Irrigation & Water Resources Department
State Government of Mizoram

IWRD

DPR Preparation Guideline For irrigation project

Revised in JANUARY 2023

MizoCESAID

Project on Capacity Enhancement for Sustainable Agriculture and Irrigation Development in Mizoram

सत्यमेव जयते
State Government of Mizoram

JICA
Japan International Cooperation Agency

Acknowledgment

The cooperation between JICA and Government of Mizoram dates back to 2013 when JICA conducted a development study from 2013 to 2015 during which a 'Master Plan' for management and development of land & water resources for sustainable agricultural development in Mizoram was formulated.
In order to properly implement the approaches and projects in the Master Plan, this Technical Cooperation Project, entitled "The Project on Capacity Enhancement for Sustainable Agriculture and Irrigation Development in Mizoram" is carried out during July, 2017 to March, 2023.
It is my pleasure to acknowledge the hard work and dedication of JICA Project Team and all other officials involved in formulating the much needed Manuals viz. 1) Officer's Manual for Construction Management, 2) Manual for Strengthening of WUA for O&M of Irrigation Schemes 3) DPR Preparation Guideline, which is one of the outcomes of Technical Cooperation Project (TCP) between JICA and Government of Mizoram.
As there is neither any particular manual that is endorsed by IWRD nor any has been prepared till date for construction of irrigation projects in the state, these Manuals will be the first of their kind for the department. I am confident that these manuals will prove to be a turning point for construction management of irrigation facilities in a systematic and improved manner. I pray that these manuals will be properly utilized and the farmers will reap the benefits.

Lalrotluanga
Chief Engineer
Irrigation and Water Resources Department
State Government of Mizoram

1. Aims of the Guideline

The irrigation facilities are one of the most important agriculture infrastructure in the state and 439 irrigation schemes were developed in the past years. However, the inventory survey carried out from October 2013 to February 2014 showed that 49% of the created irrigation potential under irrigation facilities is not in use and only 7% of the facilities are properly maintained by established water users' association (WUA).

Analysing the present situation of the irrigation scheme, the state government requested the JICA Study Team to improve the procedure for the preparation of the Detailed Project Report (DPR) with field verification and the guidelines for preparation of DPR on irrigation scheme development have been prepared.

The guideline is mainly focusing on the stakeholders' involvement in the planning process such as the beneficiaries, Department of Agriculture (DOA), and Department of Horticulture (DOH), to encourage and motivate the maximum and proper utilisation of the irrigation facilities and necessary supporting activities from relevant governmental organisations.

The guideline recommends 12 steps for the finalisation of the DPR. The guideline shows the main activities under each step and the main and sub responsible organisation to implement them. The guideline was made as simple as possible and necessary forms to be used were attached with useful reference.

2. Overall Procedure for DPR Preparation

There are 12 steps for improved DPR preparation. The contents of each step and main and sub responsible organisations are summarised below.

STEP 1	Publication of Irrigation Scheme Selection and Implementation Procedure and Receipt of Application	Main Responsibility IWRD Sub Responsibility -
STEP 2	Preliminary Technical Site Survey for Scheme Selection	Main Responsibility IWRD Sub Responsibility -
STEP 3	Meeting among BAIDC for Selection of Scheme	Main Responsibility BAIDC Sub Responsibility -
STEP 4	Endorse DPR Preparation for Selected Scheme by IDC	Main Responsibility Inter department committee (IDC) Sub Responsibility -
STEP 5	Establishment of Water Users' Association (WUA)	Main Responsibility IWRD Sub Responsibility -
STEP 6	DPR Preparatory Survey	Main Responsibility IWRD Sub Responsibility DOA, DOH Other concerned departments

