

Attachments

Sample No.

Attachment I-1 Questionnaire for Interview Survey

Date (Month/Date/Year): / / Enumerator:

Dzongkhag No.: Gewog No.: Name of Village:

Dzongkhag No.: Lhuentse: 01 Mongar: 02

Gewog No.: for Lhuntse

Gangzur: 01 Jaray: 02, Khoma: 03, Kurtoe: 04, Menbi: 05, Metsho: 06,
Minjay: 07, Tsenkhar: 08

for Mongar

Balam: 01 Chali: 02 Chaskhar: 03 Drametse: 04 Drepong: 05 Gongdue: 06
Jurme: 07 Kengkhar: 08 Mongar: 09 Ngatshang: 10 Saleng: 11 Serimuhung: 12
Silambi: 13 Thangrong: 14 Tsakaling: 15 Tsamang: 16

SECTION I GENERAL INFORMATION

I-1 Name of interviewee

I-2 Household No.

I-3 Main activity of this household
 1. Farmer 2. On-farm labor 3. Non-farm labor
 4. Salary worker 5. Private business 6. Others

I-4 Household member in the same house

No.	Items	Male	Female	Total
1	Total number of household members	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	60 years old and over	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	under 15 years old (nos. of children)	<input type="text"/>	<input type="text"/>	<input type="text"/>

I-5 Member of village organization (Head of the family)

1 2 3 4 5

I-6 Member of village organization (Housewife)

1 2 3 4 5

Village organization:

Farmer's water users' community: 01, Credit group by government: 02, Micro-credit group by NGO: 03,
 Production group: 04, Religion group: 05, Drinking water users' group: 06,
 Marketing group: 07, Youth group: 08, Veteran group: 09,
 Women's group: 10, Others: 11

SECTION II LIVING CONDITION

II-1 Living standard

No.	Items	Present condition	Expectation (Ranking)
1	Drinking water source near your house (within 50 m)	<input type="text" value="Yes / No"/>	<input type="text" value="1, 2, 3, 4"/>
2	Electricity	<input type="text" value="Yes / No"/>	<input type="text" value="1, 2, 3, 4"/>
3	Toilet	<input type="text" value="Yes / No"/>	<input type="text" value="1, 2, 3, 4"/>
4	Gas	<input type="text" value="Yes / No"/>	<input type="text" value="1, 2, 3, 4"/>

II-2 Constraints and needs for living condition

No.	Items	Constraints (Ranking)	Expectation (Ranking)
1	Food shortage	1, 2, 3, 4	1, 2, 3, 4
2	Health condition	1, 2, 3, 4	1, 2, 3, 4
3	Work opportunity	1, 2, 3, 4	1, 2, 3, 4
4	Debt	1, 2, 3, 4	1, 2, 3, 4
5	Drinking water	1, 2, 3, 4	1, 2, 3, 4
6	House building (poor, small)	1, 2, 3, 4	1, 2, 3, 4
7	Education	1, 2, 3, 4	1, 2, 3, 4

SECTION III INCOME AND EXPENDITURE

III-1 Cash income sources in last year

No.	Items	Income	No.	Items	Income
1	Selling paddy/ rice	Nu/Yr	10	Selling firewood	Nu/Yr
2	Selling maize	Nu/Yr	11	Salary from permanent job	Nu/Yr
3	Selling vegetables (including beans)	Nu/Yr	12	Wages from working on farms	Nu/Yr
4	Selling fruits (including nuts)	Nu/Yr	13	Wages from working on other farms	Nu/Yr
5	Selling other agricultural products	Nu/Yr	14	Private business (transportation, trading, shop, etc.)	Nu/Yr
6	Selling forest non-wood products	Nu/Yr	15	Remittance from family members	Nu/Yr
7	Selling livestock (cattle, pigs and poultry)	Nu/Yr	16	Selling handicraft/ cottage industry products	Nu/Yr
8	Selling livestock/ poultry products	Nu/Yr	17	Others	Nu/Yr
9	Selling fishes	Nu/Yr	18	Total	Nu/Yr

III-2 Expenditure for consumption

No.	Items	Expenditure	No.	Items	Expenditure
1	Rice	Nu/Yr	6	Firewood/ Kerosene/ Electricity/ Gas	Nu/Yr
2	Other foods	Nu/Yr	7	Transportation	Nu/Yr
3	Health/ medicine	Nu/Yr	8	Religious rites/ Ceremony/ Offering	Nu/Yr
4	Education/School	Nu/Yr	9	Others	Nu/Yr
5	Clothes and shoes	Nu/Yr	10	Total	Nu/Yr

III-3 Investment of productive and fixed assets in the last two year

No.	Items	Amount of Investment	Money Source
1	Livestock	Nu	
2	Housing (building & maintenance)	Nu	
3	Private business	Nu	
4	Land	Nu	
5	Transportation means	Nu	
6	Others	Nu	

Money Source:

Own money: 01 Borrowed (from formal source, e.g. bank): 02 Borrowed (from informal source, e.g. friend, money lender): 03

Others: 04

SECTION IV SAVINGS AND LOAN

IV-1 Loans and debts at present

No.	Source	Amount	Interest rate	Purpose	Collateral	Amount repaid
Y / N			%/Yr			
			%/Yr			

Source:

Money lender: 01 Friend/Relatives: 02 Trader: 03 NGO: 04 Commercial bank: 05 Government: 06 Others: 07

Purpose:

Seed/Fertilizer/Agro-chemicals: 01 Farm equipment/Tools: 02 Animals: 03 Food: 04
 Assets: 05 Land: 06 Education: 07 Debt repayment: 08
 Ceremonial occasion: 09 Business: 10 Reclamation/Rehabilitation of farmland: 11
 Building/Repair of house: 12 Others: 13

Collateral:

Nothing: 01 Land: 02 Crop production: 03 Jewelry: 04 Others: 05

SECTION V AGRICULTURE

V-1 Constraints and needs for agriculture

No.	Items	Constraints (Ranking)	Needs to improvement (Ranking)
1	Irrigation system	1, 2, 3, 4	1, 2, 3, 4
2	Labor shortage	1, 2, 3, 4	1, 2, 3, 4
3	Credit	1, 2, 3, 4	1, 2, 3, 4
4	Agricultural extension	1, 2, 3, 4	1, 2, 3, 4
5	Shortage of landholding (insufficient land)	1, 2, 3, 4	1, 2, 3, 4
6	Productivity (low yield)	1, 2, 3, 4	1, 2, 3, 4
7	Accessibility to farmland	1, 2, 3, 4	1, 2, 3, 4
8	Pest/disease/rat damage	1, 2, 3, 4	1, 2, 3, 4
9	Equipment & agricultural machinery	1, 2, 3, 4	1, 2, 3, 4
10	Accessibility to Market	1, 2, 3, 4	1, 2, 3, 4
11	Market information	1, 2, 3, 4	1, 2, 3, 4
12	Disease of livestock animal	1, 2, 3, 4	1, 2, 3, 4
13	Low price of agricultural products	1, 2, 3, 4	1, 2, 3, 4

SECTION VI LIVESTOCK

No.	Items	Number	Food sufficiency		Market
			Summer	Winter	
1	Cattle/ Oxen				
2	Yak				
3	Horse				
4	Sheep				
5	Mule				
6	Pig				
7	Poultry				
8	Goat				

Food sufficiency:

Sufficient: 01 Just enough: 02 Short: 03 Very short: 04

Market:

Middleman: 01 Cooperative: 02 Consumer: 03 Others: 04

SECTION VII LAND USE

VII-1 Land holding (only for farm land)

No.	Items	Land owned	Land rented from others	Land leased to others	Land operated
1	Wetland	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre
2	Dry land	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre
3	Tseri	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre
4	Kitchen garden	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre
5	Others	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre
6	Total	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre	<input type="text"/> acre

SECTION VIII PRODUCTION

VIII-1 Food condition/ availability

Crop/ Vegetable	Production	Sold product	Price	Income	Market channel/ route	Market	Reason
Rice	<input type="text"/> kg	<input type="text"/> kg	<input type="text"/> Nu/kg	<input type="text"/> Nu	<input type="text"/>	<input type="text"/>	<input type="text"/>
Maize	<input type="text"/> kg	<input type="text"/> kg	<input type="text"/> Nu/kg	<input type="text"/> Nu	<input type="text"/>	<input type="text"/>	<input type="text"/>
Wheat	<input type="text"/> kg	<input type="text"/> kg	<input type="text"/> Nu/kg	<input type="text"/> Nu	<input type="text"/>	<input type="text"/>	<input type="text"/>
Buckwheat	<input type="text"/> kg	<input type="text"/> kg	<input type="text"/> Nu/kg	<input type="text"/> Nu	<input type="text"/>	<input type="text"/>	<input type="text"/>
Barley	<input type="text"/> kg	<input type="text"/> kg	<input type="text"/> Nu/kg	<input type="text"/> Nu	<input type="text"/>	<input type="text"/>	<input type="text"/>
Millet	<input type="text"/> kg	<input type="text"/> kg	<input type="text"/> Nu/kg	<input type="text"/> Nu	<input type="text"/>	<input type="text"/>	<input type="text"/>

Market channel/route:

Middleman: 01 Cooperative: 02 Consumer: 03 Others: 04

Market:

Dramtse: 01 Sherichu: 02 Yadi: 03 Mongar: 04 Lingmethang: 05 Gyalpozbing: 06 Others: 07

Reason:

High price: 01 Faraway: 02 to repay debt: 03 Others: 04

VIII-2 Food condition/ availability

No.	Condition	No.	Condition		
1	Rice	<input type="text"/>	2	Maize	<input type="text"/>

Food condition:

Sufficient: 01 Just enough: 02 Short: 03 Very short: 04 Others: 05

SECTION IX EXPENDITURE

IX-1 Production cost

No.	Items	Summer	Winter	Total
1	Wetland	Nu/year	Nu/year	Nu/year
2	Dry land	Nu/year	Nu/year	Nu/year
3	Tseri	Nu/year	Nu/year	Nu/year
4	Kitchen garden	Nu/year	Nu/year	Nu/year
5	Others	Nu/year	Nu/year	Nu/year
6	Total	Nu/year	Nu/year	Nu/year

SECTION X POSTHARVEST PROCESSING FOR RICE

X-1 Agricultural machine

No.	Items	Machine	Ownership	Charge	Unit
1	Threshing		O / B / C		
	Place of threshing				
2	Drying		O / B / C		
	Heat source (Fuel)				
3	Cleaning		O / B / C		
4	Milling for self-consumption		O / B / C		
	wage				

Machine:

for threshing, Engine thresher: 01 Pedal thresher: 02 Manual: 03 Others: 04
 for drying, Flat bed dryer: 01 Other mechanical dryer: 02 Sun: 03 Others: 04
 for cleaning, Engine winnower: 01 Manual winnower: 02 Others: 03

Ownership:

"O" means own machine, "B" means borrow machine, and "C" means possession in cooperative machine.

X-2 Storage and P/H losses

Means of storage

No.	Items	Volume	Unit	Period
1	Max. storage volume			months
2	Kind of container			
3	Usage of fumigant	Yes / No		

Kind of container:

Bag: 01 Bamboo basket: 02 Wooden box: 03 Others: 04

Processing losses

No.	Items	1	2
1	Dominant loss		
	% of losses	%	%
2	Constraints for rice processing		
3	Expectation to improve		
4	Processing of white rice to sell		

Dominant loss:

Harvesting: 01 Threshing: 02 Drying: 03 Cleaning: 04 Storage: 05 Others: 06

Constraints for rice processing:

Low price of rice: 01 Shortage/lack of fund: 02 Shortage/ lack of machinery/tools: 03
 Low knowledge of P/H losses and counter measures: 04 Difficult for studying P/H processing technology: 05 Others: 06

Expectation to improve:

Guidance of P/H processing technology: 01 Credit for mechanical introduction: 02 Credit for mechanical dryer introduction: 03
 Credit for mechanical cleaner (winnow) introduction: 04 Provision of market information: 05 Others: 06

Processing of white rice to sell:

Noodle: 01 Confectionary: 02 Powder: 03 Liquor: 04 No processing: 05 Others: 06

SECTION XI MARKETING

XI-1 Today's selling

No.	Items	Price	No.	Items	Price
1	White Rice	Nu/	9	Fresh Fish	Nu/
2	Wheat	Nu/	10	Dry Fish	Nu/
3	Cereal	Nu/	11	Cattle	Nu/
4	Pulse	Nu/	12	Dry Cattle Meat	Nu/
5	Milk	Nu/	13	Pig	Nu/
6	Cheese	Nu/	14	Dry Pig Meat	Nu/
7	Butter	Nu/	15	Chicken	Nu/
8	Egg	Nu/	16	Others in total	Nu

XI-2 Times and reasons for selling

No.	Items	Times for selling			Means of storage
1	White Rice	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
2	Wheat	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
3	Cereal	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
4	Pulse	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
5	Milk	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
6	Cheese	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
7	Butter	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others
8	Egg	1. Right after harvest	2. If need cash	3. If need to exchange to other food	1. Wooden Box, 2. Bag 3. Others

XI-3 Marketing place

No.	Items	Transportation means	Distance from your house
1	In your village	1. On foot, 2. By horse, 3. By donkey, 4. Never	minutes km
2	Neighboring village	1. On foot, 2. By horse, 3. By donkey, 4. Never	minutes km
3	Market	1. On foot, 2. By horse, 3. By donkey, 4. Never	minutes km
4	Others ()	1. On foot, 2. By horse, 3. By donkey, 4. Never	minutes km

XI-4 Negotiation of exchange rate

No.	Items
1	Do you negotiate the exchange rate?
2	If you negotiate every time, the exchange rate will change by?

1. Fixed 2. Negotiate every time, 3. Others

1. Quantity, 2. Quality, 3. Retailer, 4. Others

SECTION XII OTHER FINDINGS

9# Are you joining the group activities for assembling and for selling activities (grading and/or packing of products) of cash crops? (for Drepong)

- ① Yes ② No ③ I don't know now,

10 From whom will you get advice for production techniques/technology for cash crops and why?

- ① EA (Extension agent) ② Progressive farmer of neighbors
 ③ Specialist of research center ④ Others (_____)

Q11: Who is responsible for the following work in your family?

Work Item	Adult (over 15 YO)		Child (less than 15 YO)	
	Male	Female	Boy	Girl
Agriculture work				
Plowing				
Transplanting / Planting				
Harvesting				
Post harvest processing				
Livestock feeding				
Shipping/selling products				
Off-farm activities				
Labor at construction site				
Village meeting				
Cottage industry				
Household work				
Drinking water supply				
Cooking				
Accounting				
Washing clothes				
Shopping				
Care of children				
Firewood collection				
Decision making				

Q12: Are you satisfied with your life? (Yes or No) If no, why?

Q13: (For children only) What do you want to be in the future? (occupation)
(Boy or Girl)

Q14: (For children only) Whom do you admire or respect most?
(Boy or Girl)

Q15: (For children only) What do you want to get most now?
(Boy or Girl)

ANNEX-II

***AGRICULTURE, LIVESTOCK AND
EXTENSION SYSTEM***

ANNEX-II

Agriculture, Livestock and Extension System

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ANNEX-II

AGRICULTURE, LIVESTOCK AND EXTENSION SYSTEM

CHAPTER II-1 INTRODUCTION

This Annex is the supplemental report on the agriculture, livestock and extension system for “the Study on Agriculture and Farm Road Development in the Lhuntse and Mongar Districts in the Kingdom of Bhutan”. The Study was carried out through the field survey (April to December 2002) in the Bhutan and home work in Japan during from April 2002 to February 2003. The Study consists of two parts of the Master Plan Study (April to August of 2002) and the Formulation of Action Plan (September to December of 2002).

The master plan was formulated through participatory approaches of the problems, objectives and alternatives analysis by PCM (Project Cycle Management) with participants of District staff and Gewog leaders, RRA (Rapid Rural Appraisal) survey with key personnel and beneficiaries in villages, and questionnaire interview survey with 300 beneficiaries.

The Master Plan aims at:

- ① Improvement of living standard through cash crop production,
- ② Attainment food security, and
- ③ Farm road development to improve accessibility of agricultural products to market.

The Master Plan was formulated by two regional development plans: Regional Agriculture Development Plan (RADP) and Farm Road Development Plan (FRDP). RADP consists of four Programs and 15 sub-programs including horticulture, marketing and sectors as shown below:

Program-1 (P1): Program for Food Crop Production Increase

- Food security sub-program (SP)
- Paddy rice production SP
- Irrigation development SP (Road and Other Infrastructure)
- Backyard animal husbandry SP
- Post-harvest technology training sub-program (Marketing)

Program-2 (P2): Program for Cash Crop Production Strengthening

- Market research SP (Marketing)
- Technical research and development SP (Horticulture)
- Training of extension agent SP
- Agro-processing technology training SP (Marketing)

Program-3 (P3): Market System Development Program (Marketing)

- Collection depot construction SP
- Group assembling SP

- Group assembling and shipping SP
- Marketing support by FCB SP

Program-4 (P4): Program for Extension Strengthening

- Extension strengthening for food crop
- Extension strengthening for cash crop

Action Plan was formulated on priority Gewogs selected through zoning by the development stages, which were categorized by accessibility, food sufficiency and development potential. As the results, below three (3) Gewogs were selected for the formulation of the Action Plans.

