterns



T. Farm management method by farmers

Crop	Plowing by	Harrowing by	Weeding by	Dosage of fertilizer/ac	Frequency of spraying	Harvesting by	Irrigated by
Monsoon paddy	Bull and tractor	Bull and tractor	Labour	50 kg/ac (15-15-15) Ure 25kg/ac	2 to 3 times	Labour	Canal
Summer paddy	Bull and tractor	Bull and tractor	Labour		do	Labour	
Pigeon pea	Bull and tractor	Bull and tractor	Labour		-	Labour	
Maize	Bull and tractor	Bull and tractor	Labour			Labour	
Sesame	Bull and tractor	Bull and tractor	Labour		-	Labour	
Groundnut	Bull and tractor	Bull and tractor	Labour		-	Labour	
Green Gram	Bull and tractor	Bull and tractor	Labour		5 times	Labour	
Sorghum	Bull and tractor	Bull and tractor	Labour			Labour	
Chickpea	Bull and tractor	Bull and tractor	Labour		-	Labour	
Sunflower							
Soybean							
***							
***							
Onion							
Chili							
Potato							
Toddy							
Tomato							
Carrot							
Eggplant							
Okra							
Leafy vegetables							
Cucumber							
Watermelon							

U. How often do farmers in the Region renew seeds?

Paddy	☐ Never	☐ Every year	☐ Every 2 years	■ Every 3 years	
Oil crops	☐ Never	■ Every year (groundnut)		■ Every 2 years (sesame)	
Pulses/beans	■ Never	☐ Every year	☐ Every 2 years	☐ Every 3 years	☐ Every 5 years
Fodder crops	☐ Never	☐ Every year	☐ Every 3 years	☐ Every 4 years	
Vegetables	☐ Never	■ Every year	☐ Every 4 years	☐ Every 5 years	

V. Limiting factors on agricultural production (mark all that apply)

☐ Pest and insect control ☐ High cost of chemicals ☐ Drought ☐ Flood damage ☐ Erratic rainfall
■ Lack of money ☐ Poor soil ☐ Lack of draft cattle ■ Water shortage ☐ Soil erosion

W. What kind of disaster or damage did the Region have experienced to date? (mark all that apply)

■ Pest and insect control ☐ Drought ☐ Flood damage ☐ Erratic rainfall ☐ Soil erosion ☐ Others ( )

Frequency of disasters

Disaster	Frequency	Season (month)	Years the disaster	Disease & Insect name	Crops damaged	How damaged in %
Pest	Paddy	Jan	2013	yellow mosaic		10
Insect						
Drought						
Flood						
Soil erosion				-		

Disaster map →NA

Township name where disaster occurred

Disaster	TS name disaster occured
Pest	Lewe and Pyinmana TSs
Insect	
Drought	
Flood	
Soil erosion	

X. Livestock

X.1 Number of Livestock and Number of Households Raising Livestock (2012-2013)

	Cattle	Buffalo	Sheep/Goats	Pig	Chicken	Duck
No. of Head	228,668	68,341	14,210	232,443	2,970,101	85,921

Source:LBVD

X.2 Animal Products Production per Year (2012-2013)

	Meat (viss)	Milk (viss)	Egg (piece)
Production	27,343	10,330	230,720

Source:LBVD

X.3 Unit Price of Live Animal per Head (20**)

Goat/Sheep	Pig	Chicken	Duck
		NA	

Source:LBVD

Y. Land Classification and Soil Types

Y.1 Land Types ←Acquire the land classification map, if available

Acreage by Land Type (unit:Acre)									
I	II	III	IV	V	VI	VII	VIII	IX	X

Source. JICA Report for Poverty Reduction in CDZ, MAS (former)

Legend:

I	Deposit	VI	Dissected Plateau
II	Alluvial	VII	Plateau
III	Terrace	VIII	Hilly
IV	Footplain	IX	Mountain
V	Plateau	X	Upland plateau

Y.2 Soil Types → Refer to the soil characteristics map

Acreage by Soil Type (unit:Acre)								
Meadow Alluvial Soils (Gleysol)	Meadow Carbonate Soils (Gleysol)	Catena of Savanna Soils on slopes & Compact Soils in Depretion	Compact Soils (Vertisol)	Turfy Primitive Soils (Lithosol)	Primitive Crushed Stones Soils	Light Forest Soils (Nitosol)	Yellow Brown Dry Forest and Indaing (Xanthic Ferralsol)	Other

Source. DOA Regional offfice

Z. Recommendable Countermeasures against Dry Climate and Sandy Soil

1 Nothing. There is no serious dry climate in the Nay Pyi Taw Council Area
2
3
4
5
6

Source. DOA Division office

Aa Frequewncy of Damage in the Region

1 Drought:		every year			
2 Flood:	***	times every	***	years	
3 Insect damage:	***	times every	***	years	
4 Pest damage:	1	time every	5	years	

Ab Agricultural Development Plan in the Region

1 Construction of mechanized farming
2 Production of hybrid paddy
3
4
5

Ac Crops and its Varities Promoting in the Region (mainly upland crops)

1	Crop name: Monsoon paddy	Variety: Sin Thu Kha	Objective Townships: 94% of Nay Pyi Taw Council Sarea
2	Crop name: Monsoon paddy	Variety: Sin Thwelat	Objective Townships: do
3	Crop name: Green gram	Variety: Sin-14	Objective Townships: Tatkone
4	Crop name: Black gram	Variety: Yezin-2	Objective Townships: All of the eight (8) townships in Nay Pyi Taw
5	Crop name: Groundnut	Variety: Sin-11	Objective Townships: Tatkone, Lewe, Zayarthiri, Pobathiri
6	Crop name: Sunflower	Variety: Yezin hybrid-1	Objective Townships: Tatkone, Lewe, Zayarthiri, Pobathiri
7	Crop name: Maize	Variety: UH-008	Objective Townships: Tatkone, Lewe, Zayarthiri, Pobathiri
8	Crop name:	Variety:	Objective Townships:

Ad Problems in the Agriculture in the Region (mark all that apply)

☐ Lack of irrigation water ☐ Drought ☐ Low agricultural technology ■ Low farmgate price of crops
■ High cost of agricultural chemicals ☐ Soil erosion by rain ☐ Soil erosion by wind ☐ Poor soil fertility
☐ High cost of fertilizers ☐ Monoculture ☐ Lack of draft cattle ☐ Poor agricultural credit system
☐ Inadequate production of quality see ☐ Erratic rainfall

Other issues:

1
2
3
4
5

Ae Agricultural Development Plan in the Region←acquire document if available (mainly on upland crops)

1
2
3 NA
4
5

Af Agricultural Development Plan in the concerning TS ←Acquire document if available(mainly on upland crops)

1
2
3 NA
4
5

Appendix-13 Marketing Survey

Market Needs Survey at Vegetable and Fruits Wholesale Markets in Mandalay

Market Name	Crop Name	Origin of product	Price	Market Needs (Determinant of Price)
Thiri Marlar Market (Mandalay)	Cabbage	Myingya (Mandalay) Shwebo (Sagaing)	Mar (600K/viss) Apr-May (500K/viss)	・ Appearance; freshness is important ・ Size; bigger is better ・ Wormholes; reduces prices by 100 kyat (primary factor; pesticide) ・ Color; a bit dark green is better (primary factor; fertilizer) ・ Variety; “crown” and “5-8-8” from Japan is good ・ Too much rain rots from the bottom
	Tomato	Monywa (Sagaing) Shwebo (Sagain)	Mar. (800-1000K/viss) Apr (1100-1300K/viss)	・ Hardness; harder is better, making 200 k/viss price difference ・ Color; Red, Orange, Green, makes 200 k/viss price difference ・ Size; large size goes to restaurant, small size goes to retailers ・ 1 basket has no discount, 10 basket with discount of 50K/basket ・ Variety; “901” is good
	Onion	Myingyan (Mandalay) Monywa (Sagaing) Pakokku (Magway) Myittha (Kayukse)	Mar (300-400K/viss) Apr (350-450k/viss) May (150-200k/viss)	・ Size makes price differences ・ Closed Peel > Broken Peel (closed peel can be kept longer and has good appearance) ・ Color; light purple > dark purple (consumer prefer light color) ・ Location; product from Myittha is good (looks young, sweet due to irrigation) ・ Onion from India is not good (but sometime is imported due to drought)
	Garlic	Myingya (Mandalay) Monywa (Sagaing) Pakokku (Magway) Myittha (Kayukse)	Mar (800-1300K/viss) Apr (1000-1500K/viss)	・ Closed Peel > Broken Peel (closed peel can be kept longer and has good appearance) ・ Size and amount is one of determinant of price differences ・ Form; Flat and Round, but no price differences ・ Garlic from China is small but price is higher due to transportation
	Carrot	Maymyo (Mandalay)	Apr (400K/viss)	・ Color; same color from bottom to top makes higher price (600K/viss), while carrot which has dark color on the top commands s lower price (400K/viss) ・ Form; straight is better ・ Variety; hybrid variety is better
Kaing Den Market (Mandalay)	Onion	Monywa (Sagaing) Myingyan (Mandalay) Myittha (Kayukse) Pakokku (Magway)	Mar-Apr (from CDZ) Jun. (from Shan) Dec-Jan (from Nahtoe Gyi) Mar-Apr (350-450K/viss)	・ Production Area; Myittha is famous for good quality (good looking, do not change color after frying, keeping yellow not change to brown), Onion from Myittha is 100K/viss higher than others. ・ Taste; Sweet one is better ・ Color; Gold > light color > dark purple

			Dec-Jan (1400K/viss)	・ Peel; thin has better taste ・ Form; flat and round is better than long one
	Grape	Yamethin (near Meiktila)	Retail; 2000K/viss (wholesale; 1200 K/viss) Apr (4000K/viss, highest) Jul (1000K/viss, lowest)	・ Made in China is bigger and no seed (10,000K/kg) ・ Form; longer (Kyonli variety) is sweeter (3000K/viss). ・ No cold storage in the market

Source) Market Needs Survey (April 30, 2013)

Subject	Marketing Survey
Date	April 30 (Tue), 2013　10:00～12:00
Place	Broker, Miller and Traders Maha Kahtaintaw Association (Mandalay)
Persons Met	U Thein Tun (Chairman) U Chun (Secretary-1) U Khin Mg Kyaw (Accountant-1)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Brochure of the Association ・ Mandalay Market Daily Price Sheet ・ Rules and Regulation of the Association

1) Organization

- The association is Non Government Organization which was established in 1935 (78 years ago). The new building was constructed in 2009 (4 years ago). The association is operated by 15 chief executive committee members with 15 permanent employees, and has 2,000 members consisting of traders, millers and brokers.
- The association has 10 committees that includes 1) collection of donation, 2) social welfare, 3) regulation, 4) members and representatives, 5) problem solving, 6) media, 7) oil seed crops, 8) price recording, 9) construction, maintenance and repairing, 10) woman support.
- Major activities of the association are; provision of place for trading (crop exchange center), monitoring of transaction, solving problems among traders, and collection of donation.
- Annual member fee is 50,000 kyat/ person/ year, and admission fee is 500,000 kyat with 200,000 kyat for 2 representatives.

2) Transaction in the exchange market

- The crop exchange market is operated 6 days in a week, starting from 8am to 11am.
- Around 70 to 90 pulses are transacted in addition to oil seeds (sesame, groundnut) and cereals (maize and wheat).
- Basically, the association provide place for transaction to members. Only members can enter the transaction venue and each wholesaler can have their own table. Members include exporters, millers, and processors.

3) Market chain

- Farmers bring their products to nearby city, where brokers collect products to bring large cities including Yangon and Mandalay.
- The crop exchange market is wholesale trading center where brokers bring sample of products and negotiate with traders, millers and processors by face to face negotiation.
- Outline of transaction at the crop exchange market are summarized in the table below.

Outline of Transaction at Broker, Miller and Traders Maha Kahtaintaw Association (Mandalay)

Crop Name	Product Inflow	% from CDZ	Export/ Import	Domestic Market	Market Needs (Determinant of Price)
Sesame	Feb-Mar (Rakhine) Mar-Apr (CDZ, Irrigated) Aug-Sep (CDZ, Rainfed)	75%	Export Black sesame to Japan	Whole country	・Black (3,500k/viss) > White (2,850K/viss) > Brown (2,400K/viss) ・Black seed is originally from Japan and export to Japan
Sunflower	Not so many transaction	-	- (Imported from China)	Whole country	・Quality of Myanmar product is low, China is higher and size is larger
Groundnut	Nov.-Jan.(Shan) Jan.-Mar. (Delta) Apr.-Jun. (CDZ, Irrigated) Aug-Sep (CDZ, Rainfed)	70%	Export (70% of trading volume) Mostly to China	Domestic Market (30%)	・Quality is almost same among production places ・Spanish variety is white and round shape, whereas Japanese variety is red and longer ball shape
Green Gram	Mar-Apr (CDZ, Irrigated) Jun. (Delta) Aug-Sep (CDZ, Rainfed) Dec. (Delta)	75%	Export (60%) Mostly to India and China, China also buy from Delta	Domestic Market (40%)	・Productivity in Delta is higher than CDZ ・Size of CDZ product which goes to India is smaller, whereas that of Delta which goes to China is larger
Chick Pea	Feb-Mar (CDZ)	100%	Very few for export	Yangon (1/3), Magway (1/3), Pyay (1/3)	・Variety from Pyey (Mya Kyae Mon) is larger, but volume is not so large
Pigeon Pea	Jan-Feb (Shan) Feb-May (CDZ)	70%	Export (80%) Mostly to India	Domestic Market (20%)	・Variety from CDZ (ICCV2, ICCV3) is good and price is higher, while that from Shan is lower since moisture content is high and many worms

Source) Broker, Miller and Traders Maha Kahtaintaw Association, Mandalay (April 30, 2013)

Subject	Marketing Survey
Date	May 1 (Wed), 2013　10:00～12:00
Place	Maha Kahtaintaw Association of Broker, Miller and Traders, Monywa (Saganing)
Persons Met	U Myo Min (Chairman of Commodity Exchange Center) U Tun Tun (Secretary of MTC) U Palik Kyaw (Member)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Brochure of the Association ・ Mandalay Market Daily Price Sheet

1) Organization

- The association was established in 1991, and at present, has 560 members with 59 board members.