STEP 7	Preparation of Agriculture Action Plan	Main Responsibility WUA, IWRD, DOA, DOH, Other concerned departments Sub Responsibility VCP
STEP 8	Irrigation Planning	Main Responsibility IWRD Sub Responsibility -
STEP 9	Facility Design and Preparation of O&M Plan	Main Responsibility IWRD, WUA Sub Responsibility
STEP 10	Preparation of Construction and Quality Control Plan	Main Responsibility IWRD Sub Responsibility -
STEP 11	Cost Estimation, Benefit and Other Impact Assessment	Main Responsibility IWRD Sub Responsibility DOA, DOH, DOF
STEP 12	Consensus Building and Finalization of DPR	Main Responsibility WUA, IWRD, DOA, DOH, Other concerned departments Sub Responsibility -

Contents		Dec	Jan	Feb	Mar	Apr	May (Kharif)	Jun (Kharif)	Jul (Kharif)	Aug (Kharif)	Sep (Kharif)	Oct	Nov	Dec
Step 1	Publication of Irrigation Scheme Selection and Implementation Procedure and Reception of Application	◀												
Step 2	Preliminary Technical Site Survey for Scheme Selection													
Step 3	Meeting among BAIDC for selection of Scheme													
Step 4	Endorse DPR Preparation for Selected Scheme by IDC													
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Step 6	DPR Preparatory Survey													
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Step 12	Consensus Building and Finalization of DPR													

Annual Preparation Schedule

3. Step Wise Procedure

Step 1 Publication of Irrigation Scheme Selection and Implementation Procedure

Receipt of Application

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

【Sub Responsibility】

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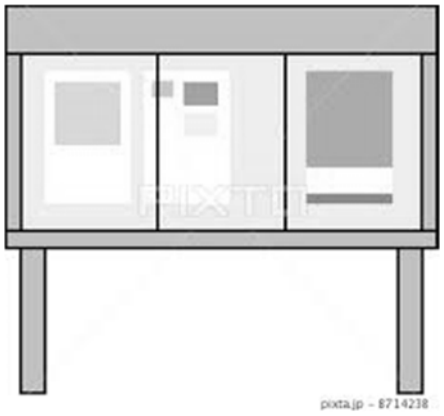
【Description of Step】

The Irrigation & Water Resources Department (IWRD) notifies the eligibility, schedule, selection procedure and criteria and necessary application form through official letters and/or bulletin board in the division office every year to ensure the transparency of the selection and to encourage stakeholder's necessary involvement.



A group of farmers who would like to apply for irrigation scheme development, discusses and collects the information necessary to fill in the application form (refer to the "FORM 1 Application Form for Irrigation Development") and submits the application to IWRD Divisional Office by the due date. The IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer facilitate or support the applicants to fill in the forms if necessary. The application form mainly requires the following information:

Step 1 Publication of Irrigation Scheme Selection and Implementation Procedure

Receipt of Application

(1) Name and address
(2) Location and area of proposed development land and legal document of ownership
(3) Proposed water resources
(4) Objectives and proposed crop to be cultivated

After receiving the application form, IWRD divisional officers will check its conformity and helps the applicants to fill in missing details if required. The application is disqualified at this stage if the form is not filled out properly. Considering the effectiveness of the project, the project whose command area is less than 10 ha is disqualified at this stage.

【Form and Reference】

FORM 1-1: Application Form for Irrigation Development

Step 2 Preliminary Technical Site Survey for Scheme Selection

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

【Sub Responsibility】

-

【Description of Step】

After receiving the application form, the preliminary technical site survey is carried out for the selection of the project. In the preliminary technical site survey, the following information are collected at the site or through analysis of the existing data. After conducting the survey or analysis, the result is compiled in the Preliminary Technical Site Survey Sheet (FORM 2-1).

Major Information Collected	Source or Way of Collection
Geological and geographical information	GIS (topographic map) or satellite map
Beneficiaries and land ownership	Interview with farmers
Present land use and farming	Interview with farmers
Availability of water resource and present water right	Site survey and interview with farmers
Relevant projects/ schemes nearby	Collected from relevant departments.
Risk of disasters (floods, landslide, erosion, etc.)	Site survey and interview with farmers
Any considerable impacts on surrounding environment	Site survey and interview with farmers

Since the site survey takes time and money, it is recommended to collect any necessary information in the office first and then conduct the site survey.