- Drepong Gewog (Mongar Dzongkhag): Development stage 1
- Gangzur Gewog (Lhuntse Dzongkhag): Development stage 2
- Chaskhar Gewog (Mongar Dzongkhag): Development stage 3

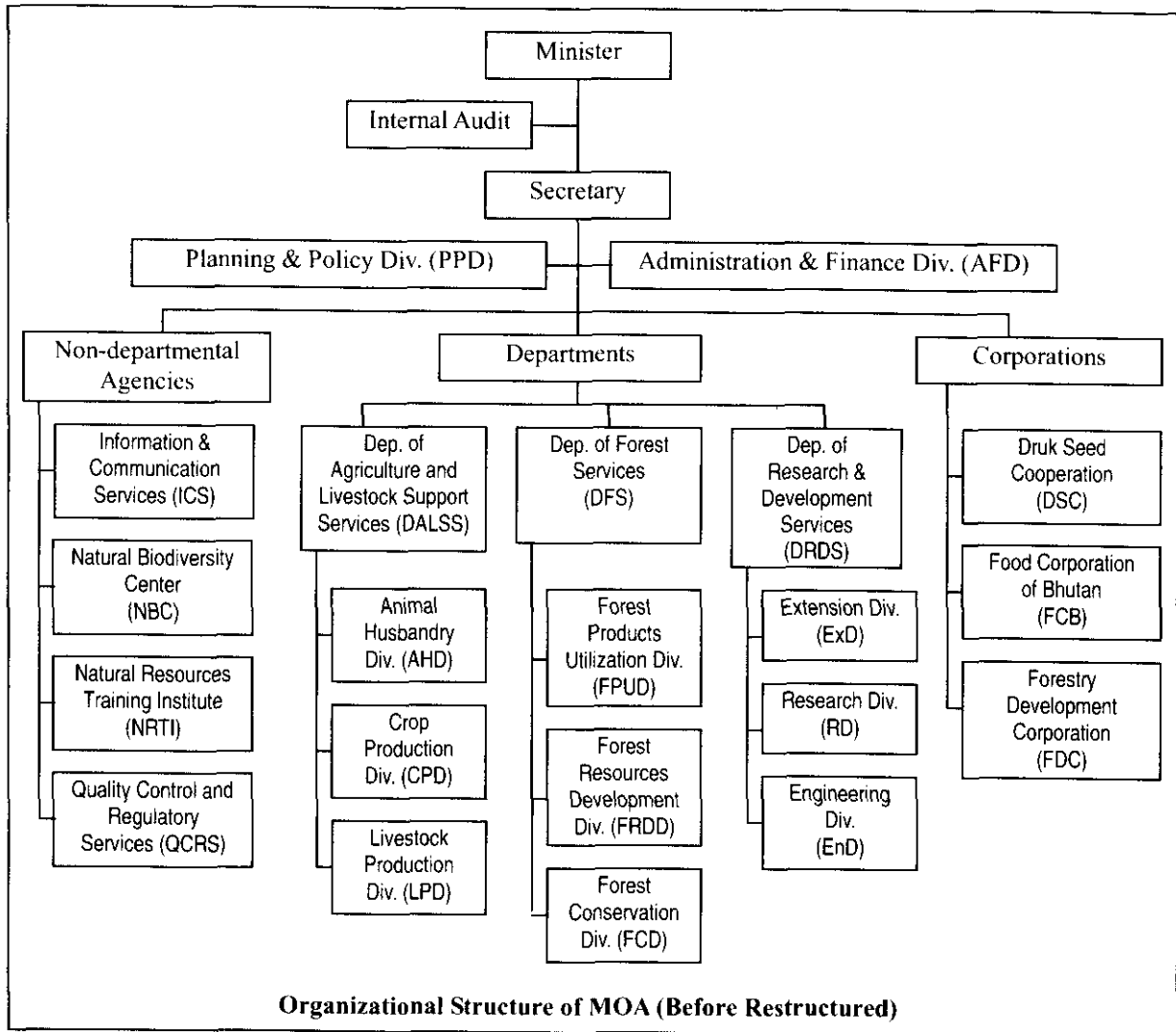
Action Plans of six (6) sub-programs (underlined sub-programs) out of above 15 sub-programs on RADP were formulated in the sector in Annex II. The Action Plans of Gewog were formulated through workshops with Gewog leaders and discussion of beneficiaries in Gewog. The detailed Action Plan was described in the Action Plan Sheet, which was a form for formulation of Action Plan.

This Annex II is composed of the following Chapters:

Chapter II-1	Introduction
Chapter II-2	Agricultural Background of Bhutan
Chapter II-3	Present Conditions of the Study Area
Chapter II-4	The Master Plan
Chapter II-5	Justification of the Master Plan
Chapter II-6	Formulation of Action Plan

II-2.1 Administration of Agriculture Sector

Agricultural sector consisted of agriculture, livestock and forestry is named “Renewable Natural Resources (RNR)” sector in Bhutan. Ministry of Agriculture (MOA) is the responsible Ministry of RNR sector. The organization chart of MOA is shown in Fig. 2.3.2 of the Main Report. The chart shows new organization restructured for 9th FYP, however the new organization has not started as of December 2002. Organizational structure before the restructure is shown figure below.



Under the decentralization policy of ROGB (Royal Government of Bhutan), the responsibility of planning and implementation on agriculture development was sifted to Dzongkhag (District Administration). MOA is responsible to policy, budget and technical support to Dzongkhag.

Dzongkhag officers on three sub-sectors of agriculture, animal husbandry and forest are appointed in each Dzongkhag. They are responsibility persons for each sub-sector of the Dzongkhag. Two (2) to three (3) extension agents are stationed in each Gewog for field

activities of extension. The organization charts of both Dzongkhags are shown in Figures 2.3.3 and 2.3.4 in the Main Report.

II-2.2 Ninth Five-Year Plan

Five-Year Plan (FYP) is the national development plan for middle term period. 9th FYP shows development plan during the period from July 2002 to June 2007. 9th FYP of RNR Sector was prepared for the National, Dzongkhag and Gewog levels under the decentralization policy.

II-2.2.1 Objectives of RNR

Objectives of the RNR sector for the 9th FYP are:

- Attainment of national food security: to maintain a minimum of 70% self-sufficiency in food grain production, and to strengthen food security of all households at all the time, as well as to cover the cost of food import by the export of crops with advantage such as horticulture crops.
- Conservation and management of natural resources: to protect mountain environment and its unique flora and fauna for future generation through utilization and management in a sustainable utilization of natural resources, including forest, land, biodiversity, and water resources.
- Enhancement of rural income: to alleviate poverty and improve living standard in the country through the development and promotion related to horticulture, livestock and other income generation activities with appropriate, viable and ecologically sustainable agricultural technologies, and better accessibility to the market.
- Generation of employment opportunities: to sustain current level of employment and halt rural urban migration, and to generate new employment opportunities in rural area through promotion of agro and wood-based industries, promotion of agro and eco-tourism for off-farm and off-season employment and income, and provision of vocational training for youth.

II-2.2.2 Priority Areas of RNR

In order to attain above objectives the priority approaches for RNR sector in the 9th FYP are the following:

- Enhancing household and national food security,
- Enhancement of rural livelihood and income,
- Development of farm infrastructure,
- Development and organization of farm-business and wood-based industries,
- Conservation and utilization of natural resources, and
- Development of internal and external markets for farm produce and products.

II-2.2.3 Strategy of RNR Sector

The following 17 strategies are adopted in implementing of the development plan of 9th FYP:

- To create enabling policy and legal framework,
- To improve planning and management of the programs,

- To improve monitoring and evaluation of the programs,
- To generate appropriate technology,
- To deliver extension services,
- To create enabling financial environment,
- To deliver inputs to the farmers,
- To mechanize farms,
- To enhance markets for priority products,
- To develop adequate level of vital infrastructure,
- To diversify the economic base of the sector,
- To enhance the integrity of the natural resources,
- To promote economic growth and employment,
- To strengthen human resources and capacity building,
- To introduce and adopt information technology,
- To mobilize financial resources, and
- To strengthen administrative management of implementation.

II-2.2.4 Programs of RNR Sector

The implementation programs identified in the 9th FYP are categorized into following three (3) categories:

- ① Field Program: As a bottom-up approach, the programs will be planned implemented by Dzongkhag and Gewog. Each program has several sub-programs based on the specific problems and potential of the area as given in II-2-2-5.
- ② Regional and Area Program: The programs would basically support the development of more than one Dzongkhag based on geographical divisions or thematic areas. The programs basically will be implemented in region-wised programs by for (4) donors: EU for Western region, GTZ for West central region, SDC (Swiss Development Cooperation) and Helvetas for Eastern Central region, and SEZAP (Second Eastern Zone Agricultural Project) financed by IFAD for Eastern region.
- ③ National Program: The program shall have national coverage usually along thematic fields of specialization. This programs consist of the followings:
 - Direction and management of delivery of goods and services from MOA,
 - Amendment and formulation of policy and legislation,
 - Land use planning,
 - Agriculture marketing,
 - Human resource development,
 - Information, communication and statistics,
 - National Biodiversity Center (NBC),
 - Quality control and regulation,
 - Plant protection services,
 - National Soil Services Center (NSS),
 - Research,
 - Extension,
 - Horticulture development,
 - RNR engineering,
 - Farm mechanization,

- Livestock development,
- Forest services,
- Druk Seed Corporation (DSC),
- Forestry Development Corporation, and
- Food Corporation of Bhutan (FCB).

II-2.2.5 Field Programs of RNR Sector

Field programs out of above three (3) categories are shown in below with the sub-programs:

- **Food security:** Rice, maize, wheat, buckwheat, barley, millet, oilseed, and legumes.
- **Income generation:** Horticulture (chili, potato, asparagus, other vegetables, ginger, apple, citrus, walnut, cardamom, mango, other fruits) medical and aromatic plants, mushroom, apiculture, backyard animal (poultry, dairy, piggery, others), NYFP (Non-timber forest products), private nursery, seed production, peri-urban production, business credit, marketing, animal transport, trekking & camp, cottage industry, and agro-processing.
- **Rural livelihood support:** Assistance to small farmers, credit, irrigation, farm road, river bank protection, RNR center, processing/storage/post-harvest facilities, land development/reclamation, soil fertility management/agro-forestry, land swapping, plant protection, feed/fodder, livestock breed improvement (cattle, yak, equine, others), cattle improvement, animal health services, community forestry, fuel-wood, rural timber, and farm mechanization.
- **Nature conservation and environment protection:** Afforestation, fire management, wild animal management, protection outpost, and watershed management.
- **Employment generation:** vocational training on agriculture and horticulture, forestry (logging, carpentry, cable crane operation), livestock (backyard farm management training), agriculture (food processing)
- **Institutional and capacity building:** Cooperative, farmers organization (growers, WUA, registered seed growers, etc.), farmers training, RNR staff training, information/education/communication for awareness raising (field day, study tour, livestock show, etc.), machineries and equipment supply, staff development, infrastructure development.

II-2.3 Agriculture in Bhutan

II-2.3.1 Agricultural Population and Labor Force

Population in Bhutan was reported about 600,000 in 1996 by RGOB, and is increasing with 3.1 % of the annual growth rate. It is estimated to be around 720,000 in 2002. RGOB forecasts 2.5 % of population growth rate during 9th FYP. According to the 9th FYP, 79 % of the total population are living in the rural area, and 75 % of the active labor force, which occupy 53 % of total population, are engaged in agriculture (CSO/RCSC in 1999). Agriculture sector is dominant industry sector in Bhutan with occupying high employment ratio of labor force and 36.8 % of GDP in 2000 (ADB: Key indicators of developing Asian and Pacific Countries).

II-2.3.2 Agricultural Land

Bhutan is rugged mountainous country with wide variation in altitude from 150 m to 7,000 m in the high Himalayan zone. Climate conditions range from wet sub-tropical in the south to Alpine snow and ice in the north. Agricultural lands are studded between mainly altitude 150 m and 3,600 m: from the wet sub-tropical zone to cool temperate zone.

According to the land use map prepared by MOA, forest land occupies 72 % of the country. Agriculture land including pasture and *Sokshing* and orchard occupies 8,000 km² or 6 % of the whole land. The agricultural land are shown in the below table:

Land Use Category	Land Registration Record	RNR Statistics 2000	Land Cover Map
Wet land	22,010	21,860	38,760
Dry land	48,310	45,640	97,720
Tseri/Pangshing (Shifting cultivation)	30,460	28,800	88,330
Kitchen Garden	1,060	1,040	-
Mixed Land *1	-	-	84,030
Cultivated Land Total	101,840	97,340	308,840
Orchard	8,660	8,600	2,220
Plantation	-	-	3,570
Sokshing *2	7,500	7,270	-
Tsadrok (Pasture)	177,750	173,310	156,440
Total	295,750	286,520	471,070

*1: Mixed land of the above 4 land use categories.

*2: Government owned forest land used by farmers to collect leaf litters for cow bedding and compost preparation.

Almost farm households have operational farmland. Ratio of farm households owned farmland types are shown in the table below:

	Wet land	Dry land	Tseri	Kitchen garden	Orchard	Sokshing	Pasture	Landless
Ratio of farm households (%)	58.9	86.9	47.5	25.5	28.0	27.7	5.4	2.6

Source: RNR Statistics 2000

II-2.3.3 Food Crop Production

Major staple food crops of Bhutan are rice and maize, and followed by wheat, barley, buckwheat and millet as minor crops. According to the RNR Statistics 2000, the production of the cereal crops are shown in the table below:

Cereal Production and Major Production Area of Bhutan

	Production (ton)	Harvested area (ha)	Yield (kg/ha)	Major producing Dzongkhags
Paddy	68,573	19,148	3,581	Sarpang, Punakha, Samtse, Wangdue
Maize	77,298	31,137	2,483	Trashigang, S/Jongkhar, Mongar,
Wheat	4,352	4,688	928	Wangdue, Paro, Punakha
Barley	1,735	1,498	1,158	Mongar, Bumthang, Wangdue
Buckwheat	2,887	3,529	818	S/Jongkhar, Bumthang
Millet	3,793	6,167	615	Samtse, Sarpang,
Total	158,638	66,167	2,398	

Source: RNR Statistics 2000

II-2.3.4 Horticulture

RGOB are promoting horticulture production for getting foreign currency by export. Orange, apple and potato presently are major export products to India and Bangladesh. These products are produced under the advantage of highland in the tropical zone. Production of major horticulture is shown in the table below:

Production of Major Vegetables, Spices Fruits and Nuts

Vegetables / Spices	unit	Potato	Chili	Radish	Turnip	Ginger	Beans	Brinjal	Carrot
Production	ton	35,436	2,849	3,384	2,615	1,267	1,151	188	148
Harvested area	ha	3,122	937	779	349	626	-	-	-
Vegetables / Spices		Cassava	Peas	Raj. Bean	Sag	Tomato	Garlic	Onion	Cardamom
Production	ton	824	627	351	518	330	429	285	510
Fruits/Nuts		Apple	Orange	Walnut	Plum	Pear	Peach	Areca nut	Guava
Number of trees	1,000	368	1,761	37	9	13	29	358	27
Bearing trees	1,000	197	907	6	5	8	21	142	18
Production	ton	5,133	20,616	235	235	718	1,091	1,330	665

Source: RNR Statistics 2000

II-2.3.5 Livestock

Livestock sub-sector is essential for farm households for income source, draft power and diets for inhabitants. Cattle husbandry is major activity in livestock. Average number of cattle per household is around 4 heads.

Livestock Population in Bhutan

	Total number of animals	Ratio of households owing livestock (%)
Cattle	320,500	77.5
Buffalo	1,800	0.8
Yak	34,900	2.2
Horse	23,300	23.8
Mule	4,300	-
Donkey	300	-
Sheep	22,900	5.8
Goat	31,328	15.7
Pig	41,401	37.5
Poultry	230,723	65.5

Source: RNR Statistics 2000

II-2.3.6 Food Security

Rice and maize are major staple food for Bhutanese. The diet composition of Bhutanese is dominated by cereals at 25 % and non-cereal including livestock products, account for 25 %. “Policy Objectives & Strategies, Arable Agriculture Sub-sector for 9th FYP” analyzed food security of Bhutan at 2001 as follows:

- Maize and rice are the major crops of domestic cereal production contributing 40 % and 39 % respectively, wheat and other minor cereals make the remaining contribution, and Bhutanese cereal diet consists of 56 % of rice and 29 % of maize,
- Present food grain self sufficiency by domestic production stands 69 % against the RGOB target of 70 %,
- Per capita consumption of food grain is estimated at 195 kg,
- Shortage of food grain of 31 % is met by the import of rice (38,000 tons), the import amount of rice is nearly equal with the domestic production,
- The demand of rice is expected to rise further due to increase in population, increasing preference and income level,
- An additional 42,000 tons (30 % increase of present level) will needs to attain food sufficiency for growing population and to meet 216 kg per capita consumption in 2007 at end of 9th FYP.

II-3.1 Soils and Land Capability

Soils in the Study Area are developed on steep slopes of rugged mountainous terrains with from sub-tropical to alpine climate conditions according to the altitude between 200 m and 5,600 m, diverse vegetation provided by the temperature and rainfall circumstances, and various soil parent materials. The soil distribution is intricate by the topography, relieves, geology, vegetation and activities of the inhabitants. The soils on the gentle slopes are relatively fertile comparing with those on steep slopes. The soils on the steep slopes are eroded, shallow and contain lots of gravels and stone. Lands of relatively gentle slopes are suitable for field and horticultural crops with advantage of various climate conditions from sub-tropical to cool temperate.

According to the "Feasibility Study on the Lhuntse and Mongar Integrated Agricultural Development Project", soils in the Study Area were classified into seven soil units based on the FAO/UNESCO soil classification system, namely 1) Phaezems, 2) Cambisols, 3) Acrisols, 4) Gleysols, 5) Arenosols, 6) Regosols and 7) Lithosols.

Soils and Capability

Soil Unit	Topography	Vegetation/ Land use	Soil characteristics	Land capability assessment
1) Phaezems	High altitude more than 2,000 m; steep slopes	Mainly forest or grassland, partly for Tseri	A horizon: strongly structured; B horizon: porous	Low potential for cultivation because of high altitude, and steep slopes
2) Cambisols	Middle to low altitude on old talus; gentle to steep slopes	Cultivated as dry land on gentle slopes, or forest on steep slopes	Weakly developed surface soils; medium to coarse clay loam	Medium potential for cultivation except steepness
3) Acrisols	Upper slopes	Cultivated or grass lands	Rather deep soil; fine texture	Capability is not high but there is no serious limitation except slopes
4) Gleysols	Relatively gentle to middle slopes	Wet land	Fine texture; relatively high organic matter content	Suitable wet land, and relatively high productivity
5) Arenosols	Alluvial terraces	Forest and grassland	Coarse texture, gravels and stone contained; low nutrient	Low fertility due to shallow soil depth
6) Regosols 7) Lithosols	Mainly south slopes on the hard and weathered bed rocks	Scare vegetation	Suffered serious erosion; thin (around 10 cm) and gravely surface soil	Low potential for cultivation

Source: Feasibility Study on the Lhuntse and Mongar Integrated Agriculture Development Project, JICA, 1989

The soils and land capability in the Study Area are characteristics as follows:

- As the farmlands are distributed between the altitude range of 600 m and 3,000 m, climate conditions range from humid subtropical to highland cool temperature, and various crops within the climates are suitable for cultivation,
- The farmland located on the inclination of 15 % to 45 % (mostly 35 % and 40 %).

Due to the steep slopes the soils are subjected to erode, and generally low fertile. Marginal land of slope conditions have been used for cultivated land including Teri (shifting cultivation land),

- The soils are generally shallow, and contain gravels and stones. Such as the conditions obstacle workability of farming practices, such as plowing and carrying of inputs and outputs,
- Soil distribution sequence depends on soil depth, soil characteristics by parent materials, and soil moisture and sunlight conditions by micro-relief reflect to the land productivity,
- Soil conservation on sloped lands is introducing in the filed level with ecological measures to protect erosion.