2) Activity

- Main activity of the association is operating Commodity Exchange Center for members. The Commodity Exchange Center provides place for trading pulses and beans, oil seeds and cereals (maize).
- The association monitors daily transaction in view of fair trade and appropriate prices, conducted between traders, millers and buyers.
- The association also record daily commodity price.

3) Trading Situation

- In the Commodity Exchange Center, around 32 to 40 kinds of commodities are transacted.
- Major pulses for international trade are; Chick Pea, Pigeon Pea, and Green Gram.

4) Other

- **"SGS (Myanmar) Ltd."** in Yangon is an agriculture product inspector, established in 1948 with over 70 full time employees. SGS inspects Rice, Broken Rice & Rice Bran, Beans & Pulses, Yellow Maize, Sugar, Oil Seeds, Rubber, Cotton, Timber and other Agricultural Products. The firms service includes 1) Supervision of Loading / Stuffing, 2) Weight determination, 3) Quality inspection, 4) Quantity inspection, 5) In Land Services (Cargo receiving and preparation at warehouses and rice mills).

  Address : 79/80 bahosi Housing Complex, Wardan Street Lanmadaw Township, Yangon

  Phone : +95(1)220 225, 211 537-38

  Fax : +95(1)211 548-49

  Email : sgs@myanmar.com.mm

  Website' http://www.sgsmyanmar.com/

- Outline of transaction at the crop exchange market are summarized in the　table below.

Outline of Transaction at Maha Kahtaintaw Association of Broker, Miller and Traders, Monywa (Sagaing)

Crop Name	Product Inflow	% from CDZ	Export/ Import	Domestic Market	Market Needs (Determinant of Price)
Sesame	Feb-Mar (CDZ*, winter) May-Jun (CDZ*, premonsoon) Jul-Aug (CDZ*, monsoon) * CDZ (Sagaing, Mandalay)	90%	Export (60-70%) via Yangon, White sesame goes to China	Mostly purchased by Oil Millers	・Color, oil content, freshness, cleanliness, flavor, and smell are main check point of procurement. ・For oil contents, more than 40% is good, and price difference by oil contents is 1000 to 2000 K/basket (=15viss). ・Colors are Red, White, Black and Brown sesame, but Red is most oily and has highest demand. Next is White, and is most expensive due to international (China) demand. China prefers "White" for traditional food and medicine, while Japan prefers "Black". ・ "Magway sesame" is the best, and next is "Aung Lam" (near Pyay) due to weather condition, soil type, and good farming practice.
Sunflower	Dec (Ayardaw and Butalin in Sagaing) Aug (Kalay in Sagaing, but rare case)	100%	Imported from Germany	100% (Oil, feed, and seed)	・Sunflower oil is mostly for own consumption. Farmers extract oil by themselves. ・Oil extracting skill is not good, because smells remain in the oil. Removing smell from oil is subject to be considered.
Groundnut	Jul-Aug (CDZ, rainfed) Oct-Nov (CDZ, but rare case) Dec-Jan (Magway)	Sagaing 90%, Magway 10%	Exported indirectly to China via Mandalay	30% for domestic market in Monywa	・Groundnut from Magway is bad quality because good one is exported. ・Main usages in domestic market are oil extraction and snacks. For oil, S1 (Spanish variety) is good. For snacks, size, freshness, color (white and red, but no difference in price) is important. ・Special snack called "Nive Salo"
Green Gram	May-Jun (Chaung Oo TS, Salingyi TS in Sagaing)	100%	Mostly exported (90%) indirectly to China via Mandalay	Very few (10%)	・Big size (Yezin-14 and -11; hybrid variety) is for export to China and India, while small size (local variety) is for domestic consumption. ・Small size (2000k/viss) is more expensive than large size (1500k/viss) ・In 2009, China and India competed in buying Green Gram, but demand in China was higher due to medicinal use and can buy at higher price. Since then China is major buyer of the beans.
Chick Pea	Mar (Chaung Oo and Butalin TS in Sagaing)	100%	Export (40%), India (75-80%), and rests goes Pakistan, Banlgadesh	60% is for domestic consumption	・Color (red, white, yellow) and size (bigger is better) are main determinant of price. Red ("929") is most expensive (1000k/viss), and next is White ("Taiwan", 975k/viss). Cheapest is Yellow ("V2", 950 k/viss) ・Production in Sagaing is 46% of national total. ・Domestic demand is for noodle, curry and snacks

Pigeon Pea	Jun (CDZ; Keni TS, Sagaing)	100%	100% to India via Yangon	No demand in local market	・Color (red, orange, and white) and Size (large, medium, and small) is main determinant of price. ・Small and red is the most expensive (1100k/viss), and next is medium and Red (1075k/viss). The cheapest is large and white (950k/viss). ・Production in Sagaing is one third of national total. ・Buyer of Yangon buys from local trader with 10% commission fee.

Source) Broker, Miller and Traders Maha Kahtaintaw Association, Monywa (May 1, 2013)

Market Needs Survey at Vegetable Wholesale Markets in Sagaing

Market Name	Crop Name	Origin of product	Price	Market Needs (Determinant of Price)
Myi Thalar Market (Monywa, Sagaing)	Onion	Monywa (Sagaing)	Feb-Mar: 250k/viss Mar-Apr: 350k/viss (buy), 380k/viss (sell) May-Jun: increase Oct: Export price is more than 1000k/viss	・Hardness: Harder is better for keeping long time. Price difference between "Hard and closed peel" and "Soft and rotten" is more than 30k/viss. ・Color: Gold color (Shwe Phalar variety) is better than Purple (Padauk Pyun variety). The difference of color makes price gap of around 20-30k/viss. ・Skin (peel): Soft skin is better than hard skin. Soft skin can be cooked more easily and color will change to light brown when fried (hard skin will change to dark brown). ・Size: 1st class (450k/viss), 2nd class (400k/viss), 3rd class (350k/viss), rotten (less than 200k/viss). Big and grow from seedling can be kept for nine (9) months in storage, whereas small and plant from onion itself can be kept for two (2) months only. ・Myittha variety is very good, but it cannot grow Monywa since planting season and farming method (water spray method) is different. ・Trader from China and Malaysia come and buy for export to China, Thailand and India.
	Garlic	1. Myanmar White from Kyee Kone, Monywa (15%) 2. Lae Nyo from Yinmarbin in Sagaing (25%) 3. Pone Taung Pone Nyar from Pakokku (60%) 4. Shan Phyu from	1. Myanmar White: 2000k/viss 2. Lae Nyo: 1600k/viss 3. Pone Taung Pone Nyar: 1200k/viss 4. Shan Phyu: 1200k/viss Mar (beginning): 700k/viss Mar-Apr: 1200-2000k/viss Dec: 3500k/viss	・Myanmar White is easily crashed by hand, and easy to cook and peel, has good taste and flavor, and sweet and mild taste. While Pone Taung Pone Nyar is hot and spicy, not easy to cook due to its hardness. ・Price of garlic in the beginning of March is the cheapest since garlic is still wet and not easy to crashed. At end of March to April, garlic is appropriate to dry and easy to crash by hand. ・Garlic from China and Thai can be seen in the market all year round, but quality and taste is bad. Size is bigger than Burmese variety. Chinese restaurant prefere Chinese variety. ・Pone Taung Pone Nyar can keep 10 months whereas Myanmar White can

		Yawnggy in Shan State (December)		be kept for only eight (8) months.
	Water Melon	Chaung Oo and Butalin in Sagaing Region Mar-Apr: Irrigated Sep: Rainfed	Road side: 500-700k/piece (8-9kg/piece) Border Price: 300k/kg Seedless: 2500k/piece Dark line: 1600k/piece Monotone: 1200k/piece	・ Size: bigger is better ・ Taste: higher sugar contents is better ・ Shape: round is better than long one. If it is export to China, shape and size should be same. The difference makes price difference of 500k. ・ Weight: heaver is better since it may contain much water. ・ Variety: the best variety is “Ohnmar Danti” (red and sweet variety). ・ Farmers usually sell at local market and road side, or to middleman in Monywa TS. Some middleman brings water melon to Wholesale market in Muse (Chinese border) and sells to Chinese middleman. Demand in China market increase in the beginning of March to middle of April.

Source) Market Needs Survey (May 1, 2013)

Subject	Data and Information Collection at Sagaing Region
Date	May 2 (Thu), 2013　13:00～15:00
Place	DOA, Sagaing Regional Office
Persons Met	U Thein Sin (Deputy Director) Daw San San Myint (Staff Officer) U Zaw Naing Win (Sub-assistant Officer, Marketing) U Zaw Than Win (temporally Staff)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Market Price (Wholesale Price) List (12months) ・ Border Trade Statistical Data ・ Market Price Trend in 2012, Sagaing Region (March, 2013) ・ Questionnaire No. 3

1) Marketing in Charge

- Main activity is to collect wholesale price of cereals, oil seed, pulses and selected kitchen crop (tomato) using fixed format and send it to Market Information Service (MIS) in Nay Pyi Taw every Wednesday.
- The wholesale prices are collected at 1) crop exchange center (Maha Kahtaintaw Association of Broker, Miller and Traders, Monywa), 2) Rice miller, and 3) Tomato miller. Tomato is shipped from Southern Shan State. Fruits is excluded since Sagaing has not much fruits and statistically not important for the Government.

2) Fruits

- Dragon fruits: Nyaung Oo and near Mt. Popa is famous, but mostly imported from China and Thailand.
- Mango: mostly come from Kyaukse and Mandalay. Local production is quite a few.
- Banana: Thee Hmway variety (small and slender) come from Nyaungloin Win and Ayardaw TS, while Phee Gyan variety (fat and wider) is from Kain, Butalin, and Ye Oo TS. Season is December to February.
- Grape: coming from Meiktila.
- Plum: coming from Lezin, Aung Thar, and Zee Kyun (all in Sagaing)
- Tamarind: only for home consumption

3) Plant Quarantine

- Sagaing TS has a border town, Tamu TS, at Myanmar-India border, and DOA has quarantine check point at the border. From the border, Ginger, Betele Nut, Turmeric, Green Gram, Pigeon Pea, and Garlic are exported.
- At the border, “Pod Borer” from Chick Pea, Maiz, Cotton and Okra, and “Helicoverpa Armigerce” for Chick Pea, Green Gram, Sunflower and Cotton are current main issues.
- DOA conducts quarantine inspection at border check points including Tar Chi Leik (Thai), Kaw Thaung (Thai), Mydwadi (Thai), Tamu (India), Kan Patti (India), and Muse (China), in addition to Mandalay Airport and Yangon Airport.

Subject	Data and Information Collection at Myingyan TS

Date	May 3 (Fri), 2013　13:00～14:30
Place	DOA, Myingyan TS Office
Persons Met	Daw Kyi (Head Officer) Daw Sandi Win (SAE; Sub-assistant Engineer) (Agronomist, Marketing in Charge)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Questionnaire No. 1 ・ Market Price (Wholesale Price) List (12months) ・ Completion Report for Market Price Trend in 2012, Myingyan TS (March, 2013)

1) Marketing Section

- Marketing section belongs to District Office of Myingyan. Once a week (Wednesday) it gathers wholesale price of selected crops, including rice, pulses, kitchen crops, oilseed crops, and cooking oil, and send the list to MIS in Nay Pyi Taw. The information sources are Crop Exchange Center in Myingyan and Wholesalers ("Pweyone").
- Fruits and vegetables are excluded from the MIS because these products are only for local consumption.
- There are two (2) local market in Myingyan, 1) Aye Mya Thidar (Green Grocery) and Municipal Market. Both markets are controlled by the Municipality. The markets close once a week, Full Moon day.

2) Products

- Major pulses produced in Myingyan are Green Gram, Chick Pea Pigeon Pea, Butter Bean, Soya been. Sesame and Groundnut are major oilseed crops. Sunflower is not popular.
- Onion is most popular crops and 90% of onion is produced under irrigation from tube well and pump. Garlic is only for home consumption.
- Some farmers in Lay Eain Tan Village (near Ayeyar Waddy River), Yathar and Phone Villages try vegetable production including Cabbage, Cauliflower, Radish, Carrot, and Chinese Coriander, and send them to Mandalay and Yangon.
- Harvest season of Cabbage, Cauliflower and Radish are November to December, while that of Carrot and Chinese Coriander are July and August.

3) Market Chain of Pulses in Myingyan

- Pulses and oilseeds are usually harvested with branch, and transported to farmer's backyard by animal cart or tractor. Then farmer remove beans from branch and dry it at their backyard. In some case, for example Groundnut is dried wider space since it takes more space. After drying, farmer removes beans from husk. Richer farmer use Dhall machine (cutter) for this work whereas poorer farmers remove manually.
- Farmers usually bring their product to the center of Myingyan to sell to brokers.
- The brokers bring sample to Commodity exchange center of Myingyan to negotiate with traders, millers and brokers from other Regions. Export goods are transported by large truck to Yangon and Mandalay.

Subject	Market Research at Myingyan Crop Exchange Center
Date	May 4 (Sat), 2013　9:00～12:30

Place	Maha Kahtaintaw Association of Broker, Miller and Traders, Myingyan (Mandalay)
Persons Met	U Myo Aung (Chairman) U Kyaw Aye (Vice-President)
Study Team	Sanyu Consultants Inc. Iriya, Kikuchi
Document Obtained	・ Market Price (Wholesale Price) List (12months)

1) Organization

- The association was established in 1991 to providing equal trading opportunity to members. The association has 350 members with 5 committees including Rice, Onion, Jagali, Oil Crops and Pulses. Oil crops includes Groundnut, Sesame and Cotton seed, while pulses includes Green Gram, Chick Pea, Pigeon Pea, Brack Gram, Lab Lab Bean, and Soya Bean.
- Among the crops transacted in the crop exchange center, Sesame, Groundnut, and Pigeon Pea are profitable, whereas onion is the major agricultural products since it can grow whole year.