Step 2 Preliminary Technical Site Survey for Scheme Selection

Method of Water Resources Measurement

The discharge measurement of the respective water sources is one of the most important survey items in the preliminary technical site survey. The objective of the discharge measurement is to estimate the lean discharge, which is crucial for the improvement of farmers' income generation. On the other hand, water resource availability during kharif (monsoon) season can be estimated in Step 8 (irrigation planning) just like in the existing DPR preparation.

Basically, there are two types of discharge measurement methodologies, namely:

i) Direct method;

a) Area-Velocity methods, b) Dilutions techniques,

c) Electromagnetic method and d) Ultrasonic method

ii) Indirect method;

a) Hydraulics structures, such as weirs, flumes and gates structure

b) Slope area method.

Floating method, V-Notch, pipe & bucket, current meter and Acoustic Doppler Velocimeter (ADV) are commonly used in Area-velocity method, which may be used by the department. Floating method is suitable for rivers or relatively large-scale measurement. Otherwise, pipe and bucket method is recommendable during rabi season's stream discharge measurement as it is more accurate and easy to measure.

Floating method

V-Notch method

Pipe and bucket method

By using current meter

By using ADV

Measurement of water discharge from targeted stream or river should be conducted from the middle of January to early April. Measurement should be conducted near the proposed intake site and where flow of stream is stable and straight.

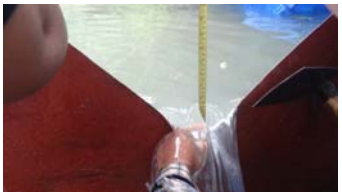
Step 2 Preliminary Technical Site Survey for Scheme Selection

IWRD surveyor should confirm with farmers that the measured discharge value is not extraordinary compared with the usual year.

Measurement should be conducted at least five times. Also, the average value is to be used after excluding extraordinary values.
When stream flow is blocked or below the level of the V-Notch, surveyor must wait until the upper stream water level is raised to a stable level.
Picture of measurement should be taken together with the board which shows measuring conditions and result.
When it comes to assessment of water resource availability in the rabi season, smaller discharge value is used as design rabi season water resource availability, comparing measured discharge and calculated estimation discharge. (Refer to Step 8 for details.)
Other general water measurement reference materials are attached in the appendix.
Example of discharge water measurement result is shown below.

Date of Measurement	**/ ** / 2014
Surveyor	**** division SDO
Measured discharge	Thingkhuanglui -11.10 (L/S)

Pipe and bucket method

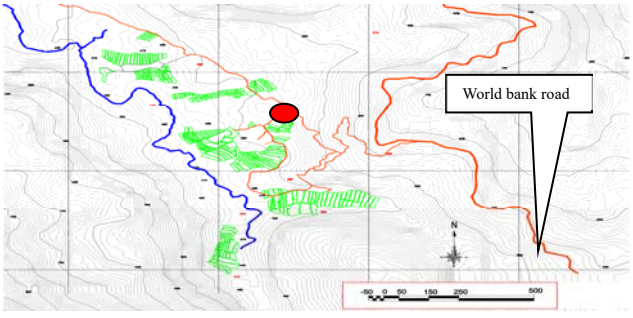


V-Notch method

By using current meter

By using ADV

Coordinate (X=477686.9918 Y=2579861.6455)



Step 3 Meeting among BAIDC for Selection of Scheme

【Form and Reference】

FORM 2-1 : Preliminary technical site survey sheet

FORM 2-2 : Discharge measurement result sheet

【Main Responsibility】

Executive engineer in IWRD divisional office

【Sub Responsibility】

Other BAIDC member such as,

District agriculture officer, DOA

District horticulture officer, DOH

Other departments concerned

【Description of Step】

After collecting basic data of the target irrigation scheme, the Block Agriculture and Irrigation Development Committee (BAIDC) discuss the rationality and technical feasibility to take up the target irrigation for preparation of DPR. The BAIDC is composed of District and Block level officers under IWRD, DOA, DOH and LRSWCD.