II-3.2 Land Use

Land use type is classified into six (6) categories by Land Use Planning Project (LUPP) of MOA in 1994: namely i) forest land, ii) pasture land, iii) agriculture land, iv) horticulture land, v) settlement area, and vi) other lands. Land use map is shown in Fig. II-1 and II-2 based on LUPP. The pasture land included natural and improved pasture is utilized to grazing for livestock animals. Horticulture land consists of orchard tree crop land. Agriculture land is sub-categorized to wet land (paddy land, *Chuzhing*), dry land (upland crop land, *Kazhing*), shifting cultivation land (slush and burn land, *Tseri*), and mixed cultivated land, which is mixed land of above sub-category land uses.

As shown below table, forest occupies 75.3 %, 88.5 % of the total land in Lhuntse and mongar respectively, while cultivated land occupies 4.4 % and 9.8 %, respectively. Wet land was terraced and small parcels according to the inclination and generally irrigated. Dry land is generally un-terraced and un-irrigated. Tseri land is cultivated for one or two years, then left uncultivated for several years for regeneration of soil fertility. The cropping ratio of the Tseri is estimated to be at about 30 % of the land area.

Present Land Use

	Lhuntse		Mongar		Total	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
1 Forest	217,351	75.3%	172,258	88.5%	389,609	80.6%
2 Pasture						
Natural pasture	9,452	3.3%	1,395	0.7%	10,847	2.2%
Improved pasture	0	0.0%	156	0.1%	156	0.0%
Subtotal	9,452	3.3%	1,551	0.8%	11,003	2.3%
3 Agriculture						
Wet land	944	0.3%	627	0.3%	1,571	0.3%
Dry land	2,383	0.8%	7,077	3.6%	9,460	2.0%
Tseri land *1	3,289	1.1%	5,904	3.0%	9,193	1.9%
Mixed land *2	6,196	2.1%	5,408	2.8%	11,604	2.4%
Subtotal	12,812	4.4%	19,016	9.8%	31,828	6.6%
4 Horticulture	0	0.0%	0	0.0%	0	0.0%
5 Settlement	36	0.0%	91	0.0%	127	0.0%
6 Others	49,109	17.0%	1,821	0.9%	50,930	10.5%
Total	288,760	100.0%	194,737	100.0%	483,497	100.0%

Note *1: Shifting cultivation land

*2: Mixed land use area of wet, dry and Tseri lands

Source: Land Cover Maps of Lhuntse and Mongar Dzongkhags (1/10,000), MAO

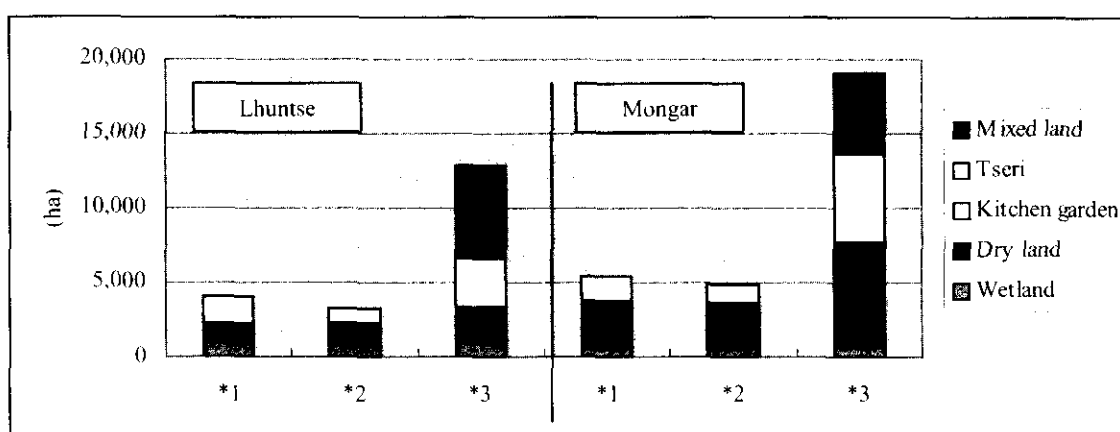
Besides the agricultural land use mentioned above, *Sokshing*, which is government own forest and used by farmers to collect leaf litters for the cattle bedding and compost materials, is registered as a kind of private land utilization right of farmers.

As for the farm land area, three data sources are available, i) land registration record, ii) RNR Statistics 2000 (Agriculture Census), and iii) land use map prepared MOA. The private lands are registered to certify the land ownership. Land tax is imposed according to the registered land area. It is conceivable that the registered land areas are generally quite small compared with the actual land areas. The registered land area depends on a traditional land unit, *Langdo*, which is equal with around 0.13 ha or area to be able to plow by a pair of bullock in one-day work. Reviewing of the registered land area has just started covering the whole country. According to the review survey, registered land areas have been revised to be 1.5 to 2 times as large at the previous registration. It is estimated that the actual cultivated land is significantly larger than the registered land. Tseri and mixed cultivated land will be able to be used more intensively in the future for food and horticulture production to catch up the population growth.

Land Use Areas by Data Sources

(Unit: ha)

Dzongkhag	Lhuntse			Mongar		
Data source	*1	*2	*3	*1	*2	*3
Agricultural land						
Wet land	926	812	944	495	500	627
Dry land	1,296	1,371	2,383	3,112	3,055	7,078
Kitchen garden	105	49	-	146	45	-
Tseri land	1,748	1,030	3,289	1,595	1,263	5,904
Mixed land *4	-	-	6,196	-	-	5,408
Subtotal	4,075	3,262	12,812	5,348	4,863	19,017
Horticulture land	0	14	0	191	64	69
Pasture land	871	790	2,480	523	367	300
Total	4,946	4,066	15,292	6,062	5,294	19,386



Note: Refer to Table II-1 for detailed and Gewog level.

Data source of above table and figure *1: Land registration record, *2: RNR Statistics 2000, and *3: Land Cover Maps Lhuntse and Mongar Dzongkhags (1/10,000), MOA

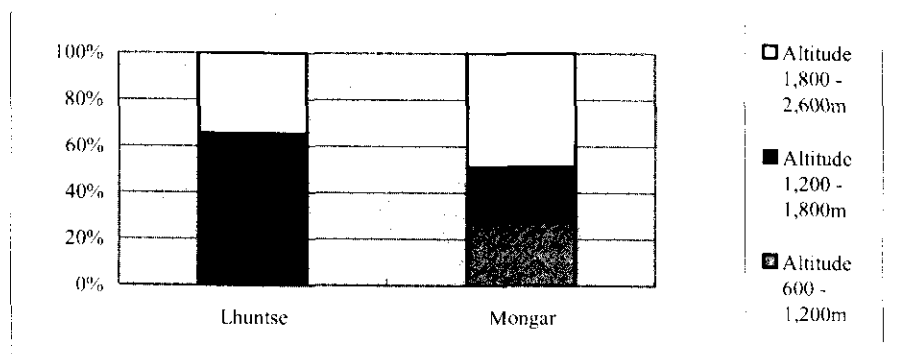
Cultivated Land Area by Data Sources

Government is going to change the land use system of Tseri land from slush and burn to i) permanent cultivated land (dry land), ii) orchard land iii) private pasture land, or iv) community forest. It is supposed that approximately 50 % of the Tseri land could be changed to dry land at the maximum for the conservation of natural environment, prohibition

of slush and burn cultivation, and effective land utilization.

Farmers yearn to eat rice for a staple food, and to operate wet land. Wet land, however, are distributed unevenly due to the shortage of water resource and suitable gentle land for paddy cultivation. As shown in Table II-1, Gewogs in Lhuntse Dzongkhag except Jaray, and Chali, Chaskhar, Drametse and Tsakaling Gewogs in Mongar Dzongkhag are blessed relatively by wet land. However, five Gewogs: Gongdue, Jurme, Kengkhar, Silambi and Thangrong, in the southern part of Mongar Dzongkhag have no or few wet land in the areas, the inhabitants resignedly have maize for staple food.

Cultivated lands are distributed altitude range of from 600 m to 2,600 m, humid subtropical (600 – 1,200 m), dry sub-tropical (1,200 – 1,800 m) and warm temperate (1,800 – 2,600 m) climate zones. The farm lands in Mongar are distributed in the three zones, but the farm lands in Lhuntse are located humid tropical and warm temperate zone as shown the figure below.



Data source: Prepared by the Study Team based on the Land Cover Map, MAO
Distribution of Agricultural Land by Altitude Ranges

Constraints and potentials on land resources are summarized as follows:

- Cultivated land ratio in the Study Area is only 6.6 %, and the land are scattered on the steep slopes in the mountainous terrain. It hampers effective use of farmland,
- Wet lands are distributed unevenly, therefore the farmers without wet land can hardly access to rice, they have unavoidably maize for staple food,
- Areas of the land registration record are smaller than the actual land area. For land potential analysis and future land use planning, more accurate data on present land use are necessary,
- Tseri land occupies around 25 to 30 % of cultivated land. For prohibition of slush and burn farming and sustainable land use, change of land use from Teri to other use is main subject for food security, horticulture development, and natural environmental conservation,
- For increase of population and rice demand by income increase, wet land development is necessary through water resource development and terracing of farm land,
- As the altitude range in the Study Area is wide, it is advance that various kinds of crops are suitable there, and harvesting period can be prolong,
- Most cattle are grazing in grassland, forest and roadside. For natural environmental conservation, prevention of over grazing, and improvement of fodder shortage in the winter season, pastureland development and feed and fodder production is required.

II-3.3 Land Tenure and Land Holding

There are few landless farmers in the Study Area. Private land holding size is limited at 10 ha (25 acres) or less per household by the government. Fallow land in Lhuntse and Mongar Dzongkhags occupies 8 % and 6 % of wet lands, while it occupies 17 % and 13 % of dry lands, respectively. The reasons of high ratios of fallow land are i) shortage of labor force, ii) water shortage and mal-functioned irrigation facilities for wet land, iii) sufficient production for self-consumption food (maize), and iv) no market for selling surplus products.

Around 80 % of cultivated land is operated by land owners. Wet lands of Lhuntse Dzongkhag, where is major paddy production area, especially, Menbi and Minjay Gewogs, are leased in or leased out at high ratio compared with dry land and wet land in Mongar. Because some of the wet lands are owned by, or leased out to farmers of rice deficit areas such as Bumthang Dzongkhag under crop sharing system.

Land Tenure Status and Cultivated Land Size Distribution

(Unit: %)

Land tenure status (% of land area)	Lhuntse Dzongkhag		Mongar Dzongkhag	
	Wet land	Dry land	Wet land	Dry land
Own and operated	79.5	78.7	89.5	83.1
Leased in	5.0	1.6	1.8	1.3
Leased out	7.4	2.4	2.9	2.2
Left fallow	8.1	17.3	5.9	13.4
Cultivated land size (% of households)				
< 0.4 ha	24.7	14.1	62.7	10.8
0.4 - 1.2 ha	52.7	49.0	28.2	64.8
1.2 - 2.0 ha	15.0	23.0	4.5	18.2
2.0 - 2.8 ha	2.3	8.2	1.3	3.7
2.8 - 4.0 ha	1.8	2.4	0.0	1.3
4.0 - 10.0 ha	3.6	1.6	0.0	1.2
> 10.0 ha	0.0	1.7	3.2	0.0

Note: Refer to Table II-3.3.1 in detailed on Gewog level

Source: RNR Statistics 2000

Average farm sizes including Teri land per household of Lhuntse and Mongar Dzongkhags are estimated at 1.6 ha and 1.1 ha, respectively, which were calculated on the basis of the land registration record and number of households. These holding sizes might be smaller than the actual due to the aforementioned "smaller registration areas". On the other hand, the potential land resource per household is estimated at 5.1 ha and 3.8 ha respectively, on the basis of the land use map. The former may be too small and the later probably includes incidental land of cultivated lands and serious marginal lands. Through the above examination, the average holding size estimated to be at 2 – 3 ha per household.

II-3.4 Agricultural Labor Force

The Labor Force Survey 1998 and 1999 conducted by RCSCV (Royal Civil Services Commission) reported on labor force situation in Bhutan through the field survey as follows:

- 85.9 % (84.4 % in 1998, hereafter figures in blanket shows at 1998) of total population living in the rural area,
- 55.9 % (54.4%) and 39.9 % (32.5 %) of the rural population are over 15 years of age, and economically active,

- 83.6 % (87.3 %) of economically active population are engaging in agriculture, forestry and fishing activities.

As the results, agricultural labor force is estimated at 38.8 % (33.6 %) of the total rural population. As the average family sizes of Lhuntse and Mongar Dzongkhags are 7.7 and 8.9 persons, respectively, the average agricultural labor forces per household are estimated to be at 2.7 and 3.2 persons, respectively.

Labor force requirement for on-farm activities of crop cultivation considerably high, because depending on manual and draft animals for farming practice, steep slopes of farm land, and scattered and far distance from their residence to farmland. Plowing by draft animal, especially, requires two male laborers due to the hard labor for control the cattle and drive the plow. Watching and fencing to prevent from damage by wild animals such wild boar, deer and monkey, also requires rather high labor force. Labor requirements for major crop production are estimated below:

<u>Major crops</u>	<u>Labor requirement</u> (person-day/ha)
Paddy	270 - 300
Maize	250 - 280
Wheat	100 - 150
Mustard seed	100 - 150
Potato	250 - 280

Labor and draft animal requirement for major works per ha are shown below:

Paddy transplanting	55 - 65 man-days/ha
Paddy harvesting/threshing/carrying	65 - 75 man-days/ha
Maize land preparation/sowing	40 - 50 man-days/ha
Maize harvesting/threshing/carrying	50 - 55 man-days/ha
Potato land preparation/sowing	30 - 35 man-days/ha
Potato harvesting/carrying	70 - 80 man-days/ha
Watching and fencing for animal damage	20 - 50 man-days/ha
Plowing (wet and dry lands)	8 pair bullock-days/ha and 16 man-days/ha

Traditional labor exchange system is common in the Study Area. Plowing, sowing, transplanting and harvesting are carried out by the labor exchange system. On-farm work in the community is carried out smoothly one after another, however, the busy season would become long period for each households. Plowing is generally carried out by pair bullock using traditional plow. Farmers without draft power hire bullock in their community by labor exchange system, which one-day work of bullock equals with two person days of laborer work. Hired labor system has not been common, however, recently the hired labor is increasing especially for manual transportation of products.

Considering the above labor requirement and available labor force, cultivated farm land area per household is estimated at around 2.0 ha at maximum, and 1.5 ha on average, even applying the labor exchange system. It might be a reason of the low cropping intensity and cultivable farmland per household does not exceed around 2 ha. It may cause low cropping intensity and high ratio of fallow land.

Mechanization of farm work in order to reduce labor requirement and to solve labor shortage

is essential. The possibility, however, is limited by considering the size of a farm lot, slope of farm land and access to farm. Possible mechanization and countermeasures for reduction of labor requirement are below:

- Use of power-tiller for plowing and transportation of input and output (it is limited to accessible by road condition),
- Use of herbicides and more exact row trans-planting for reduction of weeding works for paddy cultivation,
- Improvement of traditional plow and plowing by draft animal,
- Introduction of small-scale or portable farm machines such as pedal thresher, manual winnower, portable irrigation pump,
- Introduction of small-scale machines for hauling/carrying such as cable ropeway, and power tiller, small cart or bull-cart after improvement of farm road and farm mule track.

II-3.5 Food Crops

Major food crops in the Study Area are maize and paddy, and followed by supplementary crops of wheat, barley, buckwheat and millet even small share. Production ratios of maize and paddy to the total cereal crops occupy about 73 % and 23 %, respectively. The Study Area is a major producing area of maize in Bhutan occupying 18 % of the national production.

Marketing of maize is limited within in and around the villages because most of farmers are producing maize for their self-consumption, consumers market scale in urban is small scale of, and transportation of cereals is difficult due to the lack of access road. Some areas (farmers) might produce surplus maize, and the surplus maize might be used to feed of livestock, and homemade liquor (*Ara*). Surplus paddy rice even in Minjay and Menbi, which is major producing area of paddy in Lhuntse, is distributed only within Lhuntse Dzongkhag.

Food Crop Production in the Study Area

		Lhuntse	Mongar	Study Area	National
Paddy	Area (ha)	750	440	1,190	19,148
	Production (ton)	2,918	1,445	4,363	68,573
	Yield (kg/ha)	3,890	3,287	3,667	3,581
Maize	Area (ha)	1,093	3,092	4,185	31,137
	Production (ton)	3,158	10,565	13,722	77,298
	Yield (kg/ha)	2,890	3,417	3,279	2,483
Other cereals	Area (ha)	147	461	608	15,882
	Production (ton)	242	584	826	12,767
	Yield (kg/ha)	1,646	1,267	1,359	804
Cereals Total	Area (ha)	1,990	3,992	5,982	66,167
	Production (ton)	6,318	12,593	18,911	158,638
	Yield (kg/ha)	3,175	3,154	3,161	2,398
Mustard seed	Area (ha)	39	78	117	3,450
	Production (ton)	17	45	63	1,696
	Yield (kg/ha)	440	580	533	492
Soybean	Production (ton)	30	63	93	577

Note: Refer to Table II-3 in detail and Gewog level

Source: RNR Statistics 2000, MOA

Besides the cereal crops, mustard for oil seed, and soybean and Rajma bean (kidney bean spp.), which are exported for small amount to India, are major field crops in the Study Area.

It is supposed that the yields level of above table might be considerable high because cropped areas were estimated smaller than the actual areas mentioned previously. According to the rough estimation by the team, average yields of paddy and maize are around 2.2 ton/ha and 2.0 ton/ha, respectively. According to the RNR Sample survey 2000, average yields of field crops in Bhutan are shown below.

<u>Crops</u>	<u>Yield (kg/ha)</u>
Paddy	2.28
Maize	1.58
Wheat	0.98
Millet	0.80
Buckwheat	0.97
Barley	1.22
Mustard	0.77

II-3.6 Horticulture

Many kinds of horticulture crops are grown in the Study Area under the climate conditions of humid sub-tropical, dry sub-tropical, warm temperate and cool temperate. Horticulture crops might have high potential for increase of cash income of the farm households through export to India. However, despite such high potential, their production still remains at low level due to the following reasons:

- Difficulty of marketing because of small capacity of domestic market in and around the Study Area, high transportation cost due to poor road network and long distance to export port to India, Samdrup Jongkhar, and small quantity and low quality of products for marketing,
- Less intention of farmers for horticulture production. Most of farmers intend to produce agricultural products for their self-sufficiency, therefore, they do not have high willingness to cash crop production,
- Less knowledge of farmers on horticulture farming, even most of farmers have experience of horticulture cultivation.
- Poor supporting activities for farmers on horticulture such as technical guidance, input supply (seeds and saplings), and
- Less technical and institutional capacity at Dzongkhag and Gewog levels.