2) Wholesale price making

- Basically, prices in the crop exchange center are made by following that of Mandalay. Mandalay's price is recorded at 10:30am every day, and transaction at Myingyan crop exchange center starts 11:30 every morning except the full moon day. Based on the Mandalay's price, traders, millers and brokers in Myingyan negotiate and make decision on their price.
- At blackboard in the Myingyan crop exchange center, demand from buyers with necessary amount and expected price are listed, and providers make decision based on the information at the board.

Outline of Transaction at Maha Kahtaintaw Association of Broker, Miller and Traders, Myingyan (Mandalay)

Crop Name	Product Inflow	% from CDZ	Export/ Import	Domestic Market	Market Needs (Determinant of Price)
Maize	Mar-Apr: Myingyan (summer) Jun-Oct: Shan Nov-Feb: Myingyan (winter) <Wholesale Price> Mar-Apr: 415-420k/viss Jun-Oct: 395-400k/viss Nov-Feb: 475k/viss	20% from Myingyan, 80% from Shan	Export (75%) to China via Muse	Local (25%) to CP (Thai company) for feed.	・Lower moisture content is better. Maize from Shan has higher moisture content (17-18%) than that from Myingyan (14.5%). High moisture content is prone to fungus, heavy to carry, and easily rotten during transportation. Mechanical dryer is used in Shan, while sundry is practiced in the CDZ. ・Color and size: dark yellow color and larger grain is better. ・25% of maize is bought by Myanmar C.P Livestock Co., Ltd, which is a member firm of Thai-based agribusiness conglomerate, Charoen Pokphand Group (CP Group). ・The CP and farmers enter into contract for farming and marketing, and the CP provides farming instruction (skills), seed, and training (at Thailand) to farmers. Price is fixed at the time of contracting, but if price goes down within 2 weeks after the contract, it can be cancelled. If price goes above the contract price, the contract is effective. CP has office in Yangon, Mandalay, Kyaukme (north Shan), and Taunggyi (South Shan).
Sesame	Jun -Jul: Myingyan Aug-Sep: Myingyan and other areas Nov-Dec: Myingyan <Price> Jul: 1800k/viss Dec: 2400k/viss	20% from Myingyan, 80% from Magway, Pakokku, Pyay, Kyauske	Export via Yangon	Mostly sell to Oil Millers in Myingyan (600 millers with 200 oil extracting machine)	・Moisture content: less than 12% is better. Higher moisture content has bad smell, and change color from white to white. Package (plastic bag) also should be dried. ・Sesame with dust and dirt has cheaper price. ・China prefers white sesame for sesame oil and medicine.
Groundnut	Feb-Mar: Winter Apr-May: Summer Sep-Oct: Monsoon	From many places due to lack of supply	Export (15-20%) to Thailand (via Yangon) and China (via Mandalay)	Mostly (80-85%) sell to Oil Millers in Myingyan	・12 to 13% of moisture content is good quality. If moisture content is high, color changes to yellow. ・Monsoon groundnut has the highest price because it has high oil contents. More than 42% of oil content is good product. ・For summer groundnut, more than 36% of oil content is good.

Cotton	Jan-Feb: Myingyan (Summer) Jul-Aug: Magway and Pyay, if amount is not enough) <Wholesale Price> Jan-Feb: 400k/viss Jul-Aug: 400k/viss (375k/viss at Magway and Pyay)	20% from Myingyan, 80% from Other Region	Export (50%) to China and Thailand	Local (50%) to local trader from 2012 (before 2011, Ministry of Industry 1 buys)	・Cotton seed from Myingyan is famous. Its usage is animal feed. ・From cotton tree, 60% of cotton is for soft cotton (cotton yarn, medical use, etc.), whereas 40% is for cottonseed which in turn use for 38% for cotton cake (feed for cow), 125 for cotton oil, and 50% for feed for fish (CP). ・Humidity is one of indicator since moisture content reduces quality of cotton. Moisture content can be checked by hand. ・Dust and dirt also reduce quality of cotton. ・There are four (4) types; 1) long one (1st class), 2) short one (middle class), 3) yellow and 4) summer yellow (low class).
Green Gram	Aug: Myingyan Dec-Jan: Bago, Pyay <Wholesale Price> Aug: 1050k/viss Dec-Jan: 1100k/viss	20% from Myingyan, 80% from Bago, Pyay	Export		・Color: there are two colors, Gold and Green, and Golden is the best quality with no warm. ・Size is also important. In Myanmar, small size is more expensive than larger size. Burmese prefer young, small and soft bean sprouts which is good for soup and salad.
Chick Pea	Mar: Myingyan, in addition to Magway, Monywa, Pakokku	30% from Myingyan, 70% from Other Region	Not sure		・Color and variety is major determinant of price difference. Best variety is “V2 (white)” and next is “Taiwan (yellow)”, followed by local variety “929 (Red)”. “V2” and “Taiwan” is for export, whereas “929” is for local consumption only. ・Freshness, cleanliness, and no warm are also important indicators.
Pigeon Pea	Jan-Feb: Myingyan (it can keep 9 months)	100%	100% export to India via Yangon	0%, There is no demand in Myanmar	・Color: Red has higher price (1035k/viss), whereas White is lower class with price of 1000k/viss. ・Pigeon Pea from CDZ is the best quality. Customer prefers small size which is easy to peel and cook. ・Freshness, cleanliness, and no warm are also important indicators.

Source) Broker, Miller and Traders Maha Kahtaintaw Association, Myingyan (May 4, 2013)

Subject	Interview to Oil Miller
Date	May 4 (Sat), 2013　13:00～14:30
Place	Triple Nine Great Integrity Trading Co., Ltd.
Persons Met	U Aung Kyaw Kyaw (Managing Director)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ non

1) Company

- The company was established in 1990 by Managing Directors' parents. The firm employs 80 staff and run oil milling factory, grain and pulses storage, pulses and oil seed trading, gasoline station, retailing cooking oil at their grocery store, bus transportation, and agricultural production. Agricultural production is still experimental stage and plants organic mango and lime.

2) Trading

- Trading goods are; Maize, Sesame, Pigeon Pea, Green Gram, Groundnut Oil, Cotton, and Palm Oil.
- Cooking Oil: retail price of Groundnut oil is 4000k/viss, and Palm Oil is 2600k/viss. Cotton oil is sold at 1700k/viss and the quality is worse.
- Maize is for feed and 75% of Maize is sold to China while 25% is sold to Myanmar C.P. Livestock*.
- Pigeon Pea: the company buys at 1035k/viss in Myingyan and sells it at 1085k/viss in Yangon. Transportation means is firm's truck (31 ton class truck).

- Cotton is procured from Pyaw Bwe, Pyinmana, Myinmu (Sagaing) and Pyay, and is for oil extraction. From 2012, private company can trade cotton, and Ministry of Industry-1 stop procuring from farmers. The cotton oil is sold at retail shop in Nay Pyi Taw and Shwebo, whereas cotton cake (residual) is sold to fishery company "Htoo Thit".
- Most profitable trading goods are Maize and Pigeon Pea. Farm gate price of Maize is 413k/viss, and wholesale price in Myingyan is 415-420k/viss. At the China border (Muse), Maize is sold at 500k/viss. Distance from Myingyan to Muse is around 400 miles. Pigeon Pea is also profitable since it is also export good.

3) Pulse Trade

- India started buying Pigeon Pea from Tanzania around 2-3 years ago. Tanzania's Pigeon Pea is cheaper than Myanmar's but quality is still better in Myanmar. Due to the situation, Pigeon Pea import of India

from Myanmar decreases around 33%.

4) Oil Cake

Oil Seed	Price of Seed	Price of Cake	Main Usage
Brawn Sesame	2400k/viss	1140k/viss	Cattle, chicken
Groundnut	1750k/viss	900k/viss	Chicken, fish
Niger	1200k/viss	600k/viss	Fish
Cotton	400k/viss	400k/viss	Fish

* Myanmar C.P. Livestock Co,. Ltd.

The Company is the leader and pioneer in the manufacture and distribution of livestock feed in Myanmar. The Company produces livestock feed in the forms of concentrate, powder and pellets for broilers, layers, swine. The Company has a system to randomly check the quality of raw materials and products. The Company has four branches located in Yangon, Mandalay, Kyaut Me and Taung Gyi. Myanmar C.P. Livestock Co,. Ltd. is a member firm of Thai-based agribusiness conglomerate, Charoen Pokphand Group (CP Group).

<Food Business>

Yangon; No. 135, Pyay Road, 8 1/2 miles,
Mayangone Township, Yangon, Myanmar.
Tel: 95- 1- 651324, 651325, 651364, 652081, 660546
Fax: 95-1-663710
E-mail: gm-south@mcpl.com.mm

<Feed Mill>

Yangon; PyinmabinFeedmill,
MingalardonTownship,
Yangon,Myanmar.
Tel: 95-1-600217, 600197, 700572
Fax: 660282
Mandalay; G4(A), Industrial Zone (1). Yangon-Mandalay Road, Aung Thu Kha Soap Factory Avenue, Pyi Gyi Ta Gon Township , Mandalay , Myanmar.
Tel : 02-53269,02-53672

Source: http://myanmarcp.com/CP2011WEB/contant.html

Market Survey at Retail Markets in Nyaung Oo

Market Name	Crop Name	Origin of product	Price	Remarks
Mani Sithe Market (Nyaung Oo)	Eggplant	Apr-May: Pakokku (river side)	Apr-May: 400k/viss (wholesale: 300k/viss)	・Irrigated, price is cheaper in winter, higher in summer
	Tomato	Apr-May: Pakokku (river side) Dec: Nyaung Oo	Apr-May: 1500k/viss (wholesale: 1200k/viss) Dec: 150-200k/viss	・Irrigated
	Okura	Apr-May: Pakokku (river side)	Apr-May: 800k/viss (wholesale: 650k/viss) May: 200k.viss	・Irrigated
	Onion	Mar-Apr: Nyaung Oo Apr-May: Pakokku (river side) Jul-Oct: Yaw TS	Mar-Apr: 200-300k/viss Jul-Oct: 800-1000k/viss	・Irrigated
	Garlic	Mandalay	Low: 1800-2000k/viss High: 2000-2400k/viss	・
	Potato	Taunggyi (Shan)	Apr-May: 1200k/viss (wholesale: 1000k/viss) Dec-Jan: 700-800k/viss	・
	Carrot	All Year: Pakokku (river side)	Apr-May: 500k/viss (Wholesale: 400k/viss)	・Irrigated
	Chili	Apr-May: Pakokku (river side)	Apr-May: 1200k/viss (Wholesale: 1000k/viss) Dec-Jan: 300-500k/viss	・Irrigated
	Coriander	Apr-May: Pakokku (river side)	Apr-May: 3000k/viss (Wholesale: 2500k/viss) Dec-Feb: 200-300k/viss	・Irrigated ・Grown in Green House from April to May
	Water Cresson	All Year: Pakokku (river side)	Apr-May: 100k/band (6peice) (wholesale: 80k/band (6peice))	・It is available whole year round
	Cauliflower	Chanthargyi Village (Pakokku)	Apr-May: 350k/piece (1000k/3 pieces) Dec-Feb: 200k/piece	・Irrigated
	Banana	Kyauk Padaung (near Mt. Popa)	Large: 1500k/hand Medium: 1300k/hand Small: 1000k/hand	・Green Banana is for a votive offering, and its demand is high in this area due to many Pagoda. ・Demand for Green Banana in Bagan (Nyaung Oo) increases during Buddhism festival (Apr, Oct, Nov).
	Mango	The foot of Mt. Popa	Apr-May: 250-330k/piece June: 500k/piece	・Orange and apple come from China via Mandalay
	Grape	Meiktila	Mar: 4000k/viss May: 2500k/viss	・Long shape has high demand
	Watermelon	Katar (Mandalay) Myingyan (Mandalay)	Apr-May: 2000-2500k/piece Nov-Dec: 500-700k/piece	・In winter, there is not so much demand except hotels.
	Gandan	All year: Pyin Oo Lwin	Low: 2100 k/band (5 pieces)	・For a votive offering, and demand increases during

	(flower)	(Mandalay) Dec-Feb: Nyaung Oo	High: 2500 k/band (5 pieces)	Buddhism festival (Apr, Oct, Nov).
	Rose (red)	All year: Pyin Oo Lwin (Mandalay) Dec-Feb: Nyaung Oo	Low: 150 k/band High: 250 k/band	・For a votive offering, and demand increases during Buddhism festival (Apr, Oct, Nov).
	Show (flower)	Pyin Oo Lwin (Mandalay) Dec-Feb: Nyaung Oo	Low: 350 k/band High: 400 k/band	・For a votive offering, and demand increases during Buddhism festival (Apr, Oct, Nov).
	Sesame Oil	Nyaung oo	Apr-May: 3200k.viss Dec-Feb: 800-1000k.viss	・The oil seller buy oilseed from wholesaler and mill by 3 cows at home.
	Groundnut Oil	Nyaung oo	Apr-May:3600-4000k.viss Dec-Feb: more than 5000k/viss	・The oil seller buy oilseed from wholesaler and mill by 3 cows at home.
	Palm Oil	Mandalay	Apr-May:1800k/viss Dec-Feb: 800-1000k/viss	・The oil seller buy oilseed from wholesaler and mill by 3 cows at home.

Source: Market Needs Survey (May 5, 2013)

Note: Tax for selling space (1.5m×2.0m) to Municipal Office is 1000k/month in the retail Market.

Subject	Cotton Market Chain
Date	May 6 (Mon), 2013　9:30～11:30
Place	Department of Industrial Crop Development, Myingyan Township Office
Persons Met	U Tin Aung (Township Officer) Daw Ni Ni Win (Deputy Supertendent)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Brochure of Department of Industrial Crop Development, MOAI ・ Production Record of Cotton, last 10 years

1) Background history of Cotton Sector

- In 2006, in accordance with the decision of meeting No. 39/2006 held by government body on November 19, 2006, five (5) enterprises including Myanmar Cotton and Sericulture Enterprise, Myanmar Jute Enterprise, Myanmar Sugarcane Enterprise, Myanmar Perennial Crops Enterprise and Myanmar Farm Enterprise were reorganized into one commercial enterprise, namely Myanmar Industrial Crops development Enterprise (MICDE).
- However, due to the new government policy that development of high-yielding variety, seed production, and training and extension of important crop sector should be carried out by MOAI, the MICDE was again reorganized into Department of Industrial Crops Development (DICD) by the meeting No. 3/2012 held by the new government body on January 19, 2012.