After selection of the schemes for preparation of DPR, schedule and responsibility of each department are also confirmed in this meeting.

【Form and Reference】

None

【Main Responsibility】

Inter Departmental Committee (IDC) chaired by Secretary of IWRD

STEP 4 ENDORSE DPR PREPARATION FOR SELECTED SCHEME BY IDC

【SUB RESPONSIBILITY】

None

【DESCRIPTION OF STEP】

Among the candidate projects proposed by each BAIDC office, the possible projects are selected in this step. The possible projects are selected based on the selection criteria which is agreed and published in advance by IDC and the state-level stakeholders and divisional officers. Equal responsibilities are given to DOA, DOH and IWRD as a member of IDC since these departments are mainly involved in further steps for DPR preparation and O&M stage of the scheme.

The overall section procedure is shown in Figure 4.1.

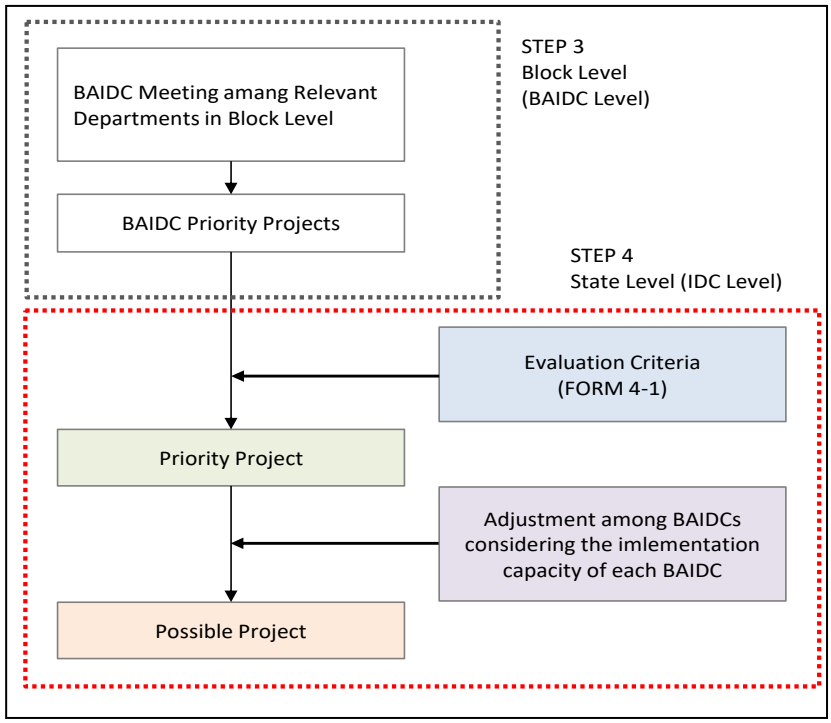


Figure 4-1 Procedure for Step 4

The criteria is shown in FORM 4-1: Evaluation Criteria and Evaluation Sheet. In the aspects of rationality, effectiveness, efficiency, impact and sustainability, 11 criteria are employed. The evaluator gives the mark for each criteria, namely: “High (Big)”, “Middle (Medium)” or “Low (Small)”, and gives 1 to 3 points for each criteria. After that,

Step 4 Endorse DPR Preparation for Selected Scheme by IDC

the evaluator sums up the points for each candidate project in divisional basis and gives the priority in each division.

Based on the divisional priority, the possible projects are selected considering the implementing capacity of each divisional staff.

The criteria should be reviewed and revised yearly based on the adaptability of the expected fund, if needed.