Major horticulture crops currently cultivated in the Study Area are mainly temperate crops such as potato and chili and radish among vegetables, and mandarin orange, mango, peach and walnut among fruits including nuts. Production of major horticulture crops is shown in Table II-4 and table below.

Production of Major Horticultural Crops

Vegetables	Lhuntse		Mongar	
	Planned area (ha)	Production (ton)	Planted area (ha)	Production (ton)
Total	-	667	-	3,218
Potato	38	332	241	2,132
Chili	57	151	53	154
Radish	14	55	62	340
Tree crops	No. of Trees (1,000 tree)	Production (ton)	No. of Trees (1,000 tree)	Production (ton)
Total	11.00	197	51.88	1,206
Apple	1.29	11	1.42	12
Orange	4.81	60	24.58	594
Walnut	1.66	18	7.09	51
Peach	1.44	39	4.99	232
Mango	-	-	8.14	22

Note: Refer to Table II-4 in detail and Gewog level

Source: RNR Statistics 2000 except mango (Dzongkhag data)

The number of non-bearing trees occupies nearly 50 % of the total because of the high ratio of young trees of fruits. The major producing areas of horticulture products are Drametse Gewog that is located at eastern area in Mongar Dzongkhag for potato, and southern Gewogs of Mongar Dzongkhag for orange. The former has an advantage of transportation being located closer to Samdrup Jongkhar, export outlet to India, while the latter areas, even having been cultivating orange for long time, face difficulty in marketing due to lack of proper access to the market.

It is necessary to improve and strengthen followings for the horticulture development:

- Selection of suitable crops for agro-ecological, geographic conditions, and export to India,
- Variety and cultivar improvement of horticulture crops for better quality of products,
- Awareness and technical dissemination on horticulture production for farmers,
- Capacity building of EA (Extension Agent) on technical and marketing aspects, and
- Strengthening of seed and sapling supply system.

Besides the horticulture crops, various AMT (Aromatic and Medicinal Plant) are grown natural and under the various bio-ecological conditions, such as lemongrass (essential oil plant), *artemesia annua* (medicinal plant), *Lac* (dyeing material, secretion of insect), and pine resin. They are also important income sources of farm households.

II-3.7 Livestock

Cattle, horse, mule, pig and poultry are major livestock animals. Present situation of livestock husbandry and livestock production in the Study Area is shown in table below and Table II-5.

Livestock Animals and Livestock Production

Rearing number of livestock animals	Unit	Lhuntse Dzongkhag *			Mongar Dzongkhag *		
		Total	Per HH	HH ratio	Total	Per HH	HH ratio
Cattle	head	14,089	5.6	78%	26,635	5.4	83%
Yak	head	44	0.0	1%	0	0.0	0%
Horses/Mule/Donkey	head	1,950	0.8	41%	2,655	0.6	34%
Sheep/Goat	head	286	0.1	1%	446	0.1	5%
Pigs	head	1,617	0.6	40%	4,398	0.9	47%
Poultry	head	9,577	3.8	78%	17,564	3.5	73%
Livestock products	Unit	Total	Per HH		Total	Per HH	
Milk	liter	1,098,000	436		2,055,000	414	
Butter	kg	76,000	30		125,000	25	
Cheese	kg	115,000	46		179,000	36	
Egg	piece	920,600	247		1,405,400	283	
Productivity	Unit						
Milk (per milking cow)	kg			393			391
Local	kg			362			358
Improved	kg			616			667
Egg (per total poultry)	piece			65			80

Note * per HH: average per household, HH ratio: Percentage of rearing households
Refer to Table II-5 in detailed and Gewog level.

Source: RNR Statistics 2000 and Gewog data on households.

The most important livestock is cattle for home-made dairy products and draft power of plowing. Farm households process milk to local butter and cheese. The products provide essential diet of fat, protein and minerals to rural inhabitants. The surplus products, which are sold in and around their villages mostly by barter trading, bring farmers income. Average rearing numbers of cattle per household is 5.5 heads in total. About 20 % of the cattle are adult-male for draft power of plowing. Plowing is done by pair of bulls using traditional plow. A pair of bulls for plowing are driven by two farmers: one for bull control at the front and another for plow control behind the plow. This high labor requirement causes labor shortage during the land preparation period. A pair of bullocks can plow 0.13 ha per day. A bull-work day is equivalent to two labor days in the labor exchange system in the community. The high population of cattle is a constraint of land degradation by grazing land, and shortage of feed and fodder in the winter season. Free grazing of cattle, which is common in the Study Area, damage to field crops, especially to vegetable cultivation in the dry season. The productivity of milk of cow is still low (average milk production of milking cow 390 liter per year) due to the high ratio of local breeds, improved breeds is still 10 % in the Study Area.

Horse, mule and donkey are important transportation means for living commodity, and agricultural inputs and outputs in rural area. Sheep and goat are not promoted due to the protection of soil erosion by the over-grazing.

Pig and poultry are backyard livestock to supply of meat and egg to rural people. But their rearing scales are small. The products of meat and eggs are distributed limitedly in and around the villages. Bhutanese taste and demand for meat is high, but they refrain from killing animals due to the Buddhism sentiment. The rearing farmers must ask for slaughtering of animals with treatment charge (usually in kind of meat). Such contradiction makes livestock development difficult.

Livestock husbandry provides materials of FYM (Farm Yard Manure). Animal shed/pen should be improved in order to provide better materials for compost preparation and to improve the productivity of livestock.

The development constraints on livestock sector are:

- Low productivity and high population of cattle due to the local breeds, and
- Buddhism sentiment hampering livestock for meat.

Small-scale backyard animal husbandry of pig and poultry might have high potential by utilization of surplus maize and/or their by-products, and in order i) to provide meat and eggs to rural people, and ii) to increase farm household income, and iii) to provide materials for FYM.

II-3.8 Cropping System and Farming Practices

Farming is generally practiced in traditional farming system. The farming system of major crops is shown in the table below:

Crop	Growing season	Farming practices	Inputs
Paddy	Nursery: Apr/May Transplanting: Jun/Jul Harvesting: Oct/Nov	Majority is local variety; dry nursery; transplanting; manual threshing in the farm after several days drying	Generally used FYM, less used chemical fertilizer, some of farmers use herbicide for reduction of labor requirement of weeding
Maize	Sowing: Mar/Apr/May Harvesting: Aug/Sep	Improved variety is planted, farming practice provided by manual	Generally use FYM, some chemical fertilizer is used
Other cereal crops	Summer cropping: Apr - Oct Winter cropping: Sep - Apr	Generally extensive farming practices	Generally no inputs
Beans (Soya/Rajma beans) / Mustard	Summer cropping: Apr/May/June - Sep/Oct Winter cropping: Sep/Oct - Mar/May	Generally extensive farming practices	Generally no inputs
Vegetables	Sowing: Feb - Jul Harvesting: Jun - Dec	Most of vegetable planted in kitchen garden except part of potato	Generally FYM and chemical fertilizer are used, seed provided from DSC through Commission Agents
Fruit tree	Perennial	Generally poor management (pruning, tinning)	Usually no use of input, Saplings supplied from DSC through Commission Agents

As mentioned above, labor requirement for crop production is generally high. It includes; i) watching and fencing to protect crops against damage by wild animals (wild boar, deer, and monkey), ii) carrying and hauling of outputs from the farm land to farmers houses and houses to motor roads for marketing of the products, and iii) Two male laborers for control of draft animal plowing.

According to the RNR Statistics 2000, FYM is applied generally for maize cultivation at a rate of over 60 % of households. FYM is generally not well matured. Chemical fertilizer, however, is used for paddy and maize only by 20 - 30 % of the households. Insecticide and fungicide are rarely applied for food and horticulture crops. The input cost mainly consisting of seed and fertilizer is estimated at about Nu. 1,000 - 1,500 per ha. Total production cost occupies around 20 % of the gross production value as shown in Table II-6 of crop budget.

Altitude range of major crops and Cropping patterns are shown in Fig. 3.3.1 and 3.3.2 of the Main Report, respectively. Many kinds of crops can be grown under various agro-ecological

conditions in the Study Area. Typical cropping calendar of these crops is illustrated in Fig. II-3.

II-3.9 Farm Household's Economy

Present economic condition of farm households surveyed by the Study Team is shown in Table II-7, and summarized below. The balance of farm households' economy is shown by two kinds of analysis: i) the balance of actual cash income / expenditure values, and ii) the balance of income / expenditure including self-production and self-consumption values.

Farm Household Economy						
Cash Income Expenditure						
	Study			Study		
	Area	Lhuntse	Mongar	Area	Lhuntse	Mongar
Income						
Food crop	3,400	7,700	1,200	12%	26%	5%
Horticulture crop	4,600	1,900	5,900	16%	6%	22%
Livestock	6,100	6,200	6,000	22%	21%	22%
Agriculture/livestock total	14,100	15,800	13,200	50%	53%	49%
Off farm income	14,100	14,100	14,100	50%	47%	51%
Total Income	28,200	29,900	27,300	100%	100%	100%
Expenditure						
Production Cost	9,300	8,400	9,800	33%	28%	36%
Living expenditure	18,900	21,500	17,500	67%	72%	64%
Staple food	3,200	4,800	2,300	11%	16%	8%
Other food	2,200	2,600	2,000	8%	9%	7%
Food total	5,400	7,400	4,300	19%	25%	16%
Other living expenditure	13,500	14,100	13,200	48%	47%	48%
Total Expenditure	28,200	29,900	27,300	100%	100%	100%
Including self-consumption of own-products						
Income						
Food crop	15,400	19,700	13,200	30%	37%	26%
Horticulture crop	7,800	5,100	9,100	15%	10%	18%
Livestock	13,700	13,800	13,600	27%	26%	27%
Agriculture/livestock total	36,900	38,500	36,000	72%	73%	72%
Off farm income	14,100	14,100	14,000	28%	27%	28%
Total Income	51,000	52,600	50,100	100%	100%	100%
Expenditure						
Production cost	9,300	8,400	9,800	18%	16%	20%
Living expenditure	41,700	44,300	40,300	82%	84%	80%
Food expenditure	28,200	30,200	27,100	55%	57%	54%
Other expenditure	13,500	14,100	13,200	26%	27%	26%
Total Expenditure	51,000	52,600	50,100	100%	100%	100%

Source: Interview survey of 300 households conducted by the Study Team

The results of examination are described below:

- Average cash income (including barter trading) level is around Nu. 28,000, of which about 50 % is from agriculture and livestock. Farmers in Lhuntse earn large part of the income from food crops and livestock, while farmers in Mongar earn

from horticulture crops and livestock,

- Major cash income sources of off-farm activities are NTFP (Non-Timber Forest Product) such as wild vegetable collection, lac (dyes), resin, and lemongrass, then weaving, temporary wage work for construction, transportation service by horses, etc. follow,
- Production cost including livestock is Nu. 9,300, which is 33 % of the total cash expenditure,
- Income level including self-consumption is around Nu. 51,000, out of which 72 % of the total income comes from agriculture and livestock activities. Food expenditure occupies around 62 % of the living expenditure, and
- Self-sufficient rate of food expenditure is 80 % - 85 %.

II-3.10 Food Balance

As for the national food security, RGOB targets to maintain self-sufficiency in food grain production at the minimum of 70 %, and to cover the cost of import cereals by export of agricultural products consisting mainly of horticulture products. RGOB currently imports about 40,000 ton of food per year, mainly milled rice. MOA estimates the self-sufficient rate in 2000 at 68.6 % out of 195 kg of per capita as total food grain consumption. MOA also forecasts that the per capita food grain demand would be 216 kg at the end of 9th FYP, namely 2007.

Based on RNR Statistics 2000, food balance analysis of each Dzongkhag and Gewog was carried out by the Study Team. The conditions of the analysis are below:

- Production of cereals is applied RNR Statistics 2000,
- Population is applied registration record of Dzongkhag in 2002,
- Milling recovery rates of rough grain are assumed to be 60 % for paddy, and 80 % for maize and other cereals,
- Per capita milled grain is including post-harvest losses, seed reserves, animal feed and home processing utilization such as liquor.

As shown in Table II-8, per capita food cereal production in Lhuntse and Mongar Dzongkhags are 230 kg and 224 kg, respectively. Food supply and demand are supposedly nearly balanced at present in both Dzongkhags. However, Gewogs located in remote area are generally in short of food, and experience frequent seasonal food shortage, especially, in Jaray of Lhuntse Dzongkhag, Drepong, Gongdue, Jurme, Kengkhar, Silambi and Tsamang Gewogs of Mongar Dzongkhag.

	Lhuntse	Mongar
Rice	90	20
Maize	130	191
Other cereals	10	11
Total	230	222

Constraints on food security are followings:

- The food balance in the Study Area is nearly balanced, but seasonal food shortage occurs mainly in remote area,
- Increase of food crop production is necessary coping with high population growth,

- Rural people depend on maize in staple food, especially in Mongar Dzongkhag. Demand of paddy rice will probably increase according to improvement of their living standard.

II-3.11 Agricultural Extension Services

Agricultural extension activities are provided by Extension Agent (EA) under coordination and guidance by RNR sector of Dzongkhag. Dzongkhag appoints EAs of three sub-sectors, agriculture, livestock and forestry. They are assigned in RNR center or extension center in the Gewog. The extension services are integrated in RNR center in Gewog for covering the three sub-sectors. EAs in RNR center work in cooperation with sub-sectors each other.

Tasks of EAs cover wide fields as follows:

- Coordination of input supply
- Technical guidance on crop and livestock production
- Resource management on soil, water, labor, farm mechanization
- Post-harvest management including storage, agro-processing and marketing
- Advice on farm management, finance and credit
- Support of farmers group and association
- Farm survey on data collection and monitoring, and
- Environmental management

Establishment of RNR centers and number of EAs will be increased during 9th FYP. One or two EAs is (are) assigned to each Gewog in Lhuntse, while two to three in Mongar. Present conditions of the extension facilities and staffs are shown in the table bellow:

Extension facility and Extension Agents in the Study Area		
	Lhuntse	Mongar
RNR Center	2	14
Agricultural Extension Center	5	2
Livestock Extension Center	6	0
Forestry Extension Center	0	3
Agricultural EA	15	15
Livestock EA	9	16
Forestry EA	0	3

Source: Lhuntse and Mongar Dzongkhags

Extension activities are carried out under supervision and coordination of RNR sector of Dzongkhag in linkage with research and extension programming of Regional RNR-RC (RNR Research Center). Training for EAs is provided by NRTI (Natural Resource Training Institute) and other programs or functions of MOA.

Constraints on extension activities are summarized below:

- An EA generally has to cover broad geographical area,
- Poor communication and transportation conditions for regular and temporary activities such as reporting and meeting at Dzongkhag,
- Less opportunities of EA training, and poor knowledge on horticulture crop farming, and
- Less linkage between research and extensions, especially in horticulture fields.

II-3.12 Agricultural Research and Development

Research on RNR sector is carried out in RNR Research Center (RNR-RC), MOA. RNR-RC of the Eastern Zone (RNR-RC-East) is located at Wengkhar in Mongar Dzongkhag. RNR-RC-East has two sub-centers at Khangma (Trashigang) and Lingmethang (Mongar).

The above three centers cover major agro-ecological zones of the Eastern Zone:

	Location	Altitude (m)	Farm area (ha)	No. of Staff
Wengkhar Center	Mongar	1,700	28	10
Khangma Sub-center	Trashigang	2,100	16	35
Lingmethang Sub-center	Mongar	640	16	8
Total			60	53

RNR-RC-East was established at Khangma in 1987 by an IFAD project. The center was moved to Wengkhar in 2001 during the Phase I of SEZAP. In the Phase I, research farm, irrigation facility and administration building were constructed. Laboratory, greenhouse, and training facilities have not been facilitated.

RNR-RC-East covers agronomy (field crops, horticulture, and aromatic/medicinal plant), livestock, forestry, irrigation engineering and extension. Among these items, priority of research and development is given to horticulture, especially, citrus, mango, walnut, potato and vegetables, which are regarded as “target crops” in the Eastern Zone.

The constraints of RNR-RC-East are summarized below:

- Improvement of the research and training facilities of the Wengkhar Center has not been completed for full activity of the Center. Due to limitation of resources, the improvement of research infrastructure and equipment is delayed,
- Capacity of staffs for horticulture development is not enough to conduct proper researches and dissemination of the results. It is necessary to train and build capacity of researchers and extension agents, and
- Lack of research on post-harvest and marketing of horticulture development.

II-3.13 Agricultural Input Supply

Organizations and agents related to input supply and distribution are mentioned in the following.

(1) Druk Seed Corporation

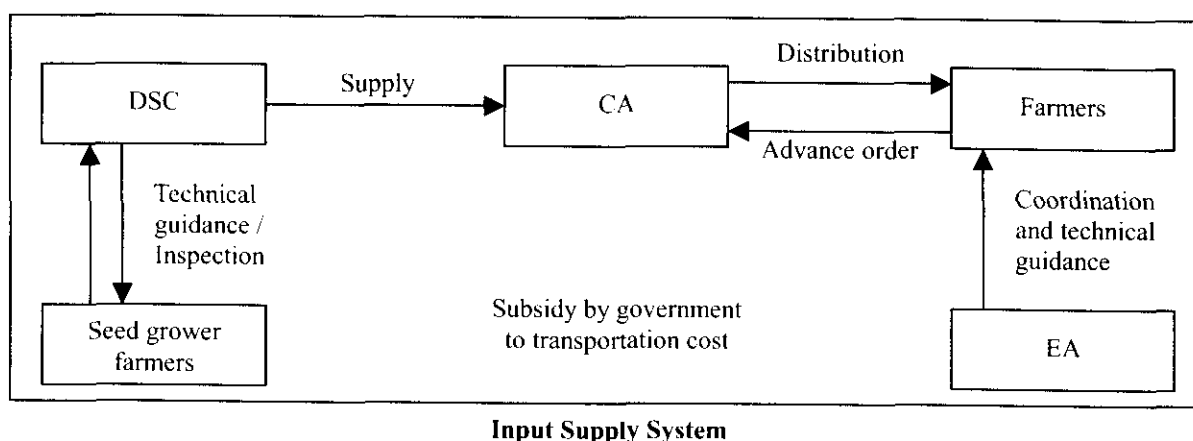
Druk Seed Corporation (DSC) is an autonomous body under MOA. DSC plays roles of; i) seed multiplication, import and distribution including seedlings of horticulture tree crops, and ii) import and distribution of chemical fertilizer and agro-chemicals. DSC has a central office in Paro, four regional centers and three seed production farms in the country. Regional center of the eastern zone is located in Trashigang Dzongkhag. DSC supports seed grower farmers, and farmers groups. Produced seeds by the farmers are inspected, processed, and distributed as certified seeds to user farmers.