2) Duty and Function of Department of Industrial Crops Development (DICD)

- To produce high-yield varieties and seeds of industrial crops including sugarcane, cotton, jute, rubber, oil palm, cashew nut and coffee.
- To utilize modern cultivation techniques concerning industrial crops and to provide training and education of the required techniques for the effective utilization of cultivation practices.
- To carry continuous research activities on improvement of good agricultural practices in order to resist disease and bad weather for producing high yield varieties and good quality seeds.

(Source: Brochure of Department of Industrial Crop Development, MOAI)

3) Activities of the office

- Main activities of the Township office are 1) dissemination of advanced technology to farmers, and 2) promotion of good quality seed. For this purpose, the office work with two cotton research and seed multiplication farms under the DICD, Lunkyaw Farm (Kyauske TS) and Shwe Taung (Wantwin TS).

4) Cotton in the Region

- Myingyan is famous for cotton production. In Myanmar, top three (3) cotton producing areas are 1) Yame Thin District, 2) Kyauske District, and 3) Myingyan TS. Therefore, this office is focusing on cotton production.
- Myingyan is also famous for cotton wear including lungi and shirts. It is said that Myingyan's cotton cloth becomes smoother after washing, and good for summer season since it is quite airy. Some Burmese buy “Labyin” cloth in Myingyan for souvenir because of its good quality and cheaper in price.
- Rubber, Sugarcane and jute are famous in Tha Htone, whereas Palm oil is famous in Taninthayi Region.

5) Market Chain

- **Input**: cotton seed is produced at the government farms and is provided to farmers by the government. The government also provides fertilizer to farmers upon requests. The government farm is being transferred to private sector step by step, but the cotton farms are still under the government control.
- **Production**: Cotton production was conducted by Contract Farming. The government provided seed, fertilizer and technical instructions to farmer contractors, whereas farmers had to sell cotton product to the government with the t volume equivalent to the input cost provided by the government prior to the production (seed and fertilizer). The contract is s made between individual farmers and the government. The Myingyan TS office covered 10 villages and average number of cotton farmer is 100-200 HH/village.
- Most farmers in Myingyan grow cotton under rainfed condition, except for a few farmers who practices irrigation by tube well. Yield difference between the irrigated and the rainfed are almost double, 800viss/acre under the irrigation and 400viss/acre under the rainfed condition.
- **Collection:** At present, most farmers sell product to brokers..Farmers directly bringing to market are very few. Around 80% of brokers are from Myingyan, while remaining 20% are from Mandalay. Before privatization, the government trucks go to village to collect products individually.
- **Ginning**: Ginning is carried out at both the government and private factory. The government owns (at least) six (6) ginning factory in Meiktila, Mahleing, Aung Len, Nga Zan, Tada Oo, and Monywa, where cotton seed and fiber are separated. The fiber is pressed in a cube veil (2m×1.5m×1.5m) for further processing. Weight of one veil is 100viss/veil, and 6 veils become 1 metric ton.

- Spinning, dying, weaving and cloth making are another process and many local firms including cottage industry in Nan Myint Village in Myingyan TS conduct this process. Private factories in Mandalay and Meiktila, including C.Y.T. Industrial Ltd. (Address: G.3(a),Yaw Min Gyi St,Sanpya Industrial Zone, MANDALAY, Tel: (02)53404) for example, also produces yarn and manufacture textile.
- **Cotton Seed**: from cotton seed, cooking oil is extracted mostly by local oil millers, including Triple Nine Great Integrity Trading Co., Ltd.
- **Export**: Export of fiber is carried out by traders including international trade firm like Itochu Corporation. The cotton fiber is exported to Thailand (50%), India (30%), Malaysia (10%) and China (10%). Transportation to Thailand, India and Malaysia are by ship, whereas to China is by land via Mandalay and Muse. 80 veils can be in a 20 feet container van.
- Before 2001, MOAI could get export permission, but after 2001 until 2012, only the Ministry of Industry-1 could export cotton abroad. After 2012, the Ministry also could not export due to

privatization.

5) Price Determinant

- There are two main varieties, 1) long staple variety and 2) short staple variety. The long staple is more expensive and is for export since it is soft and smooth, good for traditional clothes in Indonesia and Malaysia for example. While short staple is hard, and good for jeans.
- As to color, whiter is better. For moisture content, less than 70% is better.
- The government's quality specification is as follows;
  - Length: 28.6 - 30.2mm
  - Smoothness: 3.8 – 4.2 microneyar
  - Strength 7.8 – 8.5 lb/mg
  - Ripened Ratio: 0.97 – 1.00
  - Yield 37% - 39% (from veil, residual is cotton seed)
  - Number: 40 – 50 (classification of spinning, less than 40 is hard, more than 50 is enough soft, still good)

Subject	Data and Information Collection at Magway Township Office of DOA
Date	May 8 (Wed), 2013 9:00～11:30
Place	DOA Magway Township Office
Persons Met	U Khaing Min (Township Officer)
Study Team	Sanyu Consultants Inc. Iriya, Kikuchi
Document Obtained	・ Monthly Market Price at Magway TS (for 12 months) ・ Questionnaire No. 1

1) Market Price

- Twice a month, the TS office collect wholesale market price to give advice to farmers regarding marketable crops. The wholesale market prices are collected from Broker, Miller and Traders Association in Magway. The association also operate Crop Exchange Center in this region.
- There are three local market in Magway township; Yan Pe, Yam Kin, and Myo Ma. All of them are Municipal market that transacts all types of commodities incdluing vegetables and fruits.

2) Profitable Crops

- Groundnut and Sesame are the most profitable crops in upland of Magway. Variety of Groundnut is “Sinpadaythar-11”, developed in Yezin Agricultural University and the seed is produced at Dry Zone Agricultural Research Center in Nyaung Oo.
- Variety of Sesame is “Black Cumin”. It is said that Sesame in Magway is the best, and many brokers and traders from Monywa and other areas come and buy Bagway's Sesame seed. The reason is its drought tolerant characteristics. Even though rain season comes rate up to about 48 days, the seed can

survive and can be harvested. The seed is good for sandy soil but taste of its oil is a bit bitter. Oil content is around 53% and is average among varieties of sesame. In Magway, groundnut oil is better than sesame oil due to its mild taste and price of groundnut oil is always higher than sesame around 400k/viss.

3) Other Crops

- Pigeon Pea is planted with Sesame in pre-monsoon period. Pigeon Pea is also one of dominant crop in Magway TS.
- Sunflower production depends on soil fertility and is not goon in Magway TS.
- Cotton is very few in the TS.
- Watermelon and Musk Melon are potential fruits. Main production area is Taung Dwin Gyi TS, about 51 miles away from the center of Magway.
- Maize in Magway is for human consumption. The seed is hybrid and originally came from China. The Maize is planted in upland area with pump irrigation or in lowland where moisture content in soil is high.
- Vegetables, such as Tomato, Mustard, Carrot, Radish, and watercress, are basically produced in the river bank, where irrigation by tube well and pumping water is available.

Subject	Data and Information Collection at Magway Region Office of DOA
Date	May 8 (Wed), 2013　14:00～16:00
Place	DOA Magway Region Office
Persons Met	U Khin Maung Lay (Deputy Director, Head of Division), DOA Magway U Aung Myint (Assistant Director, Deputy Regional Chief Officer), DOA Magway Daw Khin May Thnit (Staff Officer), DOA Magway Daw Than Than Swe (Staff Officer), DOA Magway U Oo Than (Assistant Director), DOA Magway
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Monthly Market Price at Pakokku TS (for 12 months) ・ Questionnaire No. 3

1) Market Information

- Data for MIS (Market Information Service) is collected only at Pakokku TS. There is a Crop Exchange Center in Pakokku.

2) Promising Crops

- Groundnut and Sesame are the most promising crops in Magway Region.
- Sesame is mostly (30-40%) exported to China and Thailand, and rests are for local consumption.
- Groundnut is for domestic consumption, and supply is not enough to meet domestic demand. Therefore, palm oil is used as substitute of the groundnut oil. Oil palm is planted in Tanin Thargi Region (Southern coast area), but production is not sufficient resulting in importation from Malaysia.

Subject	Market Research at Magway Crop Exchange Center
Date	May 9 (Thu), 2013　16:00～17:30
Place	Union of Myanmar, Myingyan (Mandalay)
Persons Met	U Nay Lin Aung (Chairman of UMFCCI-Magway, Oil Miller and Distributor) U Htein Win (Central Excutiv Committeee (CEC) Member, Trader of Pulses and Oil Crops)
Study Team	Sanyu Consultants Inc.　Iriya, Kikuchi
Document Obtained	・ Quality Control Specification Sheets for Pulses and Sesame

1) Organization

- The crop exchange center is a branch office of UMFCCI in Yangon, established in 1988. At present, the organization has around 400 members including traders, millers and brokers. Main activity of the center is 1) quality control of transacted products, 2) to solve problems between buyers and sellers, and 3) operating crop exchange center.
- Quality control is carried out based on the quality control specification developed at the 4th workshop of UFMCCI in 2010. The specification is shown in table below.
- The crop exchange center is basically operated every day except the week of the Water Festival. From August to February, the center is operated twice a day, from 9am to 12am, and from 3pm to 6pm, whereas from March to July, the center operated once a day, from 9am to 12am.

2) Outline of transaction at Magway Crop Exchange Center

- Outline of transactions of major crops are summarized in the table below.

Outline of Transaction at the Crop Exchange Center in Magway

Crop Name	Product Inflow	% from CDZ	Export/ Import	Domestic Market	Market Needs (Determinant of Price)
Maize	Jan-Feb: Taungdwingyi (Magway)	100%	?	Mandalay, Yangon	・Myanmar C.P. Livestock Co., Ltd. buys 50% of product. ・CP provides qualified seeds to farmers based on Contract Farming. ・Production is very little.
Sesame	Mar-Apr (irrigated): Salin (Magway) Aug-Feb: Minbu, Taungdwingyi, Sinbaungwe (all Magway)	100%	Mostly China via Mandalay	Red sesame is for local consumption	・Rate of production is White (60%), Red (23%), Black (17%). ・White is for China, Black is for China, Japan and Korea, Red is for oil mill or home consumption. Black sesame demands the highest price. Farmers do not want plant Red since price gap between Black and red is around 500k/viss. ・Japan's inspection is severe. Japanese inspector use litmus paper to check acidity. Acidity content should be 0.5-2.0%. After rain, acidity should be checked since rain sometime contains acid. China does not check acidity content. ・For oil extraction, more than 48% of oil content is better. ・Magway's sesame is good since it is drought tolerant variety. But Kyaukse's sesame is better since they use Korean variety which is similar to African seed (color is Pearl White)
Groundnut	Aug-Feb: Minbu, Taungdwingyi, Sinbaungwe, Aunglan (all Magway)	100%	50% is go to China via Mandalay	50% is for local consumption.	・Check point is size, color, impurity. ・More than 40% of oil content is better. ・Two varieties; 3 months variety and 6 months variety
Sunflower	April: Sagu, Salin, Sinbyugyun (all Mandalay)	100%		Oil for Taunggyi (Shan)	・Sunflower is not profitable and production is very minimal. ・The most popular cooking oil is Sesame, followed by Groundnut and Sunflower.

Green Gram	No production from 2 years ago		Mostly China		・Farmers used to plant after sesame, but no production now since 2 years ago since Green Gram is not profitable crop. China's buying price is quite cheap.
Pigeon Pea	Feb-Apr: Kyaukpadaung (Mandalay), Natmauk, Minbu, Minhla, Taungdwingyi, Aunglan (Magway)	100%	100% India via Yangon		・Color and size is important determinant of price. ・Bright Red has higher price than Dark Red. Price difference is 75K/viss.
Chick Pea	Feb-Mar: West Bank of Ayeyar Waddy River in Magway Region	100%	50% is for India via Yangon, Sometime for Brunei	50% is for local consumption	・Color is important determinant of price. ・Yellow (Taiwan variety) commands highest price and second is Red (929). Price difference between Yellow and Red is 75k/viss. White (V2) is not popular.

Source) Crop exchange Center, Magway (May 9, 2013)

Quality Control Specification for Raw Pulses (Magway Crop Exchange Center)/a

Crop Name		Contamination of Dust and Stone (%)	Contamination of Worm (%)	% of Bad Quality	% of Brown Color Seed	% of Crushed Pieces	% of Other Damages	% of Different Variety	% of Similar Variety	Moisture Content (%)	% of Different Color	% of Other Mixture
1	Black Gram (Raw)	1.00	3.00		-	-	-	2.00	-	-	-	-
2	Black Gram (FAQ)	1.00	1.00	4.00	3.00	-	-	3.00	-	-	-	-
3	Green Gram (Raw)	0.10	1.00	-	/b	-	4.00	-	0.50	(14-15%)/b	-	-
4	Green Gram (Anyarshwewah)	0.10	1.00	-	-	-	4.00	-	0.50	-	-	-
5	Green Gram (Khayanshwewah)	0.10	1.00	-	-	-	1.00	-	0.50	-	-	-

6	Chick Pea	1.00	3.00	-	-	-	4.00	0.50	-	-	1.00	-
7	Pigeon Pea	1.00	3.00	-	-	2.00	-	-	-	-	-	1.00
8	Chick Pea (White, Large)	1.00	3.00	-	-	2.00	3.00	0.50	-	-	-	-
9	Butter Bean	1.00	3.00	-	-	1.00	3.00	0.50	1.00	-	-	-
10	Rice Bean	0.50	1.00	-	-	1.00	3.00	0.50	1.00	-	-	-
11	Lima Bean (Red and Blue)	1.00	3.00	-	-	1.00	3.00	0.50	-	-	-	-
12	Bocate Bean	1.00	3.00	-	-	1.00	3.00	0.50	-	-	-	-
13	Cow Pea (White)	1.00	3.00	-	-	1.00	3.00	1.00	2.00	-	-	-
14	Soy Bean	1.00	3.00	-	-	0.50	3.00	0.50	1.00	-	-	-
15	Kidney Bean	0.50	3.00	-	-	0.50	3.50	0.50	1.00	-	-	-
16	Garden Pea	1.00	3.00	-	-	3.00	5.00	0.50	-	-	-	-
17	Maize	1.00	5.00		-	-	-	-	-	14.00	6.00	-

Source: UMFCCI Magway Branch Office

Note : a/ The quality control specification was made based on discussion at the 4th Workshop of Wholesale and Commodity Crop Exchange Center in Magway Region in 2010 .
b/ The content should be decided based on weather condition.