【Form and Reference】

FORM 4-1 Evaluation Criteria and Evaluation Sheet

Step 5 Establishment of water users' association (WUA)

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

Respective officers in IWRD head office

【Sub Responsibility】

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【Description of Step】

Although IWRD is handing over responsibility for the operation and maintenance of the irrigation facilities to established WUAs, almost all WUAs in Mizoram do not understand their roles and responsibilities and they do not have necessary fund either. This step encourages them to be aware of the importance of autonomous operation and maintenance of WUA and gives them the kickstart to initiate the activities. For this purpose, audio-visual aids such as video that introduces a good model of WUA activities will be useful to change or deepen their awareness in the first session of the step. In this regard, it is also necessary that the facilitator/IWRD staff should have basic and practical ideas on how to manage and develop WUAs in a sustainable way. This is to be provided to farmers accordingly during this step. In order to promote a strong awareness, this step will be conducted under a workshop style.

Necessary tools and materials for the workshop, and sample agenda and time schedule are attached in REFERENCE 5-1 and in REFERENCE 5-2, respectively. The outline of the workshop is as follows:

(1) Introduction

KEY NOTE

Explain the objectives, time schedule, and responsibility of each participant.

Ice breaker among the participants for active discussion in the workshop.

Step 5 Establishment of water users' association (WUA)

(2) Discussion on the Current Concern on Cooperative Activities or Existing CBOs including WUA if available.

KEY NOTE

If some CBOs are available, explain the existing CBO such as their members, activities, and regulations.
During this session, facilitator and officials find farmers' spontaneous activities or good behaviour that could be brought in WUA. In this point of view, give several kinds of questions to farmers.

(3) Introduction of a Model WUA or Farmer's Organisation by Showing Video

KEY NOTE

Introduce the key organisational characteristics of successful WUAs, using an audio-visual display
Key organisational characteristics will be pointed out: degree of spontaneous action, periodic discussions, planning by members, record keeping, fund raising and credit activities, cooperative/group actions, and unity.
Discuss each point with the farmers/group and decide which of those points are important for the WUA they would like to establish and mark them on the paper.

(4) To Recognise WUA's Function, Discuss Benefit of Group Activities

KEY NOTE

According to the findings from the video for advanced WUA, the officer facilitates the discussion on the benefit of group activities such as operation and maintenance of irrigation facilities, any type of negotiations with government and private sector (purchasing of inputs or selling of harvest), and cooperative purchasing and shipping. Officer also facilitates the necessary actions to achieve the above.

STEP 5 ESTABLISHMENT OF WATER USERS' ASSOCIATION (WUA)

(5) Discussion on Vision, Objective, Rules and Regulations of WUA

KEY NOTE

Review previous activities and try to set up a self-organised WUA based on farmer's positive ideas. At this stage, farmers have basic knowledge and sense of anticipation to establish their WUA. However, it is better to show model rules and regulations, basic document list, and other legal matters concerning registration. The following output will be expected:

- Creation of vision and long-term objectives
- Role and function of WUA in general
- Definition of who the members of the organisation are
- Basic documents for the establishment of the WUA
- Preparation of draft rules and regulations
- Nomination of committee members and officers (if necessary)

It is better to implement a model committee meeting among the participants in order to guide them on how to hold meetings. It is also possible to prepare a short-term action plan in this occasion to facilitate further activities after the workshop.

(6) Preparation of Documents for Registration of WUA

KEY NOTE

Explanation of registration methods and necessary items.

Prepare further registration schedule.

【FORM AND REFERENCE】

REFERENCE 5-1: Necessary Tools and Materials for Establishment of WUA Workshop

REFERENCE 5-2: Sample Agenda and Time Schedule for Establishment of WUA

REFERENCE 5-3: List of Documents Necessary for WUA Management

REFERENCE 5-4: Reference for WUA Rules and Regulations

Step 6 DPR Preparatory Survey

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

Respective officer in IWRD head office

【Sub Responsibility】

District agriculture officer, additional district agriculture office and block agriculture officer, DOA

District horticulture officer, additional district horticulture officer and block horticulture officer, DOH

District fishery officer, DOF

Other department concerned

【Description of Step】

The DPR preparatory survey is carried out to collect the necessary technical data and information for irrigation planning and facility design. Major survey items and activities to be carried out in this step are as follows:

(1) Preparation of base map for planning
(2) Conduct of soil classification test
(3) Conduct of topological survey (if necessary)
(4) Conduct of walkthrough survey to identify potential disaster site, present land use and land ownership, and existing facilities

(1) Preparation of Base Map for Planning

Base map can be the foundation data for various survey works, planning, and design works. Therefore, base map should have scale, coordinates, and contours, and it has to be referred to the aerial picture. Preparation step of base map and roles of each office are shown in the table below.