(2) Commission Agent

Commission Agent (CA) is private individual agent certified by MOA to distribute agricultural inputs from DSC to farmers. CAs take orders for inputs from farmers in their service area, and procure them from neighboring DSC, then distribute them to the farmers and give instruction on usage of the inputs. Transportation cost is subsidized by the government, and the prices of the inputs are maintained same in the whole country. Farmers carry the inputs from the delivery point near by motor roads to their house by themselves. In the Study Area, there are six CAs in total, two in Lhuntse, and four in Mongar.

(3) Extension Agent

Coordination of input supply to farmers is one of the roles of extension services of Extension Agents (EA). They also give advice and technical guidance on inputs to farmers.



Constraints on input supply are;

- Prices of inputs are subsidized on the transportation cost; however, it is still expensive for farmers, and
- Capacity of production of seeds and seedlings is still low. Some farmers do not have access to inputs at right time for required quantity at hand.

II-3.14 Rural Credit Services

BDFC (Bhutan Development Finance Corporation) is providing micro-finance to farmers in the rural area. Financing services of BDFC have been decentralized to Dzongkhag branch level, and are going further to decentralize to Gewog level using mobile banking activity and group credit system.

Agriculture lending of BDFC is targeted for rural and agriculture sector development: short-term loan (one season / year) for agricultural inputs and middle / long term loan for developments of land, livestock and orchard, and other for farm and non-farm activities. EAs are involved in lending the short-term loan for input distribution to the farmers. Group guarantee lending / savings is undertaken at Gewog level. The loan amount ranges from Nu. 5,000 to 50,000 per users. The interest rate varies from 13 % to 15 %.

Although BDFC established micro-credit service system for the farmers, users of the system

are not many due to undeveloped money economy in the rural area. Most farmers want to repay with in-kind for the input loan.

CHAPTER II-4 THE MASTER PLAN

II-4.1 Development Needs

The Study Area is confronted with following constraints:

- Most of farmers in the Study Area are still situated at low-income level and poor living standard, and they live under self-consumptive conditions isolated from market economy.
- Seasonal food shortage occurs in Gewogs of remote area, and food grain can be distributed through barter trading in and around their community. Also, the rapid population growth might menace the people with more food shortage.
- Farmers have a limited cash income sources. Because knowledge of production and marketing on cash crops is still poor, and they do not have access to market of cash crops due to poor transportation facility and undeveloped market system.
- Main market of agricultural products is India because of small scale of domestic consumers market.

II-4.2 Targeted Crops

As aforementioned, the overall targets of the Master Plan are: i) to improve self-sufficiency of food in the Study Area, and ii) to enhance income and living standard of the people in the Study Area.

The former target would be attained by production increase of food crops, mainly maize and paddy rice. For food security, food cereal grain should be produced by 230 kg per capita per year in each Gewog in order to solve seasonal shortage of food and to cope with population growth. Demand of rice will be increased according to improvement of the living standard of rural population. However, suitable land for paddy production and water resource for irrigation are limited in the Study Area, especially in the southern Gewogs of Mongar Dzongkhag. Therefore, the target of paddy production is set to increase with a rate of 2.5 % at least per annum, which is population growth rate assumed for the period of 9th FYP.

The latter target would be attained through cash crop production and marketing of the products. The cash crops include horticulture crops (fruits, other tree crops and vegetables), pulses such as soybean and Rajma bean, AMP (Aromatic and Medicinal Plants) such as lemongrass oil and *Artemisia annua* (medicinal plant), and NTFP (Non-Timber Forest Products) such as pine resin, lac dye and wild vegetables. A lot of crops and products with marketable potential are grown in the Study Area under various climate conditions and agro-ecological diversity. However, market-oriented production has not been conducted except a few areas with advantages on transportation and marketing. Priority crops of each Gewog, which were presented in Problem Analysis Workshop, are shown in Table 5.3.1 in Main Report.

II-4.3 Development Approach of Food and Cash Crop Production

Agricultural production has to be practiced with integrated production system consisting of agriculture, livestock and forestry. Tseri (shifting cultivation land) occupies around 30 % of the total farmland area. Some of them will be converted to dry land, orchard land, pasture or forest. Even for the cash crop development, Tseri will be a target area of Orchard

development. FYM (Farm Yard Manure) is main source of fertilizer for crop production. The materials are mainly leaf litters collected from neighboring forest of the household. Backyard animals will provide good materials for preparation of FYM. Feed of backyard animals will be supplied by surplus cereal from food crop production.

The target crops for the RADP-LM are categorized into two groups, food crops and cash crops. Production increase of food crops would be achieved in each Gewog through dissemination of improved farming techniques including proper input utilization, and capacity building of EA (Extension Agent) by Dzongkhag and MOA. The both Dzongkhags generally have capacity and system for the promotion of food crop production getting support and coordination of MOA. The strengthening of production system and capacity building of EAs on the food crops would be able to be achieved by Dzongkhags' own effort.

It is essential that the target crops should be lightweight and high value considering the transportation cost. However, the crop that will satisfy the conditions cannot be identified among existing cash crops except some special crops such as wild lemongrass for distillation of essential oil, medicinal plants, and dye materials. At the first stage of the development, potato and orange will be priority crops, which are exported to India through Samdrup Jongkhar with agro-ecological advantages of tropical highland. In the future gradually and strategically, the priority crops should be diversified with advantages in marketing, and the major producing area of the priority crops should be formed in the Study Area.

As for cash crop, technical capacity, experience and knowledge of Dzongkhag staffs are not sufficient. Therefore, for cash crop development, it is necessary to implement a program for research of cash crops and intensive training of field extension staffs. The program will include R&D (Research and Development) and capacity building of EAs on the cash crops, which are suitable for the Study Area. RNR Research Center of Eastern Region (RNR-RC-East) will be able to play the role by strengthening of the function and activities with cooperation of experienced specialists in the fields of horticulture and marketing.

Production support at field level on both crop groups would be mainly provided through EAs' activities in close coordination with input supply / distribution and rural micro-financial supports.

The extension services shall be strengthened with beneficiary's participation to the extension activities at field level. The activities of demonstration plot and farmers study tour will be carried out more intensively. Farmers' field school aiming at training of leader farmers and dissemination of improved farming system will be undertaken by EAs. Working group aiming at participation of beneficiaries to extension activities and strengthening of administrative functions of Gewog will be organized under the GYT.

The development approaches of crop production and production support consist of the following sub-programs which belong to three (3) programs, namely, i) Program for Food Crop Production Increase, ii) Program for Cash Crop Production Strengthening, and iii) Extension Strengthening Program.

Proposed Sub-programs and Allocation to Programs

Sub-programs	Programs
Food Crop	
1 Food security	Program for Food Crop Production Increase
2 Paddy rice production	-do-
3 Irrigation development	-do-
4 Backyard animal husbandry	-do-
5 Extension Strengthening	Extension Strengthening Program
Cash Crop	
6 Technical research and development	Program for Cash Crop Production Strengthening
7 Training of extension agents	-do-
8 Extension strengthening	Extension Strengthening Program

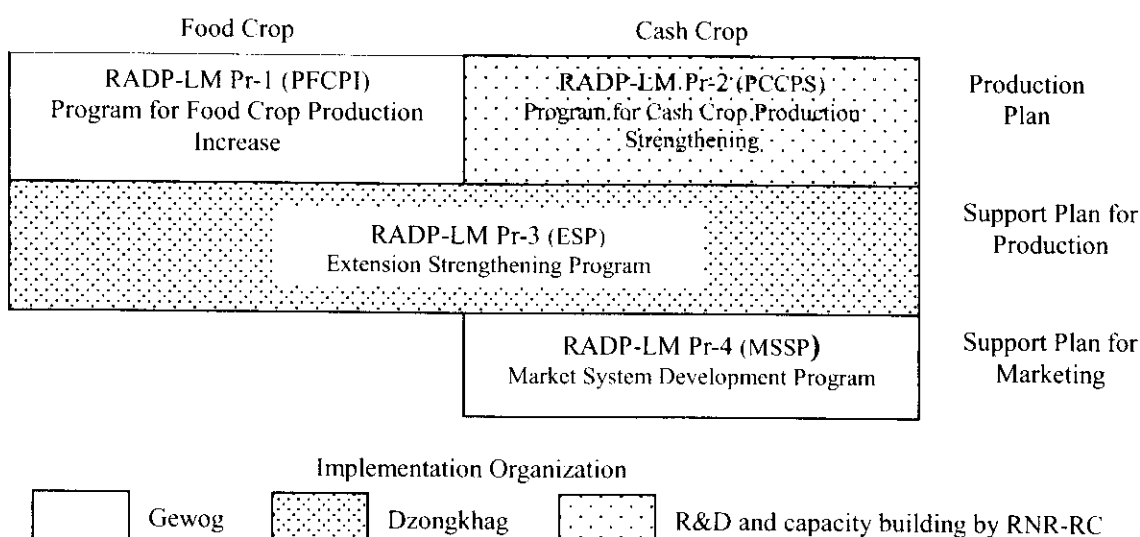
II-4.4 Development Priority

As mentioned in the Main Report, Gewogs in the study are categorized into three groups by the development stage. Gewogs of the lowest development stage are located in the most remote area in the Study Area, such as several-days-walking distance to motor road. It might be necessary to improve access road for production and marketing of cash crops.

- Gewogs of Stage 1: Attainment of food security
- Gewogs of Stage 2: Ensuring of food security coping with population growth, Capacity building of EAs, Awareness of cash crop production and marketing, Group activities of marketing on cash crops
- Gewogs of Stage 3: Strengthening of cash crop production and marketing

II-4.5 Programs of RADP-LM

Framework of the development plan of RADP-LM is illustrated below figure.



Framework of Regional Agricultural Development Plan

The Programs are consisted of sub-programs as shown in below table:

Programs and Sub-programs for RADP

Program	Sub-program	Major Component
1) Program for Food Crop Production Increase	1a) Food security	Proper land use; Introduction of improved and high yield varieties; Improvement of farming
	1b) Paddy rice production	
	1c) Irrigation development	Rehabilitation/expansion of irrigation facility; Strengthening of WUA
	1d) Backyard animal husbandry	Utilization of surplus maize for livestock; Improvement of animal breed and animal husbandry, FYM production
	1e) Post-harvest technology training	Reduction of post-harvest losses
2) Program for Cash Crop Production Strengthening	2a) Market research	Study and selection of suitable cash crops
	2b) Technical research and development	Varietal improvement; Research of production technology
	2c) Training of extension agents	Capacity building of EAs
	2d) Agro-processing technology training	Small size agro-processing
3) Market System Development Program	4a) Collection depot construction	Collection shed construction for buyers
	4b) Group assembling	Assembling by farmers group
	4c) Group assemble and marketing	Assembling and shipping by farmers group
	4d) Marketing support by FCB	Shipping to auction yard by FCB
4) Extension Strengthening Program	3a) Extension strengthening for food crop	Extension activity; Input supply
	3b) Extension strengthening for cash crop	Awareness on cash crops; Extension activity; Input supply

II-4.6 Prospective Agricultural Production

Prospective production of food and cash crops were estimated based on the land resources, available labor force including on-farm activities and shipping of products, and anticipated yield increase through production support strengthened by the programs.

Land resources to be developed are not much due to the physical condition and for environmental conservation. Production increase will be achieved by improvement of cropping intensity through efficient land use and yield increase within present farmland. The planted area in the future plan will be increased through the following manner:

- ① Utilization of fallow land: According to the RNR Statistics 2000, fallow land in Lhuntse Dzongkhag was 8.1 % for wet land and 17.3 % for dry land, and that in Mongar Dzongkhag was 5.9 % and 13.8 %, respectively. The fallow lands, which could not be planted mainly due to the shortage of labor force, will be a potential land for improvement of cropping intensity with the increase of labor force according to population growth. The population in the target year will be increased to 128 % of that at present.
- ② Similarly, Tseri will be changed to dry land for permanent cultivation. The maximum potential area is roughly estimated at around 20 to 30 % of the Tseri area.
- ③ Double cropping by planting of the second crops such as wheat, barley, buckwheat, maize and mustard after harvesting of maize will be practiced. The harvest season of maize at the altitude of less than 2,000 m is during the period of July to August. The second crop sown before middle of September will grow using rain of late wet season and residual soil moisture.

The planted area of food crops will be increased to 130 % of that at present by irrigation development. The planted area of maize will be 110 % of at present.

The anticipated yield of food crops in the target year was estimated that paddy would be increase to 2,600 kg/ha (118 % of present yield) by irrigation development, dissemination of

improved farming technology and utilization of improved / high yielding varieties. The yield of maize would be increased to 2,300 kg (115 % of that at present) by dissemination of improved crop management and improved varieties. According to the crop cut survey in improved farming areas conducted in 2001 and 2002 by the extension agents, the average yields of paddy and maize were 3.3 ton/ha and 3.0 ton/ha, respectively. Consequently, the production of paddy, maize and total cereals will be increased to 155 %, 125 %, and 130 % of those at present, respectively.

The production of cash crops was estimated assuming typical crops: orange for fruits, and potato for vegetables. As for cash crops in the target year, planted area of vegetables and number of trees estimated at around 0.1 ha, and 10 to 20 trees per household, respectively considering carrying capacity for the marketing. Prospective production of the food crops (cereals) and cash crops (fruits and vegetables) at the target year, 2012 are shown in the following table:

Yield and Planted Area of Cereal Crops						
Year	Lhuntse		Mongar		Total	
	2012	2002	2012	2002	2012	2002
Paddy						
Planted area (ha)	1,538	1,326	1,056	657	2,594	1,983
Yield (kg/ha)	2,600	2,200	2,600	2,200	2,600	2,200
Maize						
Planted area (ha)	1,944	1,700	5,951	5,574	7,895	7,274
Yield (kg/ha)	2,300	2,000	2,300	2,000	2,300	2,000

Prospective Production of Food and Cash crops in 2012					(Unit: ton)
	Food crops		Cash crops		
	Total cereals	Paddy	Fruits	Vegetables	
Target Year (2012)					
Lhuntse Dzongkhag	8,471	4,000	1,989		3,490
Mongar Dzongkhag	16,432	2,745	4,519		9,140
Total	24,903	6,745	6,508		12,630
Present (2002)					
Lhuntse Dzongkhag	6,318	2,918	197		667
Mongar Dzongkhag	12,593	1,445	1,206		3,218
Total	18,911	4,363	1,403		3,885

II-4.7 Prospective Income Increase of Household

Income increase per household was calculated based on the production increase of food crops and fruits and vegetables. The cash income was estimated on the basis of the marketed value of cash crops. The results are shown in the table below.

Prospective Income Increase per Household							(Unit: Nu).
	Agricultural Income			Cash Income			
	Stage 3	Stage 2	Stage 1	Stage 3	Stage 2	Stage 1	
Income level at 2002 *1	29,900	20,000	19,400	14,700	4,800	4,200	
Increase of income	18,900	17,900	9,100	13,300	12,300	3,500	
Income level at 2012	48,800	37,900	28,500	28,000	17,100	7,700	

Note: Incomes from food crops, fruits and vegetable production

*: Farm household interview survey conducted by the Study Team

II-4.8 Outline of Programs

II-4.8.1 Program for Food Crop Production Increase (PFCPI)

(1) Objectives

This program aims to; i) increase food crop production by proper land use and input supply, ii) improve extension system, and iii) improve capacity of extension agents; so that food security in the Study Area be ensured.

(2) Implementation Organization

Dzongkhags will be the implement organizations getting support by MOA.

(3) Sub-programs

This program consists of five (5) sub-programs of 1) food security, 2) paddy rice production, 3) irrigation development, 4) backyard animal husbandry for using surplus cereals, and 5) post-harvest improvement for losses reduction.

Food security sub-program would be implemented for two objectives: i) to solve seasonal food shortage of Gewogs (Jaray and Metsho in Lhuntse dzongkhag, and Drepong, Gongdue, Jurme, Kengkhar, Silambi, Thangrong and Tsamang in Mongar Dzongkhag) in the development stage 1, and ii) to produce food grain for coping population growth. The former is a priority program to Gewogs of Stage 1. The later should cover whole Gewogs and aims to increase food production required for growing population. Production increase of food crop would be attained through increase of planted area and unit yield:

- Effective and environmental sustainable land use including change of land use from Teri land to permanent cultivation land, reduction of fallow land and countermeasures to soil erosion,
- Improvement of farming practices,
- Reduction of labor requirement by improvement of agricultural tool, and carrying of input and output, and
- Introduction of high yielding varieties (HYV) and improved varieties.

Paddy production would be increased following approaches and irrigation development.

- Expansion of HYVs and use of certified seed,
- Improvement of farming practices including nursery management, plowing, fertilizer/FYM application, weeding etc.

In some areas and households might be produce maize over the food requirement. Marketing of surplus maize has difficulty, due to cheap price in the market, high transportation cost, and small quantity of requirement by barter trading. Backyard livestock husbandry such as poultry and pig could be expected to value-adding production of surplus maize, and to provide to rural people nutrition of protein and fat. Also, animal husbandry will provide materials of FYM. This sub-program is composed of following activities:

- Supply of improved breeds of animals,
- Improvement of animal husbandry including animal shed/pen,
- Improvement of FYM preparation.

The outline of each sub-program related with agriculture are given below.