Quality Control Specification for Raw Sesame (Magway Crop Exchange Center)/a

Variety Name		Contamination of Dust and Stone (%)	Weight Loss (%)	% of Bad Quality	% of Different Color	Moisture Content (%)
1	Sesame (Theikpan)	0.50	1.00	0.50	2.00	8.00
2	Sesame (Byar)	0.50	1.00	0.50	5.00	8.00
3	White Sesame (Grade 1)	0.50	1.00	0.50	5.00	8.00
4	White Sesame (Grade 2)	0.50	1.00	0.50	10.00	8.00

5	Sesame (Red, Brown)	0.50	1.00	0.50	-	8.00

Source: UMFCCI Magway Branch Office

Note : a/ The quality control specification was made based on discussion at the 4th Workshop of Wholesale and Commodity Crop Exchange Center in Magway Region in 2010 .

Subject	Market Research in Yangon Crop Exchange Center
Date	May 29 (Wed), 2013　11:00～13:30
Place	Yangon Region Chamber of Commerce and Industry (YRCCI) Address: No. B81/82, Kant Kaw, Bayint Naung Wholesale Market, Mayangone Tsp, Yangon
Persons Met	U Ohn Saing (Chairman) U Hoke Kyi (CEC Member) Dr. Myo Lwin (CEC Member) Dr. Myint Oo (CEC Member) U Zin Myo Naing (CEC Member) U Kyaw Win (CEC Member)
Study Team	Sanyu Consultants Inc.　Kikuchi
Document Obtained	・ Quality Control Specification Sheets for Pulses and Sesame

1) Organization

- Yangon Region Office of the Chamber of Commerce and Industry operates Crop Exchange Center which was founded in 30 years ago. The center has around 4,500 members including traders, millers, brokers, and exporters.
- Crops transacted at the Crop Exchange Center are pulses, beans, oil crops (palm oil, groundnut, sunflower seed, and sesame), kitchen crops (onion, potato, chili, ginger, and tamarind), and maize.
- The center operates every day except Sunday, from 10:00 am to 1:00 pm.

2) New Competitors

- Since 2-3 years ago, Pigeon Pea and Green Gram became difficult to sell and amount of export decreases due to increase in number of new competitors, including Tanzania, Kenya and Mozambique. India　invest and support these countries　since costs of their land and labor are cheaper.

3) Outline of transaction at Yangon Crop Exchange Center

- Export quality is checked by SGS, using　standard specification for each crop.
- For cooking oil, demand of sesame oil is high at present. Groundnut oil is most expensive while palm oil is most popular due to its cheap price. Palm oil is imported from other countries in Southeast Asia. In Myanmar, Taninthayi is production area of crude palm oil (CPO). 15-20% of CPO goes to Refinery while the　rests goes to Thailand for final products.
- Outline of transactions of major crops are summarized in the table below.

Outline of Transaction at the Crop Exchange Center in Yangon

Crop Name	Product Inflow	% from CDZ	Export/ Import	Domestic Market	Market Needs (Determinant of Price)
Maize	Mar-Apr: Delta Area Jul-Aug: Pyinmana Sep-Oct: North Shan Dec-Jan: Shan	Non (60-65% from Shan)	80% goes to China from Shan	CP (Thailand), Jatta (Indonesia)	・Size: bigger is better ・Moisture content: less than 14% ・Color: CP prefers bright grain. CP distribute “888” variety
Sesame	Jun-Aug: Kyaukse Aug-Oct: Magway	Magway (70-75%), Mandalay (20-25%)	70% (mostly China via border, rests goes to Japan, Taiwan)	30% goes to Oil Mill	・6 Colors: 1) Normal Black, 2) Science Black, 3) Brown, 4) Red, 5) White, 6) Yellow. In Yangon CEC, 50% is Scientific (for Japan, China, Taiwan), 30% is White (for China), and 15% is Red. ・Oil content: Black (50-58%), White (52-53%), Red (48-50%). Irrigated Sesame has less oil, while rainfed Sesame has rich oil. ・Size: more than 6.5mm (for Japan) ・Moisture content: less than 8% ・Acidity: Only Japanese standard, more than 3% is not acceptable. Japan use litmus paper for the test. ・Chemical residual: Only Japanese standard, Inspection is conducted in Thailand to acquire certification.
Groundnut	Whole year from Magway, Mandalay, Sagaing	100%	75% (60% to China, 25% to Thailand, rests to Indonesia, Malaysia, Vietnam)	25%	・Good quality goes to export, and bad quality (higher rate of broken beans) goes to local consumption ・Size: bigger is better ・Color: fine red is better

Green Gram	Mar-Jun: Delta Jun-Sep: CDZ Oct-Dec: Lower Myanmar	Less than 20% (55% from Lower Myanmar)	Almost 100% China: 30-35% India: 30-35% Rests go to Taiwan, Middle-east, Southeast Asia	none	・Size: large size goes to China and Taiwan, while small size goes to Indonesia. ・Color: bright/ light green is better, whereas dark/ brown/ yellow is worse. ・Over-matured bean's color turns to yellow. Maturity depends on rain, moisture, sunshine. Cold storage is required to keep good quality beans. If it is rain during harvest season, quality becomes worst. ・Moisture content: less than 10% in winter season, and less than 15-16% in rain season.
Pigeon Pea	Dec-Apr: CDZ Mar-May: Shan	Mostly from CDZ	100% India (85-90%), Rests goes to Middle-east and China	0%	・Color (White, Yellow) and Size are important indicators. ・Large and White is the best quality since 10 years. While small and yellow becomes best this year due to high demand in India.
Chick Pea	Dec-Feb: Sagaing, Mandalay	Mostly comes from Upper and Middle Myanmar	50%	50%	・Size: larger is better (the most important indicator) ・Color: White (V series) is better than Yellow (Taiwan) ・White (V2, V7, V8, V9) is for only Export to Middle-east and India. ・Red (929) is for domestic consumption (for Military consumption since 1-2 years ago, farmers do not want to plant anymore due to lack of price incentive). ・Yellow (Taiwan): export to Bangladesh from Sep. to Oct.
Onion	Rainy season: CDZ Summer season: CDZ		Sometimes (not sure), by border trade (very		・From CDZ, 70% goes to Yangon, whereas 30% goes to other regions. ・Size: Small is good to fry, export to Vietnam, Thailand and Malaysia, after fried in these country, fried onion goes to EU.

			difficult to catch since many are illegal trade)		・ Middle size goes to local consumption and sometime goes to Thailand. ・ Large size is for local consumption particularly for Restaurant ・ Since 2012, no export tax and illegal trade at border area start decreasing.

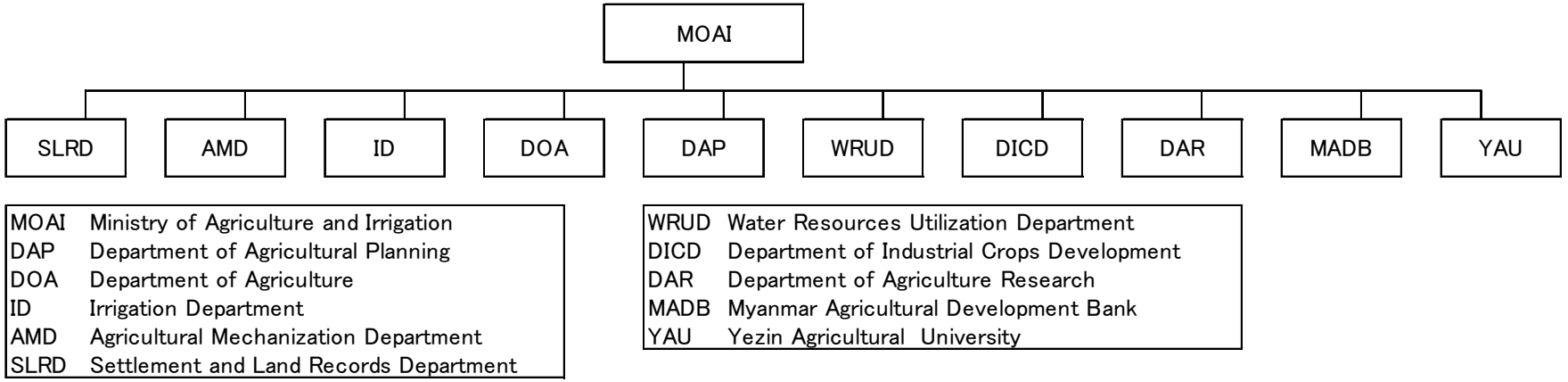
Source: Crop exchange Center, Yangon (May 29, 2013)