Description of Food Security Sub-program

Title	Food Security	Stage of Gewog: 1, 2 & 3
Implementing Organization	Gewog under supported Dzongkhag	
Agency concerned	EA	
Objectives:	<ol style="list-style-type: none"> 1) Attainment of food sufficiency in the Gewogs suffered seasonal food shortage, 2) Production increase of food coping population increase, 	
Input:		
Activities:	<ol style="list-style-type: none"> 1) Proper and environmental sustainable land use 2) Introduction improved / high yielding varieties 3) Technical guidance of improved farming and agricultural input supply by the Extension Strengthening Program 	
Expected effects / profits:	<ol style="list-style-type: none"> 1) To be solved food shortage in each Gewog level 2) To make sure food security in whole Gewog level 	
Remarks:	1) Close relation with the Extension Strengthening Sub-program for Food Crops	

Description of Paddy Rice Production Sub-program

Title	Paddy Rice Production	Stage of Gewog: 1, 2 & 3
Implementing Organization	Gewog under supported Dzongkhag	
Agency concerned	EA	
Objectives:	1) Production increase of paddy rice	
Input:		
Activities:	<ol style="list-style-type: none"> 1) Proper and environmental sustainable land use 2) Introduction improved / high yielding varieties 3) Technical guidance of improved farming and agricultural input supply by the Extension Strengthening Program 4) Irrigation Development mentioned in following Su-program 	
Expected effects / profits:	1) To improve self-sufficiency of rice	
Remarks:	1) Close relation with the Extension Strengthening Sub-program for food crops and Irrigation Development Sub-program	

Description of Backyard Animal Husbandry Sub-program

Title	Backyard Animal Husbandry	Stage of Gewog: 2 & 3
Implementing Organization	Gewog under supported Dzongkhag,	
Agency concerned	EA	
Objectives:	<ol style="list-style-type: none"> 1) Income increase through utilizing of surplus cereals (maize) 2) Production of good FYM materials 3) Production of nutrient diets for rural people 	
Input:	1) Supply of improved breeds	
Activities:	1) Technical guidance of improved animal husbandry including improved animal shed/pen	
Expected effects / profits:	<ol style="list-style-type: none"> 1) To income increase 2) To improve nutrition conditions of rural people 3) To prepare good FYM 	
Remarks:		

II-4.8.2 Program for Cash Crop Production Strengthening (PCCPS)

(1) Objectives

Cash crop production would be expected to increase income of farm household. Most of farmers, however, are still self-sustaining living situation due to the difficulty of access to market, low knowledge on cash crop farming. Supporting system and capacity of Dzongkhag administration and extension agent for cash crop production has not established. Technical R&D (Research and Development) on horticulture is implemented in RNR Research center, Easter Zone, (RNR-RC-East) cooperation with Japanese horticulture expert. However, systematic R&D of research level and extension of field level have not been carried out due to the shortage of capacity of manpower and budget as well as R&D facilities.

This program aims to; i) research on export market and selection of potential cash crops, ii) technical research, development, and establishment of farming technology on cash crops, iii) training and capacity building of extension agents for specific cash crops including extension procedure, farming technology, marketing and post-harvest, iv) training of farmers groups and women's groups.

(2) Implementation Organization

This program will be implemented by RNR-RC-East, which is located at Wengkhar in Mongar Dzongkhag, including the sub-research centers, at Lingmethang (Mongar Dzongkhag) and Khangma (Trashigang Dzongkhag). It will be carried out in cooperation with experienced senior specialists on targeted crops in a form of task force or project. The project period will be five (5) years from 2004. After the completion of the period, the project will be continued by Bhutanese staff trained by the project, and the target area will be expanded to other Dzongkhags in the Eastern Region.

(3) Experienced Senior Specialist

Senior specialists will consists of long-term and short-term expatriates

Long-term Experts

- Cash crop development (1)
- Fruit (1)
- Vegetable (1)
- Training and Extension (1)
- Marketing (1)

Short-term Experts

- Plant protection
- Plant genetic resources/Aromatic and medicinal plant
- Agricultural engineering
- Post-harvest
- Agro-processing
- Market research
- Paddy rice (for research and extension of paddy production increase)

(4) Facility Improvement of RNR-RC-East

Wengkhar Center of RNR-RC-East has not been facilitated with equipment and facilities for research and training. The following facilities and equipment should be provided for the above objectives:

Laboratory (500 m²) and laboratory equipment
 Greenhouse (600 m²) and research farm equipment
 Training hall (400 m²) and training equipment
 Boarding facility for trainees (25 persons of capacity)

(5) Sub-programs

This program will be composed of four (4) sub-programs: 1) market research, 2) technical research and development, 3) training of EAs, and 4) training on agro-processing.

Technology research and development sub-program consists of the following activities:

- Selection of suitable crop and varieties,
- Varietal improvement,
- Establishment of cash crop farming technology,
- Post-harvest technology.

Training of extension agent sub-program consists of the following activities:

- Capacity building on promotion of cash crops,
- Capacity building on improved farming technique including grafting, pruning, seed production,
- Training on marketing,
- Post-harvest including grading, packing, and
- Training on organizing of farmers group.

The outline of each sub-program is shown below.

Description of Technical Research and Development Sub-program

Title	Technical Research and Development	Stage of Gewog: -
Implementing Organization	RNR-RC-East	
Agency concerned	Horticulture of MOA, Dzongkhag	
Objectives:	1) Establishment of farming technology on selected cash crops including seed and sapling production 2) Varietal improvement 3) Post-harvest and marketing technology 4) Training of EAs through OJT	
Input:	1) Foreign Experts 2) Laboratory and laboratory equipment 3) Greenhouse and research farm equipment	
Activities:	1) Research and development on cash crops including production technology, post-harvest and marketing 2) Establishment of proper farming technology	
Expected effects / profits:	1) To establish adaptable technology 2) To be selected suitable varieties	
Remarks:	1) Close relation with the Extension Strengthening Sub-program for Cash Crops	

Description of Training of Extension Agents Sub-program

Title	Training of Extension Agents	Stage of Gewog: -
Implementing Organization	RNR-RC-East	
Agency concerned	Horticulture of MOA, Dzongkhag	
Objectives:	1) Capacity building of EAs on specific cash crops	

Input: 1) Foreign Experts 2) Training hall with training equipment, and boarding facility for trainees
Activities: 1) OJT training of target cash crops including farming technology, post-harvest and marketing 2) Training on Procedure of extension activity in the field level (farmers field school, awareness of farmers on cash crops, organizing farmers group, etc)
Expected effects / profits: 1) To be trained EAs for field activities 2) To be disseminated technology into other EAs and Gewog through trained TA
Remarks: 1) Close relation with the Extension Strengthening Sub-program for Cash Crops

II-4.8.3 Extension Strengthening Program (ESP)

(1) Objectives

This program aims to accelerate production of both food and cash crops through strengthening of extension capacity of EAs in cooperation with; i) input distribution by CA (Commission Agent), ii) input supply by DSC (Druk Seed Corporation), and iii) rural micro finance by BDFC (Bhutan Development Finance Corporation).

Supporting service activities to farmers for dissemination of farming technology and input supply are essential to promotion of crop production. The support services would be improved through strengthening of the existing systems: EA (Extension Agent) assigned in Gewog, supply of seed/sapling and chemical fertilizer/agrochemicals by DSC (Druk Seed Corporation) under MOA, and CA (Commission Agent) which is private seller certified by MOA.

EAs are carrying his duty covering wide range: input supply, technical dissemination, natural resource management, post-harvest, farm management, farmers group, farm survey and environment management. They have to report on their duty works. They work busy and perform as skilled generalists in their Gewog. Number of EAs will be increase during 9th FYP, from 2 or 3 to 3 EAs in Gewog in Mongar Dzongkhag, and from 1 or 2 to 2 EAs in Lhuntse Dzongkhag altogether agriculture, livestock and forestry EAs. Senior EAs with capacity of specialty on specific crop should be assigned to SMS (Subject Matter Specialist) as a backstop to questions and problems from the field.

The production of seeds and sampling of horticulture crops will be multiplied under DSC. The East Zone Office of DSC has seed farm in Trashigang and Trashiyantse Dzongkhags. Presently there is no seed farm of DSC in the Study Area. DSC will be set up a seed farm in Mongar Dzongkhag during 9th FYP. To accelerate the cash crop development, especially fruit development, the seed farm production organized by farmers group should be strengthened cooperating with RNR-RC-East.

(2) Implementation Agency

Each Dzongkhag will be responsible for implementation of this program. The Dzongkhags would play a role of coordination among related agents and corporations mentioned above. EAs will perform extension activities in the field of their responsible Gewog getting support of this program.

(3) Major Activities

- Preparation of technical guidebook (illustrated booklet) for EA and farmers,
- Implementation of Farmers Field School (FFS), training of leader farmers, and demonstration in the field,
- Close collaboration between RNR-RC and extension activity,
- Strengthening of seed production by farmers groups,
- Increase of CA (Commission Agent),
- Coordination between EA, CA and DSC activities, and
- Training of EAs and new appointment of Subject Matter Specialist (SMS) as a back-stop on food crop.

(4) Sub-programs

The program consists of two sub-programs by target crops, namely, food crops and cash crops. The outline of each sub-program is given below.

Description of Extension Strengthening Sub-program for Food Crops

Title	Extension Strengthening for Food Crops	Stage of Gewog: 1, 2 & 3
Implementing Organization	Dzongkhag	
Agency concerned	EA, DSC, EA, BDFC	
Objectives:	1) Production increase of food crops	
Input:	1) Extension activity 2) Input distribution 3) Micro-finance for group purchase of inputs	
Activities:	1) Preparation of technical guidebook for EA and farmers 2) FFS (Farmers Field School) and Demonstration plot in the field 3) Seed multiplication and distribution 4) Group micro-finance for purchase of inputs	
Expected effects / profits:	1) Production increase of food crops	
Remarks:	1) Close relation with the Program for Food Crop Production Increase	

Description of Extension Strengthening Sub-program for Cash Crops

Title	Extension Strengthening for Cash Crops	Stage of Gewog: 1, 2 & 3
Implementing Organization	Dzongkhag	
Agency concerned	EA, DSC, EA, BDFC	
Objectives:	1) Production increase of cash crops	
Input:	1) Extension activity 2) Input distribution 3) Micro-finance for group purchase of inputs	
Activities:	1) Preparation of technical guidebook for EA and farmers 2) Awareness activity on cash crops for farmers 3) FFS (Farmers Field School) and Demonstration plot in the field 4) Seed multiplication and distribution 5) Group micro-finance for purchase of inputs	
Expected effects / profits:	1) To increase farmers income through cash crop production	

Remarks:

1) Close relation with the Program for Cash Crop Production Strengthening

II-4.9 Implementation Organization**(1) Coordination Committee**

For the implementation of RADP, coordination body should be established in order to carry out the plan smoothly, and to coordinate sectors and organizations related to the plan. Coordination Committee would be organized consisting of the following members:

Member of Coordination Committee	
Chairperson	Program Director of RNR RC - East
Vice Chairperson	DAOs of Lhuntse and Mongar Dzongkhags
Member	DPO, DAHO, DFO and DE of both Dzongkhags

The Committee will play roles and take the following responsibilities.

- Overall coordination on implementation of programs
- *Coordination among sectors including non-agricultural sectors and Dzongkhags*
- Review of results of M&E (Monitoring and Evaluation) on the project implementation
- Modification of the Plan, programs and sub-programs

(2) Assignment of Cash Crop Specialist in Dzongkhag

Cash crop specialist should be assigned as a subject matter specialist at each Dzongkhag level in order to promote the production and marketing under the DAO. Also, DAO plays the role of technical backstop for extension agents. The cash crop specialist will be assigned among the staff of ADAO and ADEO of Dzongkhag administration.

II-4.10 Implementation Schedule

The period of implementation is set for 10 years from 2003 to 2012 including pre-stage for preparation of the action plan, and survey / design. Implementation schedule was prepared on the basis of the following concept and approach:

- On the basis of policy of equal development opportunity and benefit to all the farmers, certain program/sub-programs will be implemented in every Gewog from the initial stage,
- Constraints of BHN (Basic Human Needs) such as food shortage will be targeted at the initial implementation to solve the constraints,
- Step-wise implementation in each Gewog will be applied to bring it up to the higher development stage,
- *Food security sub-program will be focused on the food shortage Gewogs at the initial stage of the implementation for BHN,*
- Capacity building for cash crop production, PCCPS will be implemented from initial stage together with the Extension Strengthening Sub-program for Cash Crop,
- Program on production and marketing on cash crops will be implemented under close relation with schedule of farm road development,

Programs of RADP will be implemented from 2004 to 2012 according to the priority of

development stage of target Gewogs as summarized below and shown in Table 5.5.1 in Main Report.

II-4.11 Cost Estimate

The project cost was estimated on facilities and equipment required to implement the programs.

	(Nu. million)
① Program for food crop production increase	<u>73.4</u>
- Training of EAs	1.3
- Irrigation development	72.1
② Program for cash crop production strengthening	<u>86.3</u>
- Improvement of facilities and equipment of RNR-RC East	
Buildings (laboratory, training hall, trainees dormitory, working shed)	6.2
Green house	40.0
Research farm equipment	20.0
Laboratory equipment	12.0
Training and office equipment	4.0
- Training of EAs	4.1
③ Market system development program	<u>4.5</u>
- Construction of collection depots	1.2(20 plots)
- Construction of storage	1.5(1 storage)
- Procurement of truck by FCB	1.8
④ Extension strengthening program	<u>4.5</u>
- Study tour and demonstration plot	4.5
<u>Total</u>	<u>168.7</u>

Economic Investment Cost

(Unit: Nu. million)

	Financial Cost	Conversion Factor	Economic Cost	Remarks
Irrigation development	72.1	0.65	46.9	
Farm road construction	1,006.5	0.91	915.9	
Farm mule track	24.4	0.65	15.9	
Light-load bridge	23.0	0.91	20.9	
Building construction				
RNR-RC	2.1	0.91	1.9	*Share 1/3 total
Collection depot / storage	2.7	0.91	2.5	
Facility/equipment				
RNR-RC	25.3	1.00	25.3	*Share 1/3 total
Truck (FCB)	1.8	1.00	1.8	
Training	9.9	1.00	9.9	
Total	1,222.6		1,041.0	

Note *: The cost related with RNR-RC East is assumed sharing 1/3 of the total cost, because it covers 6 Dzongkhag in the Eastern Region.

Economic O & M cost was estimated based on the financial value and shadow rate.

Irrigation	3% of initial investment cost	(1.4 million per year)
RNR-RC East	3% of Initial investment cost	(0.4 million per year)
Farm road	Nu. 20,080 /km x 183 km	(3.7 million per year)
Annual O&M cost		(5.5 million per year)

Economic O&M Cost of Farm Road (per km)

	Quantity (per km)	Financial unit cost (Nu./day)	Economic unit cost (Nu./day)	Economic O&M cost (Nu./year)
Routine maintenance	Manual 200 man-day/year	130	Nu.50/man-day	10,000
Annual maintenance	Manual 100 man-day/year	130	Nu.50/man-day	5,000
Machinery maintenance	1.0 day /5year	25,400	Nu. 25,400/day	5,080
Total				20,080

Replacement period was assumed at 50 years for farm road, 25 years for light-load bridge, 20 years for building and irrigation facility, and 10 years for facility and equipment.

The economic cost and benefit flow are shown in Table 5.7.1 of Main Report. The Economic Internal Rate of Return (EIRR) is estimated at 7.7%. Such low economic viability is supposedly caused by the disadvantageous conditions as mentioned below:

- High construction cost of the farm road due to severe geographical conditions such as steep slopes and difference of altitudes, and
- Low farm road benefit due to the low population density in the rural area.

II-5.1.2 Income Increase of Farm Household

Average income from agricultural products (food and cash crops) per farm household will be increased to Nu. 28,500 for Gewogs categorized in the Stage-1, Nu. 37,900 for the Stage-2 Gewogs, and Nu. 48,800 in the Stage-3 Gewogs in 2012, which range from 147 % to 190 % as much as the income at present conditions. The average increase rate of income is around 5 % per annum.

Prospective Income Increase per Household

(Unit: Nu.)

	Agricultural Income *		
	Stage 3	Stage 2	Stage 1
Income level at 2012 ^{*1}	29,900	20,000	19,400
Increase of income	18,900	17,900	9,100
Income level at 2012	48,800	37,900	28,500

Note *: Incomes from food crops, fruits and vegetable production

II-5.1.3 Capacity to Pay

Beneficiary farmers must bear the operation and maintenance cost of farm road and irrigation facilities by the users association.

As for the maintenance of the farm road, beneficiary farmers can contribute with their labor force. Besides, the mechanical work, which is proposed as periodical repair works for every five years should be done on contract basis by the farm road users association. The average annual cost of mechanical maintenance is estimated at Nu. 503 per household. The cost to be paid by the beneficiary is less than 3 % of their income increase in the Stage-2 and 3 Gewogs.

II-5.2 Consistency with the Target of the National Plan

Long-term national development plan, "Bhutan 2020 - A Vision for Peace, Prosperity and Happiness" targets export increase of horticulture products that export value in 2012 will be increased to 300 % of that of year 2000. The value and volume in 2012 are estimated at approximately Nu. 780 million and 14,000 ton, respectively, with assumed export unit price of Nu. 5,000 /ton at current price. On the other hand, the target export volume of the Plan is 14,000 ton in 2012, which would occupy around 9 % of the national target among 20 Dzongkhags in the country. It is considered justifiable that the production and export plan are reasonable in the national plan.

Justification with National Development Plan

	2012 (End of 11th FYP)	Remarks
Target of horticulture export value ^{*1} (mill. Nu.)	300% of year 2000 Nu. 780 million	Nu. 260 million (1999) ^{*2}
Volume of horticulture	156,000 ton	Nu. 5,000/ton
Export target of cash crop in the Study Area	14,000 ton	
Share of Study Area to National Plan	9%	

Source *1: Bhutan 2020 - A Vision for Peace, Prosperity and Happiness

*2: Bhutan Trade Statistics, 1999, MOF

II-5.3 Technology and Capacity of Stakeholders

The Master Plan should be justified from the viewpoint of technology and capacity of stakeholders. The stakeholders for the Plan would consist of;

- Beneficiaries (farmers in the Study Area), who would participate in farm road construction,
- Dzongkhag Administration and its staff including EAs (Extension Agents), which would be the main organization of implementation,
- Gup Office (Gewog Chief Office) and GYT (Gewog Development Committee), which are organizations for Gewog level administration and activities,

- RNR-RC-East (Renewable Natural Resource Research Center of the Eastern Region), which will play a role of research and training of EAs,
- CMU (Central Machinery Unit) of MOA, which would be the responsible organization for management of construction machinery for the farm road construction,
- MOA, which would be the responsible line ministry of the Plan,
- Support organizations and agents of production / marketing such as DSC (Druck Seed Corporation), CAs (Commission Agents), BDFC (Bhutan Development Finance Corporation) and FCB (Food Corporation of Bhutan),
- Middlemen of cash crop products

II-5.3.1 Beneficiaries

(1) Technical capacity

Beneficiaries, who live under conditions of self-consumptive agriculture, depend on traditional farming system, and they have generally poor knowledge on farming technique and marketing of cash crops. Taking into such situation, the Plan includes awareness building of farmers, dissemination of farming technology, construction of collection depots of products, and support on group activities of group assembling and shipping. Farmers will participate in the farm road construction in their Gewogs during off-season of on-farm activity. Beneficiary farmers will participate in the farm road construction as much as possible within their available labor force, and maintain the farm road by organizing the user association. This kind of participation has been undertaken for the farm road and irrigation development activities. In the course of the Study, experimental implementation of farm mule track development was carried out so that stakeholders' capability should be confirmed. Both unskilled labor and skilled labor were arranged by Gewog. Site supervisor, blaster and mason worked for the construction period very well and beneficiaries of 20 in number on the average participated to the works without getting any payment for 45 days. One kilometer of the farm mule track was completed within proposed period. Environmental examination by NEC was also applied by Dzongkhag and Dzongkhag engineering staff supported the works well too.