Retail Market price

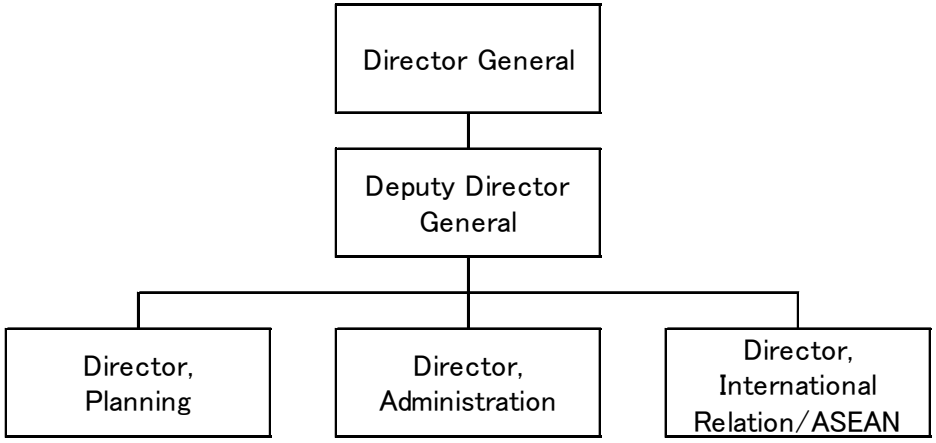
Location	Yangon			Nay Pyi Taw			Magway TS			Myingyan TS			Nyaung Oo TS			Mandalay		
Name of Market	Thiriminglar Market			Myoma Market			Yan Pe Market			Aye Mya Thidar Market			Mani Sithu Market			Thiri Marlar Market (Wholesale)		
Date of Survey	6-Jun-13			17-May-13			8-May-13			6-May-13			5-May-13			30-Apr-13		
Crop Name	Season	Price	Origin	Season	Price	Origin	Season	Price	Origin	Season	Price	Origin	Season	Price	Origin	Season	Price	Origin
Cabbage	Jun-Jul	600-1000k/piece	Aungban (Shan)	Apr-May	700k/piece	Aungban (Shan)	Mar-May	550-600/piece	Aungban (Shan)	Apr-May	500k/piece	Shan				Dec-Jan	150k/piece	Mnadalay
	Oct-Aug	250-500k/piece	Yangon, Bago, Delta	Dec-Jan	100-150k/piece	Aungban (Shan), Suburb of NPT	Nov-Dec	200-250k/viss	Minbu (Magway)	Dec-Feb	100-200k/piece	Myingyan				Apr-May	500-600k/piece	Shan
Tomato	Jun	800k/viss	Inle Lake	Apr	2000k/viss	Monywa (Sagaing)	Feb	1500k/viss	Magway (Riverbank)	Apr-May	1200k/viss	Shan (North)				Mar	800-1000k/viss	Monywa,Shwebo
	Jul-Sep	470-670k/viss	Inle Lake	May	1400k/viss	Monywa (Sagaing)	May	1200k/viss	Aungban (Shan)				May-Jun	1200-1500k/viss	Pakokku	Apr	1100-1300k/viss	Monywa,Shwebo
	Dec-Feb	200-330k/viss	Yangon, Meiktila, Monywa	Dec-Jan	400-600k/viss	Monywa, Aungban	Nov	200k/viss	Magway	Dec-Feb	400k/viss	Myingyan, Mandalay	Dec-Jan	150-200k/viss	Nyaung Oo			
Carrot	Mar-Jun	1000-2000k/viss	Pyin U Lwin (Mandalay)	Apr-May	1600k/viss	Aungban (Shan), Pyin U Lwin (Mandalay)	May-Jun	500-800k/viss	Minbu. Shan	Apr-May	1000k/viss	Pyin U Lwin (Mandalay)	May-Jun	500-700k/viss	Pakokku	May	400-600k/viss	Pyin U Lwin (Mandalay)
	Dec-Feb	1000k/viss	Aungban (Shan), Pyin U Lwin (Mandalay)	Dec-Jan	800k/viss	Aungban (Shan), Pyin U Lwin (Mandalay)	Jan-Feb	200-300k/viss	Magway (Riverbank)	Dec-Feb	500-600k/viss	Myingyan, Mandalay	Dec-Jan	400k/viss	Pakokku			
Chou-fleur	Jun	600/piece	Aungban (Shan)				Mar-Apr	800-1000k/piece	Aungban (Shan)							Mar	80-100k/piece	Myingyan, Shwebo
	Jun-Sep	1000k/piece	Aungban, Taunggyi (Shan)	May-Jun	700k/piece	Aungban (Shan)	May	600-700k/piece	Aungban (Shan)	Apr-May	700k/viss	Shan (North)	May	350k/piece	Pakokku	Apr	250k/piece	Shan
	Jan-Apr	200-300k/piece	Yangon, Bago	Dec-Jan	200k/piece	Aungban, Nay Pyi Taw	Dec-Feb	200-300k/piece	Minbu, Magway	Dec-Feb	300k/viss	Shan (North)	Dec-Feb	200k/piece	Pakokku			
Eggplant	Apr-May	500-600k/viss	Bago	May	1200k/viss	Aungban (Shan)	Mar-Apr	500k/viss	Magway (Riverbank)	Apr-May	400-500k/viss	Myingyan						
	Jun	600k/viss	Bago	Jun	300k/viss	Aungban, Thazi	May-Jun	400-500k/viss	Magway (Riverbank)				May-Jun	400k/viss	Pakokku			
	Oct-Jan	700-800k/viss	Delta	Dec-Jan	300-400k/viss	Aungban, Thazi, NPT	Jan-Feb	200k/viss	Magway (Riverbank)	Dec-Feb	100k/viss	Myingyan	Dec-Jan	300k/viss	Pakokku			
Radish	Jun	1200k/viss	Taunggyi (Shan)	May-Jun	500k/bandle	NPT	Apr-May	150k/bandle	Yenan-gyaung							Mar	100k/bandle	Myingyan, Swebo
				Dec-Jan	100k/bandle	NPT	Dec-Feb	80-100k/bandle	Magway							Apr-May	250k/bandle	Myingyan, Swebo
Okra				May-Jun	100k/bandle	NPT, Pynmana	Apr-May	100k/10piece	Minbu				Apr	650-800k/viss	Pakokku			
				Nov-Dec	30k/bandle	NPT, Pynmana	Jun-Oct	50k/10piece	Magway (Riverbank)				May	200k/viss	Pakokku			
Potato	Jun	1000k/viss	Taunggyi, Aungban (Shan)	May	1000k/viss	Aungban (Shan)	Apr-May	800k/viss	Shan	May	1000k/viss	Shan	Apr-May	1000-1200k/viss	Taunggyi (Shan)			
							Aug-Sep	1000-1200k/viss	Shan									
	Dec-Feb	700-800k/viss	Shan	Feb-Mar	500k/viss	NPT, Pynmana	Oct-Dec	300-500k/viss	Shan, Magway (Riverbank)	Dec-Jan	500-600k/viss	Pakokku	Dec-Jan	700-800k/viss	Taunggyi (Shan)			
Onion	Jun	500-550k/viss	Seikpyyu (Mandalay)	Jan-Mar	2000k/viss	Monywa, Meiktila	Mar	200-250k/viss	Magway (Riverbank)				Mar-Apr	200-300k/viss	Nyaung Oo	Mar-May	300-450k/viss	Myingyan, Monywa, Pakokku, Myittha
				Mar-Apr	300k/viss	Monywa, Meiktila, Pakokku, Mandalay	May	400-500k/viss	Magway (Riverbank)	Apr-Jul	600k/viss	Myingyan	May	500k/viss	Pakokku	Oct-Nov	800-900k/viss	Myingyan, Monywa, Pakokku, Myittha
	Dec-Feb			May-Jun	700k/viss	Meiktila	Oct-Dec	600k/viss	Magway (Riverbank)	Nov	1000k/viss	Myingyan	Jul-Oct	800-1000k/viss	Pakokku	Dec-Jan	1400k/viss	Myingyan
Garlic (Burma White)	All year	2000k/viss	Aungban (Shan)	Jan-Feb	900k/viss	Aungban (Shan), Pakokku	Feb-Mar	1300-1400k/viss	Shan	Mar-Apr	500-800k/viss	Myingyan				Mar	800-1300k/viss	Mandalay
				Mar-Apr	3000-4000k/viss	Aungban, Pakokku	May	1200-2000k/viss	Meiktila, Shan	May	1500-2000k/viss	Shan, Myingyan	May	2000-2400k/viss	Mandalay	Apr	1000-1500k/viss	Mandalay, China
				May-Jun	2000k/viss	Aungban, Pakokku	Oct-Nov	2000k/viss	Magway									
Garlic (China White)				Jan-Feb	2000k/viss	Nawnghkio (Shan)												
				Mar-Apr	4000k/viss	Nawnghkio (Shan)												
				May-Jun	2500k/viss	Nawnghkio (Shan)	May	2400k/viss	Shan									
Chili	Jun	500k/viss	Minbu (Magway)	May	4000k/viss	Pynmana	Mar-May	1300k/viss	Minbu, Magway	May	1000k/viss	Myingyan						
	Jun-Oct	500-600k/viss	Minbu, Aunglan (Magway), Mandalay, Pyinmana	Jun-Jul	2000k/viss	Pynmana, Yangon (Delta)	Jun-Jul	500-600	Magway (East Riverbank)				May-Jun	1000-1200k/viss	Pakokku			
	Dec	1000k/viss	Yangon (Delta)	Dec-Jan	2000k/viss	Pynmana, Yangon (Delta)				Dec-Jan	500-600k/viss	Myingyan, Riverbank	Dec-Jan	300-500k/viss	Pakokku			
Cilantro leaf	Jun	200k/bandle	Mandalay	Mar-Jun	1500k/bandle	Aungban (Shan)	Apr-May	2000k/viss	Minbu, Yenan-gyaung				May	2500-3000k/bandle	Pakokku			
	Jul-Sep	550k/bandle	Mandalay	Jul-Aug	5000k/bandle	Aungban, NPT	Jun-Jul	400-500k/viss	Magway (Riverbank)									
	Dec-Feb	40-60k/bandle	Yangon (Delta)	Dec-Jan	2000-3000k/bandle	Aungban (Shan)							Dec-Feb	200-300k/bandle	Pakokku (irrigation)			
Banana	Jun	1000-1500k/hand	Bago, Delta	Apr-May	1300-2000k/hand	Kyaukse (Mandalay)	May	1000k/hand	Magway (Riverbank)	May	600-800k/hand	Minbu	May	1000-1500k/hand	Kyaukpadaung			
	Oct	2000k/hand	Bago, Delta	Jun-Aug	2500k/hand	Kyaukse (Mandalay)	Jun-Sep	400-500/hand	Magway (Riverbank)	Dec-Jan	500-600k/hand	Minbu	Festival Sea	1700k/hand	Kyaukpadaung			
Mango	Apr-Jun	260k/viss	Kyaukse (Mandalay)	May	600k/piece	Kyaukse (Mandalay)	May	300k/piece	Mandalay	Jun	50k/piece		May	250-330k/piece	Popa			
	Jul-Aug	260-290k/viss	Shan	Jun	300-400k/piece	Kyaukse (Mandalay)	Jun	150-350k/piece	Mandalay	Jul	700-900k/piece		Jun	500k/piece	Popa			
Grape	Apr-May	340-420k/viss	Meiktila	Apr	3000k/viss	Yamethin (Mandalay)	Apr-May	2000k/viss	Meiktila	Apr	2000k/viss	Meiktila	Mar	4000k/viss	Meiktila	Apr	2000-4000k/viss	Meiktila
	Jun-Oct	105-125k/viss	Meiktila	May-Jun	2500k/viss	Yamethin (Mandalay)	Jun-JUl	1200k/viss	Meiktila	Jun	1200k/viss	Meiktila	May	2500k/viss	Meiktila	Jul	1000k/viss	Meiktila
Watermelon	Jun-Sep	2500-2800k/piece	Meiktila	Apr	800k/piece	Monywa (Sagaing)	Feb-Mar	800k/piece	Magway				Apr-May	2000-2500k/piece	Myingyan, Mandalay			Kyaukse (Mandalay)
	Oct-Mar	700-2800k/piece	Pyay, Bago, Delta	May-Jun	1500k/piece	Monywa (Sagaing)	May	500k/piece	Magway									
	Dec	500-2000k/piece	Nearby Yangon										Nov-Dec	500-700k/piece	Myingyan, Mandalay			
Dragon Fruits				May	2500k/viss	China										Apr	2000k/piece	China, Thai
				Jun-Jul	1000-2000k/viss	China, Popa												
Flower (white chrysanth)				May	1500k/bandle	Pyin U Lwin (Mandalay)							May	2100-2500k/band	Pyin U Lwin (Mandalay)			
Flower (Wellow chrysanth)							May	300k/bandle	Minbu									
							Jun-Jul	100k/bandle	Minbu									

Source: JICA Study Team

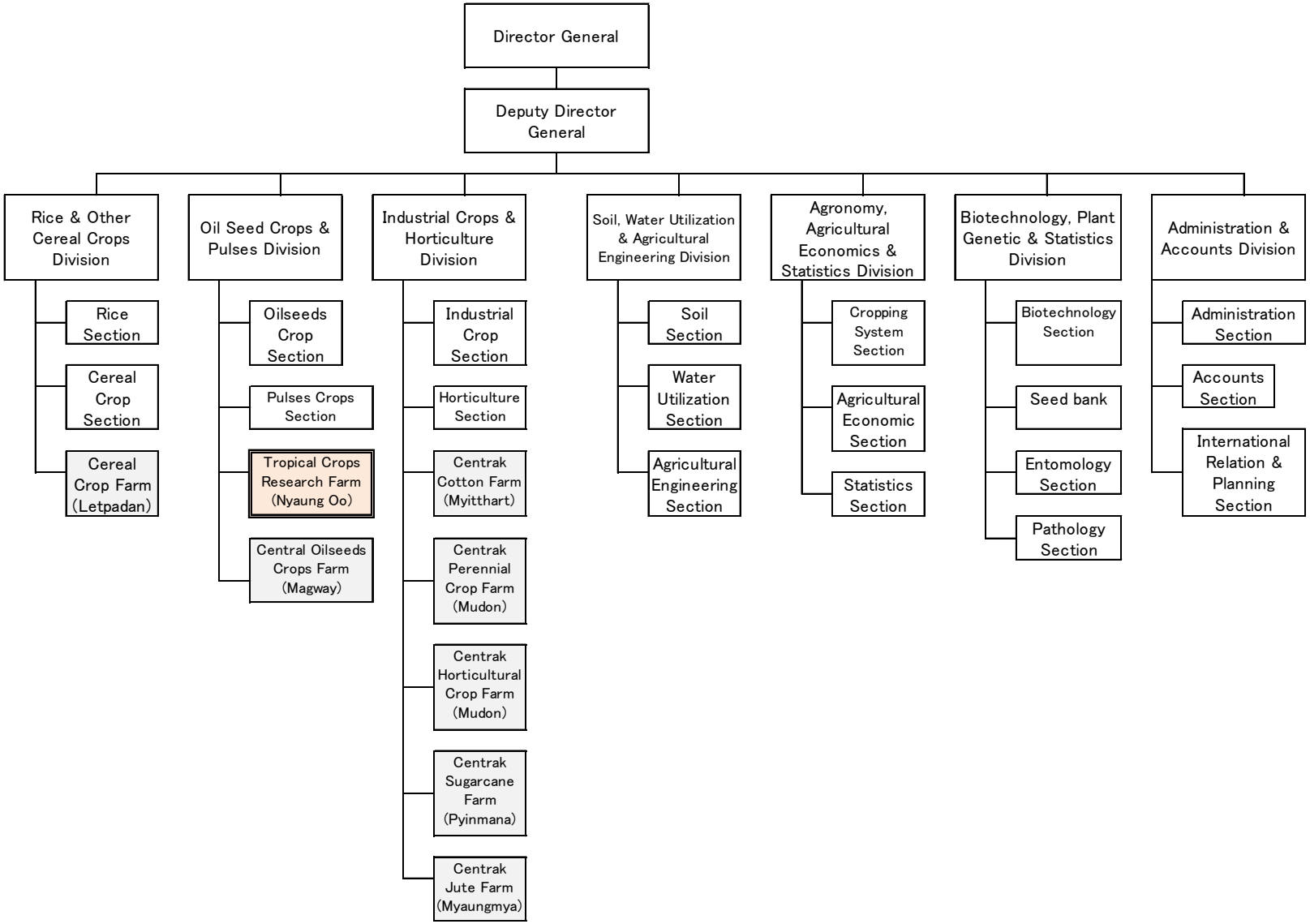
Appendix-14 Organizational Chart of Governmental Offices Concerned