Extension agents of Dzongkhag RNR Sector have basic knowledge and sufficient educational background to be trained through English communication. Even without enough experience their potential is considered high for capacity improvement.

(2) Labor force

One of the major constraints of the agricultural activity is shortage of labor force. Labor requirement in the future plan will be increased by the intensive farming, shipping of products to the proposed collection facilities, marketing activity and participation in the farm road construction. As for labor shortage, improvement of farm roads as well as introduction of agricultural tools and machines will reduce certain amount of required labor force. It is evaluated by labor balance analysis as shown below that labor force would be available for the project.

1) Average labor force per household	2.8person/HH (household)
2) Workable day per year	300 days/person
3) Labor force potential /household	840 man-days/HH
4) Average planted area /household	1.3 ha /HH

5) Labor requirement for on farm work	280	man-days/ha
	370	man-days/HH
6) Other labor requirement (housekeeping, livestock care, off-farm work etc.)	180	man-days/HH
7) Participation with farm road construction *	200	man-days/HH
8) Total requirement	750	man-days/HH
9) Labor balance (3 - 8)	90	man-days/HH

Note *: Participation period for construction is except during 3 months of busy season in farming. Maintenance work of farm road by beneficiaries is around 30 man-days/HH/year.

(3) Financial Situation

Financial situation of the beneficiaries is generally too low or poor to investment for cash crop farming, such as purchase of inputs and marketing activities. For this, group loan by BDFC (mobile credit) will be available at Gewog level.

II-5.3.2 Gup Office and GYT

Decentralization policy of the Government focuses on strengthening of Gewog activities in 9th FYP. The government intends to promote self-reliance of Gewogs in planning and implementation of development activities in 11th FYP. The functions of Gup office and GYT will be strengthened through the planning and implementation of the development plan.

II-5.3.3 Dzongkhag

RNR sector of Dzongkhag Administration plays a role of agriculture development and extension activities. EAs assigned at Gewogs from Dzongkhag work for extension activity at field level. Dzongkhag staff and EAs have basic knowledge and extension system for food crops. However, they have not been trained sufficiently on cash crops to disseminate the farming and production techniques and marketing. Training of EAs on cash crops will be provided by project type scheme by RNR-RC-East.

II-5.3.4 RNR-RC-East

RNR-RC-East is the single institution in the Eastern Region that would provide above-mentioned training, research and development activities on cash crops. Research and development on the horticulture crops have been launched by the JICA Expert. The project type program is considered one of the suitable options for research and training of EAs on the cash crops in the RNR-RC-East by cooperation with experienced experts. Wengkharr Center of RNR-RC-East was newly established in 2001, and the facilities required for the activities have not been facilitated. The required facilities additionally for the research and training should be improved by the program of the Plan. After five years of completion of the project type program, RNR-RC-East will continue the activities

II-5.3.5 CMU

CMU, which would operate the construction machinery for farm road construction in the Study Area, shifted from Paro to Bumthang in 2002. Construction of CMU's facilities was started this year, 2002 getting certain budget allocation. It has enough number of trained operators for construction machinery, but construction machinery required for the Farm Road

Development Plan in the Study Area is not sufficient at present. Procurement plan of construction machinery and workshop equipment have been formulated in the Program for Construction of Machinery Center. RGOB requested for grant aid project for the procurement of the construction machinery and started to construct a workshop.

II-5.3.6 MOA

MOA is the responsible ministry for the development and implementation of the Plan. DRDS of MOA would support research and training of activities of the Plan, and coordinate agricultural program of the Dzongkhags.

II-5.3.7 Support Organizations and Agents

Input supply by DSC and CAs, micro-credit service by BDFC, and auction and marketing services by FCB will be coordinated by Dzongkhag. The organization and agents concerned would perform effectively getting such coordination.

II-5.3.8 Middlemen

Activities of middlemen for agricultural products are little presently. The plan includes production increase and construction of collection depots of cash crop products in order to invite middlemen.

II-5.4 Social Aspect

Following social impacts are expected by the implementation of the Plan.

- The programs will activate the regional economy through production increase and marketing activities by ARDP-LM, and improvement of accessibility by FRDP-LM. It will encourage local market activities of agricultural products and small-scale cottage industry. It will contribute to generate job opportunities for the rural population.
- By the farm road development, the inhabitants will enjoy improved accessibility to social and agricultural services such as health, education, food security, agricultural input distribution, and living commodities. It will contribute to the policy of equality development of living environment for the people.
- Some of farmers will be trained to be skilled labor for construction works through participation in the farm road construction. They will be able to get more cash income in other construction sites.
- Farmers will be encouraged and motivated through farmers group activity of the marketing farmers group, farm road users association, water users association, and group credit, etc. It is expected that Gewog communities will be stimulated and activated through such activities.
- Getting integrated benefit from the above, living condition and standard of the rural society will be improved, which decelerate rural-to-urban migration and stabilize the agriculture production of the country.
- As clarified through the farm household survey at good and bad accessibility villages, enrollment rate of women in social activities such as meeting will be increased as access improvement is promoted. Women's participation to the social

activities will be encouraged by the project.

- The farm road construction works are conducted by labor contribution of beneficiaries. According to the results of experimental construction of farm mule track, women's participation was 30 person-days out of 524 person days in total getting direct instruction of Dzongda at ground-breaking ceremony. The promotion of farm road construction will not be burden to women with certain arrangement or instruction by the implementation agency.

II-5.5 Demonstration, Model and Ripple Effect

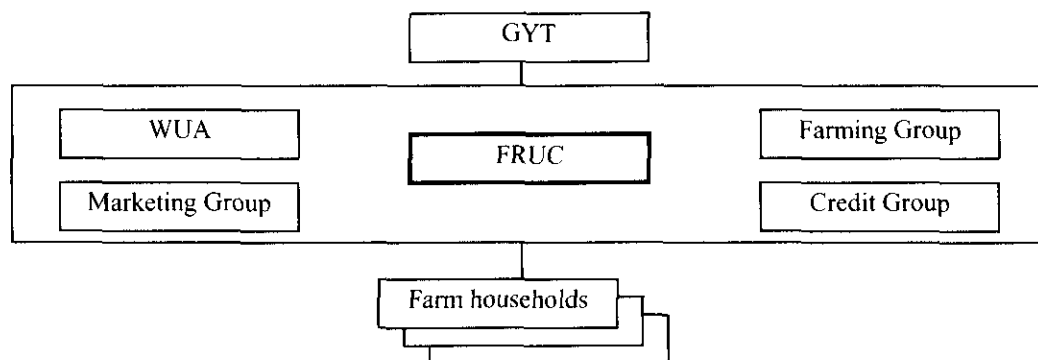
The plan focuses on the regional development of the agriculture and farm roads. The approach of master plan formulation, criteria of categorization and technical standards can be applied to other Dzongkhags and Regions. Similar program /programs in the surrounding areas will be set up and implemented by applying the plan as a model of development. It can be said that the Plan would become a model of agriculture and farm road development of RGOB.

II-5.6 Sustainability

The project should be sustainable with good operation and management, financial conditions and natural environmental conservation.

II-5.6.1 Maintenance of Farm Road

After completion of the farm road construction, maintenance works should be conducted by the Farm Road Users Cooperative (FRUC). FRUC will be organized under the GYT (Gewog Development Committee). FRUC will be one of the farmers groups under the GYT. The FRUC would prepare the maintenance schedule of routine and regular work, and arranges labor contribution and periodical repair works with machinery as required. The cost of the repair works by the machinery would have to be allocated in the budget of FRUC or GYT. The above operation and management will ensure the sustainable maintenance of farm roads.



GYT: Gewog Development Committee, FRUC: Farm Road Users Cooperative,
WUA: Water Users Association

Farmers Groups of GYT

II-5.6.2 Technical Level Applied to the Plan

The target crops were selected from familiar crops with farmers and also suitable for the

natural condition of the Study Area. Farming techniques applied in the Plan would be improved on the basis of the present level, seeking for the production increase and quality improvement.

The farm road development was planned in accordance with the concept of farmers' participation in the construction and utilization of local materials as much as possible, for building of farmers awareness on the their own farm road, reduction of construction cost, and easy maintenance by beneficiaries.

II-5.6.3 Operation and Management of CMU

CMU would provide construction services for the farm roads with its construction machinery under the contract between the beneficiaries (Gewog) and MOA. MOA or Dzongkhags as implementation agency would allocate necessary budget for operation and maintenance of the machinery of CMU. Workshop of CMU would be operated by the allocated budget from the farm road construction. The sustainable operation of CMU will be ensured through such financial and system backstop.

Chapter II-6 FORMULATION OF ACTION PLAN OF THE PRIORITY GEWOGS

II-6.1 Present Condition of Priority Gewogs

Present condition of the priority Gewogs is shown in Table II-9 – II-11.

II-6.2 Target Setting of Crop Production by Gewog

This Section describes formulation of crop production plan in Gewog including backyard animals (small animals). Since basic information and data for formulation of detailed production plan is not available, survey on present situations and development potential are included in the Action Plan itself for preparation of more accurate production plan.

II-6.2.1 Food Crop

(1) Land Use Plan

Agricultural production plan for food crop should be prepared based on the farmland potential for cereal crops. As mentioned in Chapter 3, three information sources are available on farmland of Gewogs as follows:

- ① Land registration record for land ownership and land taxation,
- ② RNR Statistics 2000 based on the agricultural census in 2000, and
- ③ Land Cover Map prepared by MOA based on the satellite image.

It is conceivable that the farmland areas by the former two sources are considerably smaller than the actual one. The farmland area of RNR Statistics was derived from interviewee's answers which were sampled for census survey (10 %). The actual farmland area including Tseri might be applied as potential farmland area based on the Land Cover Map. Farmland area in the target year may be estimated through examination of changes of land use categories such as "from dry land to wet land", and "from Tseri to dry land or to orchard". Improvement of land use of Tseri is expected or recommended for environmental sustainability through change of the land use to orchard, forestry and improved pastureland. It is an essential policy on land use of the RGOB. Farmland plan of priority Gewogs is shown in the table below:

Estimated Farmland of the Priority Gewogs				
	Wet land	Dry land	Tseri	Total
Gangzur				
Registered ^{*1}	167	238	151	556
Estimated ^{*2}	330	430	360	1,120
Proposed ^{*3}	330	430	360	1,120
Chaskhar				
Registered ^{*1}	44	195	67	306
Estimated ^{*2}	77	443	230	750
Proposed ^{*3}	77	443	230	750
Drepong				
Registered ^{*1}	16	122	3	141
Estimated ^{*2}	20	220	570	810
Proposed ^{*3}	20	220	570	810

Note *1: Area by Land Registration Record.

*2: Estimated based on Land Cover Map by the Study Team.

*3: Assumed that land use of the target year is same as present area.

(2) Food Production Plan

Cereal production plan was prepared based on the present production and potential of increase (planted area and unit yield). Present planted area shown in the following table was estimated from production of each crop compiled in RNR Statistics 2000. Yield was assumed at 2.2 ton/ha for paddy, 2.0 ton/ha for maize, and 1.0 ton/ha for other cereals.

Prospective production in the target year was set up through the following examinations:

- Expansion of planted area in the existing fallow land¹ according to increasing of labor force with population growth, irrigation development for paddy, and cultivation of winter crops after harvesting of summer crops,
- Yield increase by utilization of improved HYVs, dissemination of improved crop management, and irrigation development including rehabilitation of wet land.

Proposed cropping areas which were estimated through the examination of potential of farmland area and available labor force in the future are shown in the table below:

Planted Area of Food Crop in Priority Gewogs

(Unit: ha)

	Gangzur		Chaskhar		Drepong	
	Present	2012	Present	2012	Present	2012
Paddy	275	317	70	77	17	20
Maize	347	365	514	565	176	202
Others ^{*1}	25	31	58	75	93	112
Total	647	713	642	717	286	334
C.I. (A) ^{*2}	33%	94%	123%	138%	119%	139%
C.I. (B) ^{*3}	58%	64%	86%	96%	35%	41%
Per capita ^{*4}	0.19	0.16	0.21	0.18	0.17	0.15

Note *1: Wheat, barley, millet and buckwheat.

*2: Cropping intensity to wet land and dry land.

*3: Cropping intensity to wet land, dry land and Tseri.

*4: Planted area per capita (population in target year assumed that 128% at present).

Yield at the target year will be increased by dissemination of improved farming technology, utilization / introduction of HYVs' seeds, and rehabilitation and construction of irrigation facilities for paddy. According to the crop cut survey conducted by extension agents in 2001 and 2002, the yield level at production area with good management and improved seeds was 3.3 ton/ha (1.8 - 4.2 ton/ha for 26 plots surveyed) and 3.0 ton/ha for maize (1.6 - 3.6 ton/ha for 41 plots surveyed). The results of the crop cut survey show a potential of yield level in the future. Anticipated yield level at the target year was estimated as follows:

Paddy: 118 % of present level (present: 2.2 ton/ha → 2.6 ton/ha)

Maize: 115 % of present level (present: 2.0 ton/ha → 2.3 ton/ha)

Other cereals*: 115 % of present level (present: 1.0 ton/ha → 1.15 ton/ha)

Note *: Wheat, barley, millet and buckwheat

Anticipated cereal productions based on the above area and yield are given in the following table:

¹ Fallow land occupies 8.1 % and 17.3 % of wet land and dry land respectively in Lhuntse, and 5.9 % and 13.4 %, respectively in Mongar.

Food Production Plan of Priority Gewogs

(Unit: ton)

	Gangzur		Chaskhar		Drepong	
	Present	2012	Present	2012	Present	2012
Paddy	606	822	153	199	38	52
Maize	695	839	1,027	1,299	352	466
Others*	25	36	58	86	93	129
Total	1,326	1,697	1,238	1,584	483	647

Note *: Wheat, barley, millet and buckwheat

(3) Food Security

As mentioned in Chapter 3, the food sufficiency level was estimated to be 200 - 230 kg per capita of milled grain through examination of present situation based on "RNR Statistics 2000" and present population. The milled grain includes seed reserve, animal feed, home-processed cereals and post-harvest losses as well as cereals for food. Population at the target year will increase by 28 % of that at present after 10 years applying the annual growth rate of 2.5 %. Milling recovery rates of cereals are assumed at 60 % for paddy, and 80 % for maize and other cereals. The following table shows milled grain production and milled grain per capita under present condition and future plan.

Per Capita Milled Grain Production in Priority Gewogs

	Gangzur		Chaskhar		Drepong	
	Present	2012	Present	2012	Present	2012
Milled grain (ton) ^{*1}						
Rice	364	493	92	119	23	31
Maize	555	671	823	1,039	282	372
Other cereals	20	29	46	69	74	103
Total	939	1,193	961	1,227	379	506
Ratio of rice (%)	39%	41%	10%	10%	6%	6%
Population ^{*2}	3,487	4,460	3,095	3,960	1,733	2,220
Per capita (kg)	269	267	311	310	218	228

Note *1: Milling recovery rate is assumed at 60% for rice, and 80% for maize and other cereals.

*2: Population in 2012 is forecasted assuming an annual population growth rate of 2.5%.

II-6.2.2 Cash Crop

(1) Selection of Potential Cash Crops

Priority cash crops to be promoted in the Gewog were examined based on the opinion of Gewog people, agro-ecological conditions, present production, situation of local and export market, and farmers' familiarity with crops. The following table shows priority cash crop identified in the workshop held in the course of the Study.

Potential / Priority Crops Presented by Gewog in Workshop Held by Study Team

Gewog	Vegetable	Fruit / Nut	Others
Gangzur	Chili, Potato,	Orange, Mango, Apple	Cardamom
Chaskhar	Potato, Chili, Cabbage, Radish	Orange, Mango, Plum, Walnut, Apple	Lemongrass, Lac
Drepong	Potato, Cabbage, Radish, Chili, Asparagus	Orange, Walnut, Mango, Apple	Lemongrass, Ginger

Potential and priority crops reported by each Gewog were similar throughout the Study Area. The priority crops should be selected through examination of marketability for the local and export markets. The local market will be small size in demand. Export commodities will be

examined in the future based on the market research carried out by Market System Development Program (Sub-section 8.3.1). Potato and orange are presently dominant cash crops in the Study Area. These crops should be promoted mainly at the first stage in all the Gewog. At further stage, crops for promotion should be diversified based on the market research. Finally it should aim at formation of major production area of special crops in the Gewog taking advantage of agro-ecological condition, improvement of crop management and post-harvesting, and reduction of transportation cost.

Examination of Priority Cash Crops

Cash crop	Characteristics of cash crop, potential for export and local market
Vegetables	
Potato	The most popular vegetable in the Study Area and suitable for agro-ecological condition; presently exported through Samdrup Jongkhar; relatively high quality; expected for stable export but high transportation cost.
Chili	The most popular vegetable in local market; small quantity for exporting as dried chili; high quality; necessity of market development.
Radish, Cabbage, Vegetable bean, Pumpkin, Turnip, Asparagus	Popular vegetables in local market; difficulty in transportation and maintenance of freshness for export marketing; necessity of market research on export season.
Onion, Carrot	Suitable crops for agro-ecological conditions (temperate); presently imported from India; high market price; potential crop in the future.
Fruits/Nuts	
Mandarin orange	The most popular fruit in the Study Area, exported to India and Bangladesh through Samdrup Jongkhar; comparatively high quality but requires improvement for higher quality and crop management; expected for stable export but high transportation cost.
Mango	Popular fruits in humid sub-tropical zone; harvest season in the Area follows to that in India; a potential crop for export but little is exported; low quality and small quantity of products.
Walnut	A popular nut in the Study Area; local variety (hard shell) dominant;
Apple	A major exporting fruit in Western region of Bhutan; still low quality and small quantity in Eastern region, a potential crop for export in warm temperate zone.
Plum, Pear, Peach	Popular fruits in local market; low quality; difficulty in transportation and keep freshness to export; necessity of market research and quality improvement.
Persimmon	Mostly local variety (sour); RNR-RC is tackling to improve variety as a potential crop for export to India.
Seed beans/Peas	
	Beans and peas such as soybean, Rajma bean and lens pea will be potential crop for export in the future; with advantage of low transportation cost to the product value; more land is required for the production; presently little quantity exporting from Lhuntse; necessity of market research for export.
Other crops	
Lemon grass oil	An important export commodity in the Study Area (collection of wild grass and distillation of essential oil);
Medicinal plants	Growing many kinds of medicinal plants; cultivating some kinds of plants such as Artemisia.
Lac	A famous dyestuff in the Study Area (secretion of insect)
Pine resin	Collecting resin from natural pine tree.
Ginger	Producing for local market
Cardamom	Trial production in small area; necessity of market research.