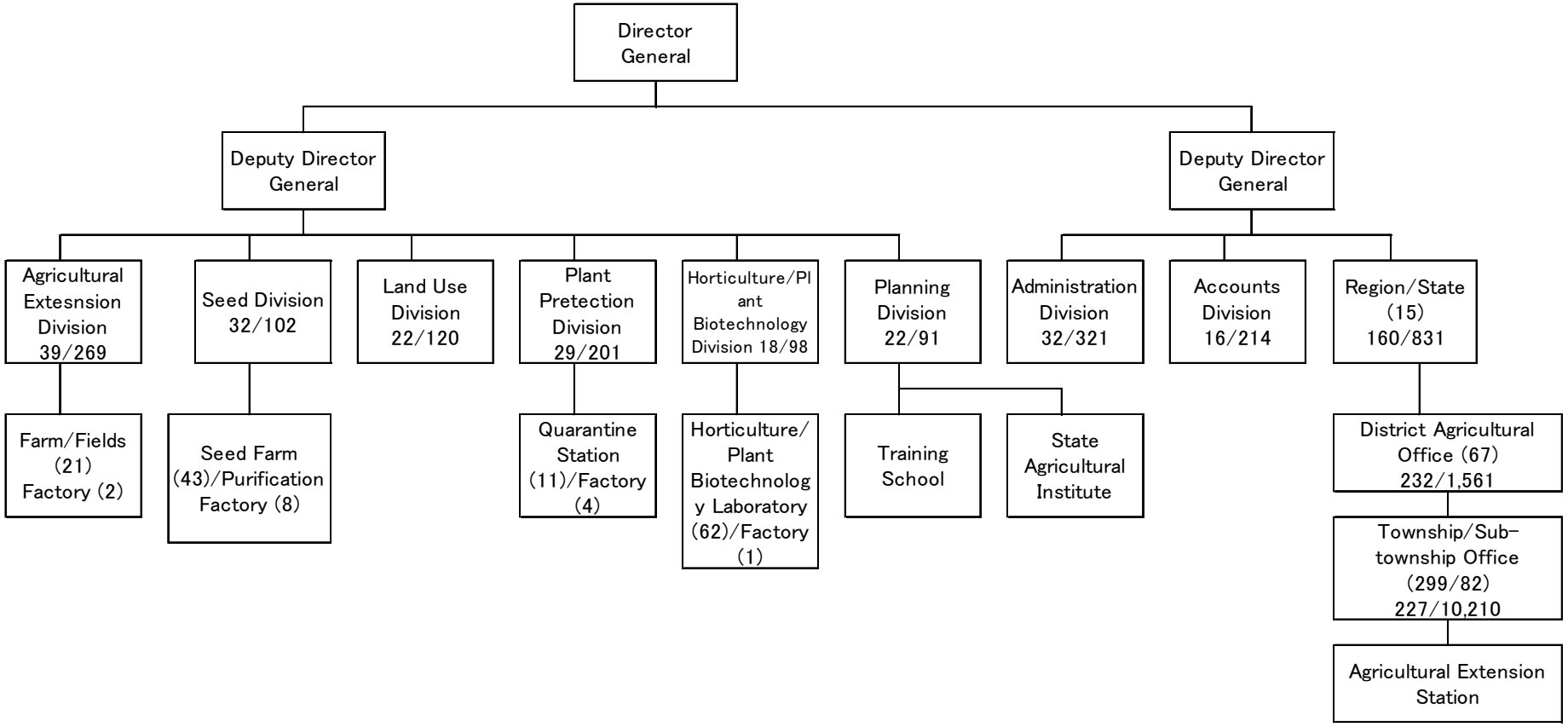
MOAI



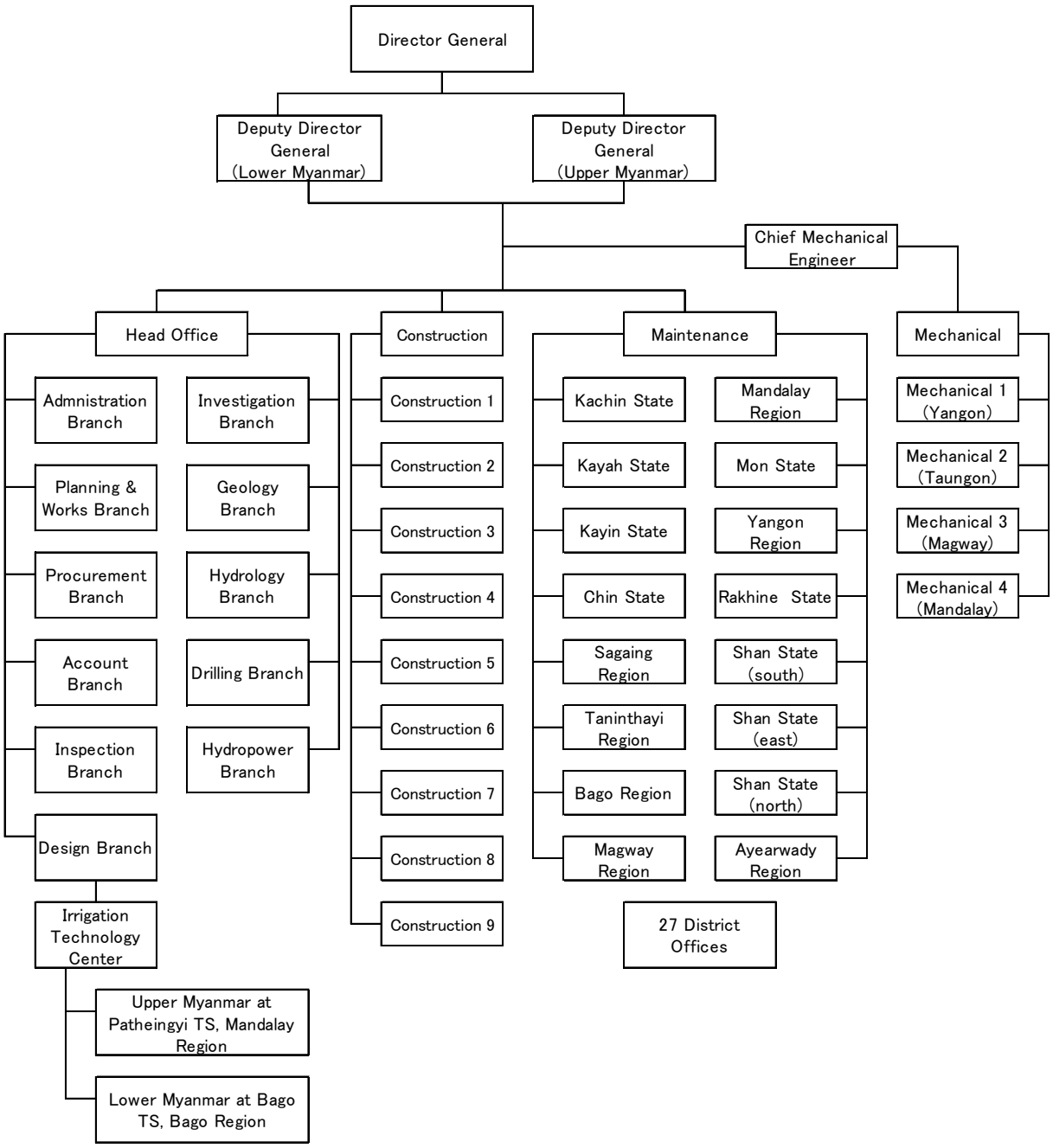
DAP


Director General
Deputy Director General
Rice & Other Cereal Crops Division
Rice Section
Cereal Crop Section
Cereal Crop Farm (Letpadan)
Oil Seed Crops & Pulses Division
Oilseeds Crop Section
Pulses Crops Section
Tropical Crops Research Farm (Nyaung Oo)
Central Oilseeds Crops Farm (Magway)
Industrial Crops & Horticulture Division
Industrial Crop Section
Horticulture Section
Centrak Cotton Farm (Myitthart)
Centrak Perennial Crop Farm (Mudon)
Centrak Horticultural Crop Farm (Mudon)
Centrak Sugarcane Farm (Pyinmana)
Centrak Jute Farm (Myaungmya)
Soil, Water Utilization & Agricultural Engineering Division
Soil Section
Water Utilization Section
Agricultural Engineering Section
Agronomy, Agricultural Economics & Statistics Division
Cropping System Section
Agricultural Economic Section
Statistics Section
Biotechnology, Plant Genetic & Statistics Division
Biotechnology Section
Seed bank
Entomology Section
Pathology Section
Administration & Accounts Division
Administration Section
Accounts Section
International Relation & Planning Section

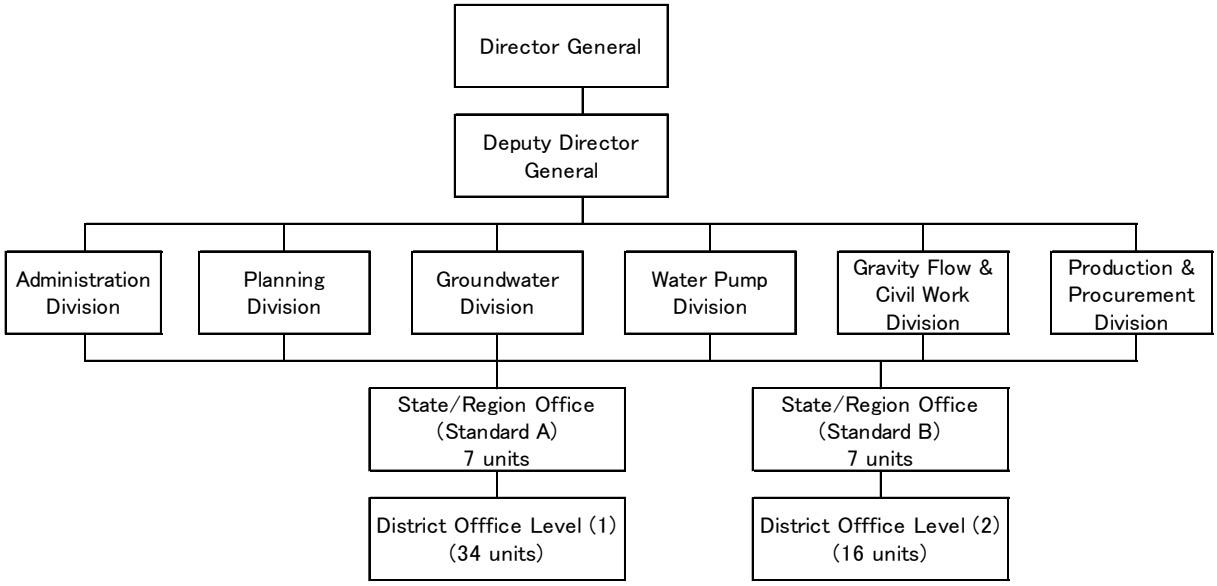
DAR


Director General
Deputy Director General
Deputy Director General
Agricultural Extesnsion Division 39/269
Seed Division 32/102
Land Use Division 22/120
Plant Pretection Division 29/201
Horticulture/Plant Biotechnology Division 18/98
Planning Division 22/91
Administration Division 32/321
Accounts Division 16/214
Region/State (15) 160/831
Farm/Fields (21) Factory (2)
Seed Farm (43)/Purification Factory (8)
Quarantine Station (11)/Factory (4)
Horticulture/ Plant Biotechnolog y Laboratory (62)/Factory (1)
Training School
State Agricultural Institute
District Agricultural Office (67) 232/1,561
Township/Sub-township Office (299/82) 227/10,210
Agricultural Extension Station

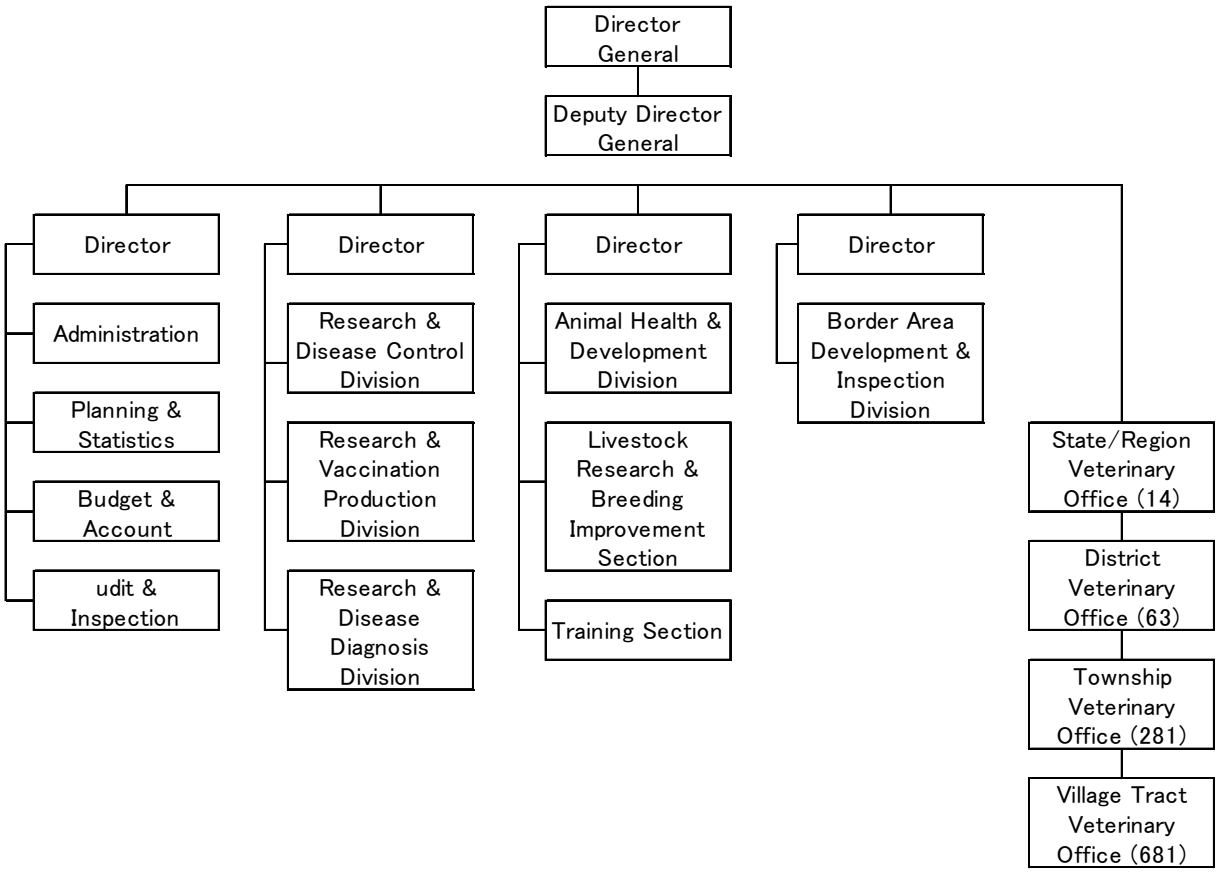
DOA


Director General
Deputy Director General (Lower Myanmar)
Deputy Director General (Upper Myanmar)
Chief Mechanical Engineer
Head Office
Admnistration Branch
Investigation Branch
Planning & Works Branch
Geology Branch
Procurement Branch
Hydrology Branch
Account Branch
Drilling Branch
Inspection Branch
Hydropower Branch
Design Branch
Irrigation Technology Center
Upper Myanmar at Patheingyi TS, Mandalay Region
Lower Myanmar at Bago TS, Bago Region
Construction
Construction 1
Construction 2
Construction 3
Construction 4
Construction 5
Construction 6
Construction 7
Construction 8
Construction 9
Maintenance
Kachin State
Mandalay Region
Kayah State
Mon State
Kayin State
Yangon Region
Chin State
Rakhine State
Sagaing Region
Shan State (south)
Taninthayi Region
Shan State (east)
Bago Region
Shan State (north)
Magway Region
Ayearwady Region
27 District Offices
Mechanical
Mechanical 1 (Yangon)
Mechanical 2 (Taungon)
Mechanical 3 (Magway)
Mechanical 4 (Mandalay)

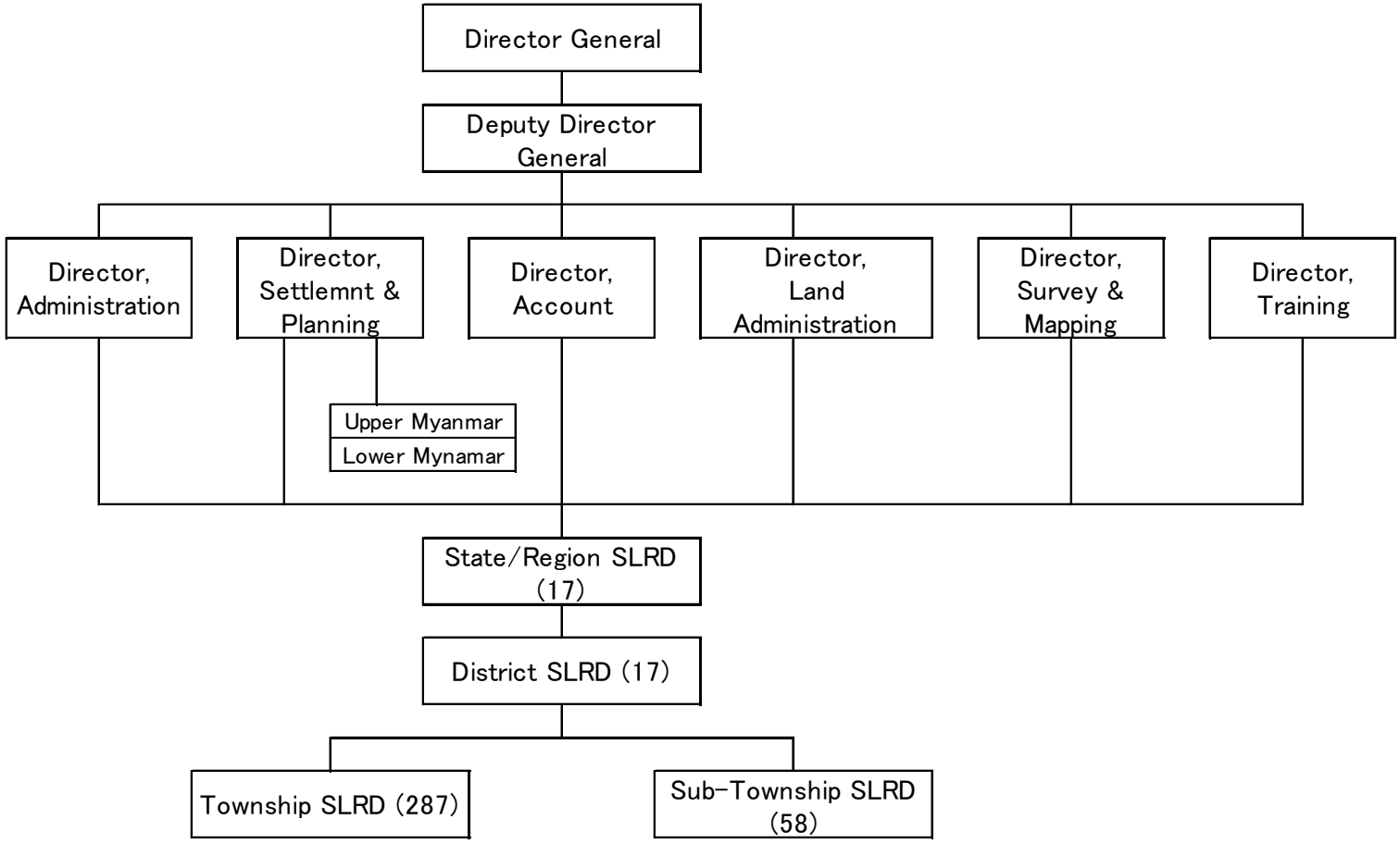
ID


Director General
Deputy Director General
Administration Division
Planning Division
Groundwater Division
Water Pump Division
Gravity Flow & Civil Work Division
Production & Procurement Division
State/Region Office (Standard A) 7 units
State/Region Office (Standard B) 7 units
District Offfice Level (1) (34 units)
District Offfice Level (2) (16 units)

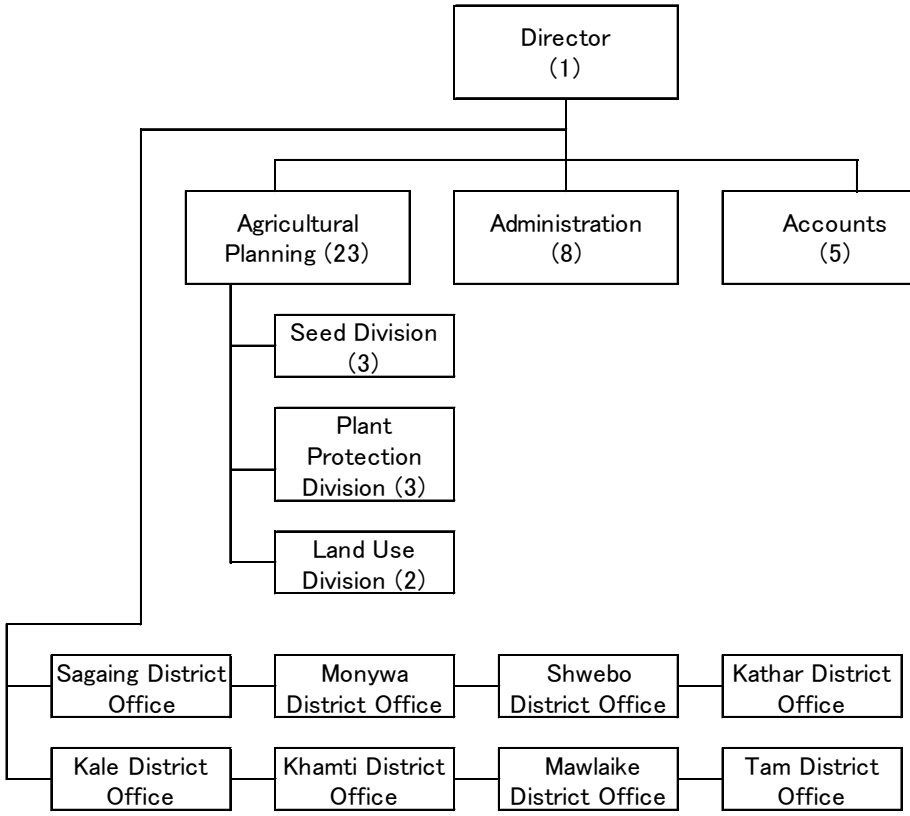
WRUD


Director General
Deputy Director General
Director
Director
Director
Director
Administration
Planning & Statistics
Budget & Account
udit & Inspection
Research & Disease Control Division
Research & Vaccination Production Division
Research & Disease Diagnosis Division
Animal Health & Development Division
Livestock Research & Breeding Improvement Section
Training Section
Border Area Development & Inspection Division
State/Region Veterinary Office (14)
District Veterinary Office (63)
Township Veterinary Office (281)
Village Tract Veterinary Office (681)

LBVD

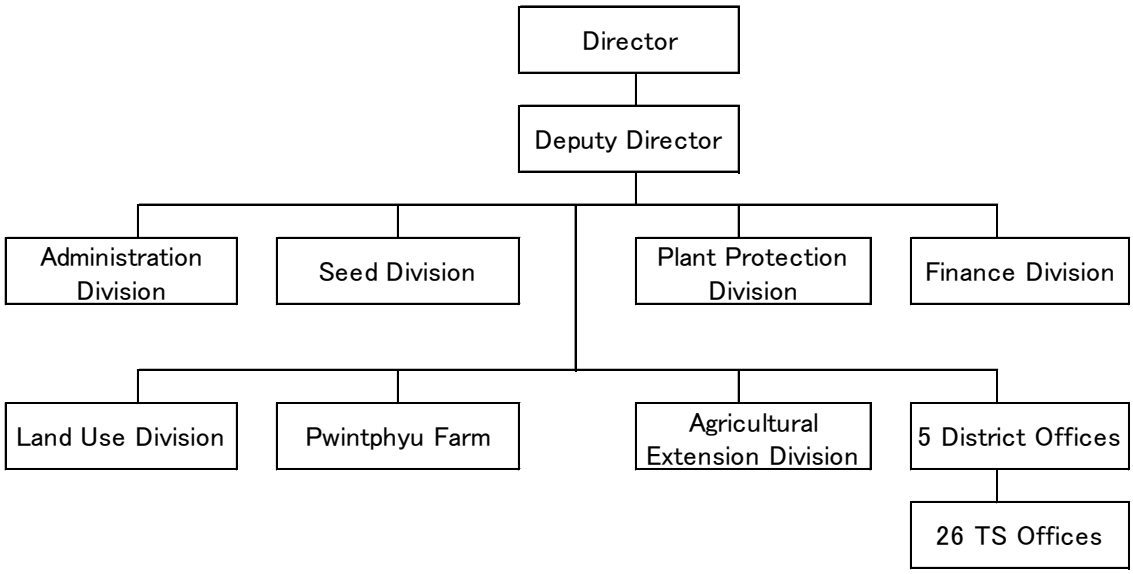

Director General
Deputy Director General
Director, Administration
Director, Settlemnt & Planning
Director, Account
Director, Land Administration
Director, Survey & Mapping
Director, Training
Upper Myanmar
Lower Mynamar
State/Region SLRD (17)
District SLRD (17)
Township SLRD (287)
Sub-Township SLRD (58)

SLRD



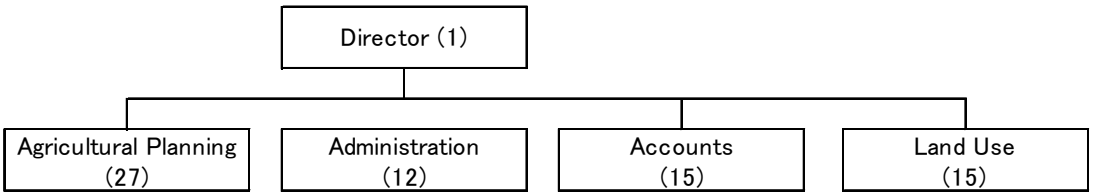
Note. Each Disrtict Office has 1) Seed Division, 2) Plant Pretection Division and 3) Land Use Division

DOA Sagaing Region Office



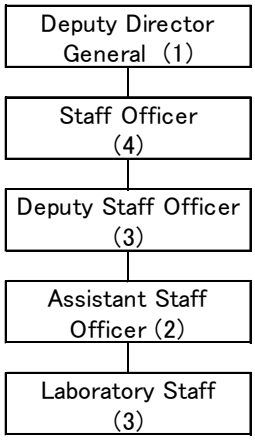
Source. Regional Land Use Division under DOA, Magway
Note. The offices of Region, District and TS are located at the same compound.

DOA Magway RegionOffice



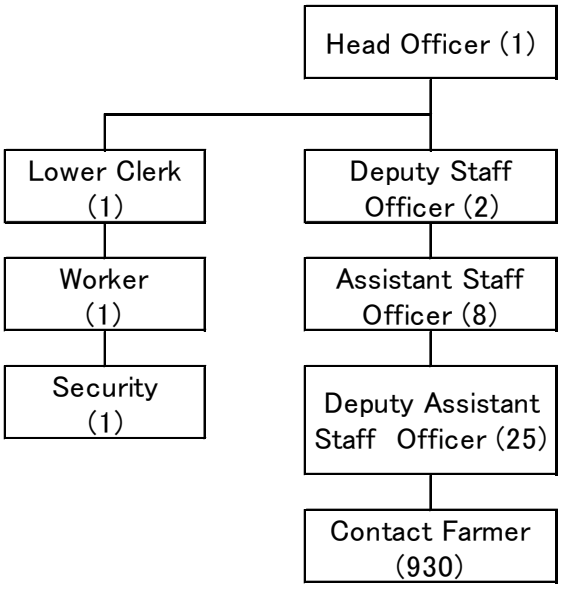
Source. DOA Regional Office, Mandalay

Organization Chart of Land Use Division, under DOA Regiinal Office Mandalay



Source. Regional Land Use Division under DOA, Mandalay
Note. The office is located at the next plot of the DOA's regional office

DOA Mandalay RegionOffice



DOA Myingyan TownshipOffice

Position	Permitted	Present	Vacancy
Officer	1	–	(–) 1
Deputy staff officer	2	3	(+) 1
Assistant staff officer	8	4	(–) 4
Deputy assistant staff officer	25	8	(–) 17
Clerk	1	1	–
Worker	1	–	(–) 1
Security	1	1	–
Total	39	17	(–) 22

Source. DOA Magway TS Office

DOA Magway TownshipOffice

No	Title	Nyaung Oo District			Nyaung Oo Township			Total			Remark
		Structure	Appointment Order	(+)/(-)	Structure	Appointment Order	(+)/(-)	Structure	Appointment Order	(+)/(-)	
1	Assistant Director	1	1	-	-	-	-	1	1	-	District Officer
2	Department Officer	1	1	-	1	-	(-)1	2	1	(-)1	
3	Deputy Officer	5	2	(-)3	2	-	(-)2	7	2	(-)5	
4	Upper Division Clerk	1	-	(-)1	-	1	(+)1	1	1	-	
5	Assistant Officer	6	5	(-)1	8	18	(+)10	14	23	(+)9	
6	Deputy Assistant Officer	4	4	-	25	3	(-)22	29	7	(-)22	
7	Lower Division Clerk	2	1	(-)1	1	1	-	3	2	(-)1	
8	Lower Division Typewriter	1	-	(-)1	-	1	(+)1	1	1	-	
9	Driver(4)	-	-	-	-	1	(+)1	-	1	(+)1	
10	Worker	1	1	-	-	-	-	1	1	-	
11	Watchman	1	-	(-)1	1	1	-	2	1	(-)1	
12	Driver(5)	1	-	(-)1	-	-	-	1	-	(-)1	
13	Office Helper	-	-	-	-	-	-	-	-	-	
	Total	24	15	(-)9	38	26	(-)12	62	41	(-)21	

DOA Nyaung U District & Township Office