(2) Cash Crop Production Plan

As mentioned above, production plan of cash crops was prepared mainly for potato and orange as priority crops of vegetables and fruits. The plan was prepared under prerequisite of improvement of transportation for marketing for export of products. Access to the collection point of depot along motor road will be improved so that it should be reached in no more than three hours either on foot or by horse / mule. The production will be increased as the farm road construction would be promoted. Carrying capacity through the improved access is estimated at 2.0 to 2.5 ton or 50 - 60 baskets per household during marketing period of 6 to 7 months.

Motor roads are available at the Gewog center of Gangzur and Chaskhar, while proposed farm road to Drepong will be constructed in 2007.

Production plan prepared through above procedures is shown in the following tables:

Production Plan of Vegetables in Priority Gewogs				
	Planted area (ha) ^{*1}	Yield (ton/ha)	Production (ton) ^{*1}	Marketing (ton)
Gangzur				
Present	8 ^{*2}	12.5	100	-
2012	55	15	826	689
Chaskhar				
Present	12 ^{*2}	12.5	150	30
2012	64	15	960	842
Drepong				
Present	4 ^{*2}	12.5	50	-
2012	22	15	326	260
Note	*1: Including all vegetables *2: RNR Statistics 2000			

Production Plan of Fruits in Priority Gewogs					
	Nos. of trees ^{*1}	Bearing trees	Yield (kg/tree)	Production (ton) ^{*1}	Marketing (ton)
Gangzur					
Present	2,070 ^{*2}	926	50	46	-
2012	9,443	5,876	80	470	424
Chaskhar					
Present	2,490 ^{*2}	840	50	42	2
2012	8,250	5,250	80	422	382
Drepong					
Present	1,340 ^{*2}	544	50	27	6
2012	4,450	2,520	80	201	179
Note	*1: Including all fruits and nuts *2: RNR Statistics 2000				

Production value and amount sold were estimated as shown in the table below. The cash income increase with the crops of vegetables and fruits is expected approximately at Nu. 5,000 to 8,000 per household.

Income per Household from Cash Crops in Priority Gewogs

	Production (kg/hh)			Marketing (kg/hh)			Price ^{*1} (Nu./kg)	Value (Nu./hh)	
	Vegetable	Fruit	Total	Vegetable	Fruit	Total		Production	Marketing
Gangzur									
Present ^{*1}	218	100	318	-	-	-	3.0	1,113	-
2012 ^{*2}	1,405	799	2,204	1,105	699	1,804	3.0	7,714	6,314
Chaskhar									
Present ^{*1}	374	104	478	75	4	79	3.5	1,673	14
2012 ^{*2}	1,875	820	2,695	1,575	720	2,295	3.5	9,433	8,033
Drepong									
Present ^{*1}	230	124	354	-	24	24	3.5	1,239	84
2012 ^{*2}	1,173	644	1,817	873	544	1,417	3.5	6,360	4,960

Note ^{*1}: Numbers of households were estimated assuming a population growth rate of 2.5 % per year.

^{*2}: Price at collection depots. It is assumed that price at auction yard in Samdrup Jongkhar is Nu. 5/kg, transportation and handling charge from collection depots to the auction yard is Nu. 1.5/kg for Mongar Dzongkhag, and Nu. 2.0/kg for Lhuntse Dzongkhag.

II-6.2.3 Backyard Animal

Backyard animal husbandry (pig and poultry) was proposed for income increase and nutritious improvement of rural people through utilizing surplus maize and by-products of home processing for animal feed. This program includes small enterprise by household such as egg production with a rearing scale of more than 10 chickens, or breeding by rearing pairs of pigs. The promotion plan was prepared based on the present conditions of backyard animal husbandry and opinion of Gewog leaders and farmers, and trading at local market in and around the Gewogs. Plan of priority Gewogs is given in the following table:

Plan of Backyard Animals in Priority Gewogs

	Pig			Chicken		
	Nos. of animals	Ratio of rearing hh	Average nos. per hh	Nos. of animals	Ratio of rearing hh	Average nos. per hh
Gangzur						
Present ^{*1}	464	48%	1.0	1,960	85%	4.2
2012 ^{*2}	705	60%	1.2	3,500	90%	6.3
Chaskhar						
Present ^{*1}	350	52%	0.8	1,290	75%	3.2
2012 ^{*2}	620	60%	1.2	3,050	85%	6.0
Drepong						
Present ^{*1}	130	45%	0.6	470	61%	2.2
2012 ^{*2}	330	60%	1.2	1,650	85%	6.0

Note ^{*1}: RNR Statistics 2000.

^{*2}: Numbers of households were estimated assuming a population growth rate of 2.5 % per year.

Income (production value) per household will be increased to Nu. 9,000 per household, which is 170 % - 290 % of that at present level. The income was estimated by the following conditions:

Conditions of Income Estimation of Backyard Animal Husbandry

Pig		Chicken	
Present	2012	Present	2012
Live pig: 120 kg /3 years feeding Nu.50 /kg Nu.2,000/head/year	Live pig: 120 kg /2.5 years feeding Nu.50 /kg Nu.2,400/head/year	Live chicken 2kg/2 years feeding Nu.50/kg Nu.50/head/year	Live chicken 2kg/2 years feeding Nu.50/kg Nu.50/head/year
Piglet by breeding: 5 piglet/year for female Nu.1,000/piglet Nu.2,500/head/year	Piglet by breeding: 8 piglet/year for female Nu.1,000/piglet Nu.4,000/head/year	Egg 60 egg/year/head Nu.2.5/piece Nu.150/head/year	Egg 80 egg/year/head Nu.2.5/piece Nu.200/head/year
Total: Nu.4,500/head/year	Total: Nu.6,400/head/year	Total: Nu.200/head/year	Total: Nu.250/head/year

Income Estimation by Backyard Animal Husbandry

	Pig			Chicken			Production value (Nu./hh)
	Nos./hh	Nu./head	Nu./hh	Nos./hh	Nu./head	Nu./hh	
Gangzur							
Present	1.0	4,500	4,500	4.2	200	840	5,340
2012	1.2	6,400	7,680	6.3	250	1,575	9,255
Chaskhar							
Present	0.8	4,500	3,600	3.2	200	640	4,240
2012	1.2	6,400	7,680	6.0	250	1,500	9,180
Drepong							
Present	0.6	4,500	2,700	2.2	200	440	3,140
2012	1.2	6,400	7,680	6.0	250	1,500	9,180

II-6.3 Program for Food Crop Production Increase

II-6.3.1 Food Security Sub-program

(1) Target

This sub-program aims to attain / maintain food security in the Study Area at Gewog level to catch up with the population increase. Annual population growth rate was estimated at 2.5 % during the 9th FYP by the Planning Commission. By applying this growth rate, population in the target year of 2012 is estimated at 128 % of that at present level.

Main staple foods of the residents in the Study Area are maize and rice. Food sufficiency level was estimated at between 200 and 230 kg per capita of milled grain through examination of present situation based on "RNR Statistics 2000" and present population.

(2) Strategy and Activities

This sub-program is closely related with the sub-program of extension strengthening for food crop (Sub-section 8.5.1), which focuses on activities in Gewog mainly performed by extension agents.

Present yield of food crops are obscure due to unclear statistics on planted / harvested area and production due to lack of accurate measuring and proper registration system. Definite production plan at the national and local level has not been prepared yet. The activities include preparation of food crop production plan based on the systematic survey and analysis of present conditions at Gewog level as well as dissemination of improved crop management through the extension agents.

The contents of this sub-program are carried out under DAO of Dzongkhag supported by RNR-RC and institutes concerned. The activities are summarized as follows:

- Training of extension agents on improved food crop management, improvement of extension system (demonstration plot, farmers field school), preparation of food production plan for Gewog, and survey of present situation and development potential of food crops,
- Preparation of cereal production plan,
- Preparation of production support plan (extension and input supply),
- Preparation of crop management manual for extension agent and farmers,
- Support to establishment of Food Crop Working Group in each Gewog,

Through the discussion in the workshop and meeting, the proposed activities on the food crop were allocated to this sub-program and the extension strengthening for food crop sub-program (Subsection 8.5.1) with the responsibility of Dzongkhag and Gewog, respectively.

II-6.3.2 Paddy-rice Production Sub-program

(1) Target

Demand of rice as a staple food is increasing by improvement of living standard and population growth. Almost all the imported cereals are rice in Bhutan. On the other hand, the Study Area is a major production area of maize in Bhutan. Crop management technology of rice growing farmers is still poor compared with major production area of paddy rice such as Paro and Wangdue Phodrang. This sub-program aims at production increase of paddy rice through improvement of crop management, expansion of improved / high yielding varieties, and wet land development.

(2) Strategy and Activities

This program is similar to food security sub-program (Sub-section 8.2.1) in terms of activities mentioned above. The following activities should be carried out in the sub-program.

- Training of extension agents on improvement of paddy rice cultivation,
- Survey of potential and present yield, area of potential development of wet land / irrigation, and
- Preparation of production plan and production support plan (extension & input distribution).

Farmers are eager to increase paddy production, however, farming techniques on nursery management and transplanting still remain at low level. Gewogs in southern Mongar produce little paddy rice due to lack of the water resources and irrigation facility.

II-6.3.3 Backyard Animal Husbandry Sub-program

(1) Target

This sub-program aims at income increase and nutritious improvement of rural people utilizing household waste, surplus maize and by-products of home processing such as rice bran, oil cake, liquor lees for animal feed. Through OJT on support for horticulture crop cultivation carried out in the course of the Study, it was confirmed that farmers are interested

in backyard animal husbandry. Target setting of the sub-program has been mentioned in Sub-section 8.1.3.

(2) Strategy and Activities

For fulfillment of local demand of livestock products: meat and egg, backyard animal husbandry will be promoted in the sub-program. Some farmers will aim at small-scale enterprise farming as far as animal feed is available. They will raise 10 to 30 of chickens for egg production or several pigs for breeding in and around the Gewog market. The backyard animals will provide materials for preparation of FYM (farm yard manure).

This sub-program will be handled by DAHO and livestock extension agent (EA) in Gewog. DAHO will provide training and support for EAs' activity. The following activities are carried out in the sub-program:

- Training of extension agent on backyard animal husbandry,
- Distribution of improved piglet and chick by Piggery and Poultry Breeding Center (PPBC) in Lingmethang, Mongar,
- Strengthening of livestock extension service through implementation of demonstration farm, farmers field school (FFS) and farmers study tour,
- Encouragement of breeder farmers and breeder farmers' group,
- Establishment of livestock working group in each Gewog aiming at strengthening of administration function of Gewog, and assistance and coordination of EAs' activities.

The training of EAs will be managed by DAHO with support of PPBC and RNR-RC. The training of extension agent will include seminar, workshop and study tour to advanced areas and the research centers.

II-6.4 Program for Cash Crop Production Strengthening

II-6.4.1 Technical Research and Development Sub-program

(1) Objectives

This sub-program aims at strengthening of research and development of horticulture crop in RNR-RC East for promotion of cash crop production in the Study Area. Technology and knowledge developed in RNR-RC would be disseminated into the Study Area through field activities of EAs.

Wengkhar Center of RNR-RC East was established newly in 2001. The facilities and equipment for research activities have not been completed yet. Improvement of research facility and equipment is also included in the sub-program.

(2) Strategy and Activities

Experienced experts on horticulture as shown below are necessary at early stage for the research and development activities. Experts will be recruited from other research centers or external resources.

- Cash crop development (coordinator),

- Fruit expert,
- Vegetable expert,
- Expert for plant protection, and
- Expert for plant genetic resources cum aromatic /medicinal plant

The research activities cover fruits / nuts, vegetables, and medicinal / aromatic / spice plants and consist of the followings

- Introduction of new varieties of fruit and vegetables,
- Development of propagation technology,
- Improvement of variety,
- Establishment of farming technology, and
- Potential survey and development of cultivation technology of medicinal, aromatic, and spice plants.

The following facilities and equipment will be constructed or procured for research activities.

- Laboratory and laboratory equipment,
- Greenhouse and equipment to be attached, and
- Research farm equipment.

The Action plan of sub-program was prepared through discussions with RNR-RC East.

II-6.4.2 Training of Extension Agent Sub-program

(1) Target

Cash crops in the Study Area are produced mainly by traditional way and for home consumption except orange and potato in advanced area. As knowledge level of extension agents on horticulture is still low, capacity building of EAs by training will be necessary in order to provide extension service to the farmers. The scope of training will be in wide range: farming technology, plant protection, crop management, propagation of plants, quality improvement of products, post-harvest, marketing and improvement of extension system such as farmers field school, demonstration plot, etc.

Training facilities in RNR-RC East have not been installed at Wengkhar Center. Construction of the training hall and dormitory, and procurement of training equipment are included in the sub-program.

(2) Strategy and Activities

The EA training will be carried out intensively in RNR-RC East. Trainees group will be organized with around five EAs for a long-term training course. They will principally station in RNR-RC East for two years except the required period for performing their routine responsibility in Gewogs. They will receive on-the-job training in the course of research and development activities of RNR-RC East. Another trainees' group will participate in the long-term training course every year. All the EAs in the Study Area (24 agriculture EAs) will finally participate in the long-term training course during the period of six years.

Beside the above training course, short-term training courses will be provided by RNR-RC East for special subjects such as propagation of seedling, post-harvesting, refreshment training, etc. The subject training will be held twice every year for one week per course. All

the EAs are supposed to participate in the training program.

This sub-program will be closely related with Extension Strengthening for Cash Crop Sub-program (Section 8.5.2), so that trained EAs should provide extension service to farmers in Gewogs.

The following experts are necessary for EA training.

- Expert for cash crop development (coordinator including research and development)
- Expert for training and extension,
- Fruit expert (research cum training),
- Vegetable expert (research cum training),
- Expert for plant genetic resources cum medicinal aromatic plant (research cum training),
- Plant protection expert (research cum training), and
- Expert for post-harvest (research cum training).

The following facilities and equipment will be constructed or procured.

- Training hall and dormitory for trainees
- Training equipment such as audiovisual.

II-6.5 Extension Strengthening Program

This program consists of activities in Gewog by extension agent (EA) and Gewog itself. EA is responsible for extension activity in the Gewog, and Gewog is responsible for farmers' participation and coordination of extension activity by EA. The action plans for extension strengthening were prepared through the workshop with Gup, Mangmi and EAs, and discussion with farmers, village leaders and EAs in the Gewog.

II-6.5.1 Extension Strengthening for Food Crop Sub-program

(1) Target

This sub-program aims to strengthen and improve extension system for food security and production increase of food crops. Food Crop Working Group will be established associated with GYT for effective extension activity and involving of farmers to extension activities as well as strengthening of administrative functions of Gewog under the responsibility of Gup.

EA and the Food Crop Working Group will prepare food crop production plan for the target year including improvement plan of extension activity and input supply based on the potential survey of food crop production.

(2) Strategy and Activities

Gup in cooperation with EA and DAO should establish the Food Crop Working Group together with groups for cash crop, for livestock and marketing. The group consists of several members including one GYT member at least.

EA will be trained in the sub-program for food security (mentioned in Sub-section 8.2.1) before the implementation of activities of the Action Plan. EA in cooperation with the Food Crop Working Group will carry out activities as follows:

- Potential survey of food crop: Aiming at grasping more accurate / detail situation and potential, EAs will carry out the survey on present situation of food crop production (yield and planted area, food security/ food sufficiency, ratio of paddy production to total cereal production), land use and farmland potential, suitability of improved variety, farmers attitude for production increase,
- Preparation of food production plan and the production support plan: EA and the food crop working group will prepare food production plan till the target year based on the results of the above survey.
- Demonstration plot: Demonstration plot for food crops will be set up in farmers' field aiming at demonstration and verification of improved variety and improved cultivation technique. The location will be shifted every year for making more opportunity for the beneficiaries. EAs will periodically visit the plot for providing technical guidance of improved farming. Farming practices will be carried out by the farmers themselves. Seed and chemicals will be supplied free of charge to the demonstration plots.
- Farmers Field School (FFS): FFS aims to encourage and train farmers' leader for dissemination of improved farming technology and post-harvesting technology through their voluntary extension activities after participation to the school. Around 15-20 advanced farmers selected from villagers will participate in FFS. FFS will be held once or twice every month at demonstration plots, community school and other facilities. EAs will provide technical guidance to the participants.
- Farmers Study Tour (FST): FST aims to train farmers through investigation and discussion with farmers in advanced areas and with organizations concerned. Gewog or Dzongkhag will prepare FST schedule.
- Group purchase of inputs: Group purchase will be carried out by using of micro-credit system of BDFC in Gewog. The inputs required will be collected from the members, and ordered to commission agent (CA). CA will place orders to DSC.
- Seed multiplication: Seed grower farmers will be encouraged getting support by DSC in several Gewogs in the Study Area.

II-6.5.2 Extension Strengthening for Cash Crop Sub-program

(1) Objective

This sub-program aims to strengthen and improve extension system for cash crop production aiming at income increase of farmers. Cash Crop Working Group will be established associated with GYT for effective extension activity and involving of farmers to extension activities of cash crop as well as strengthening of administrative functions of Gewog under the responsibility of Gup.

EAs and the Working Group will prepare cash crop production plan to the target year including improvement plan of extension activity and input supply based on the potential survey of cash crop production.

Potential cash crops may be selected firstly from popular commodities of present situation of production such as potato, orange, chili, and lemongrass. In the future, the cash crop to be promoted will be diversified or special crops with high advantage to export market according to the market research sub-program will be focused on. (Sub-section 8.3.1)

(2) Strategy and Activities

The activities will be carried out by the same procedures as the sub-program for extension strengthening for food crop (Sub-section 8.5.1). Farmers study tour and group purchase of input will be provided together incorporated with the sub-program for food crop.