Step 6 DPR Preparatory Survey

S/N	Item	Work to Do	Role	Tools to Use
1	Specify the area and inform to CE Office	Specify the targeted area for the project and identify the coordinates of the corners	Division office	GIS or Google Earth
2	Preparation of contour map	Convert GIS DEM data into contour lines within above specified area and save the data as DWG data	CE Office	Arc GIS
3	Tracing of existing facilities	Trace existing facilities like road, river, paddies, and structures with GIS and save the data as DWG data	CE Office	Q-GIS or Arc GIS
4	Capture of aerial picture data	Capture aerial picture data from website with Q-GIS or others	CE Office	Q-GIS or other
5	Overlay of above data	Overlay above data (contour line, existing facilities, aerial picture data) and prepare base map	CE Office	AutoCAD
6	Send base map to division office	Send above data to division office by email or SUMO service.	CE Office	

Contour lines are created from DEM data of GIS. However, they cannot reflect detailed geological condition. Recommended contour interval is 5 m.

Arc GIS should be used to create contour map, although it can be done with Q-GIS software.

Coordinate type of the base map is Universal Transverse Mercator (UTM).

Although base map has coordinate information, the map is not so accurate for detailed facility design use. Also, several meters are expected to be the tolerance of accuracy.

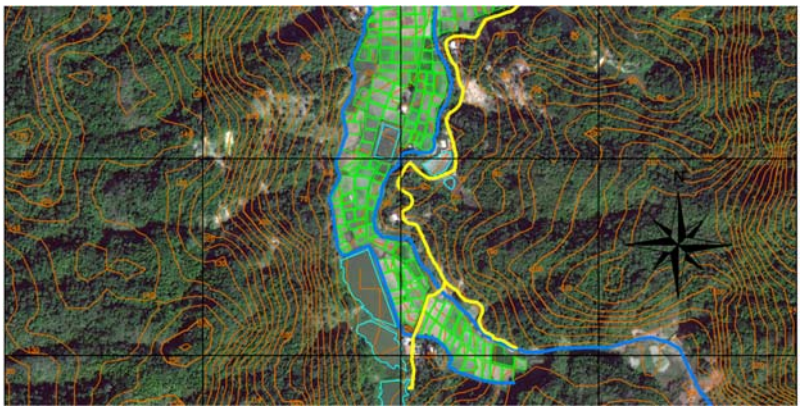


Figure 6-1 Sample of base map

Step 6 DPR Preparatory Survey

(2) Conduct of Soil Classification Test

Soil classification test result form (Form 6-2) is used to show the test result.

With regard to soil sample taking, surveyor should choose typical soil in the scheme area in consultation with the farmers. In case there are several different typical soils, soil test shall be conducted for each type.

Soil classification test should be conducted after removing small stones and organic materials.

When soil sample needs adjustment of soil moisture, water spray should be used for detailed adjustment.

Picture of the test should be taken together with the board that shows the measurement conditions and result.

Result of the soil classification test shall be an attachment to the DPR and the result can be used for cropwat irrigation calculation.

Photo 6-1 Image of soil classification test

Topological survey is recommended for the following structure design:

Survey	Machine	Target Facility
Ground level profile and section survey	Auto level or Total station	- Gentle slope canal and drainage - Pressured pipe profile - Dam or pond area
River profile and section survey	Auto level or Total station	- Relatively large-scale river diversion weir - Improvement of drainage
Area survey	Total station	- Gentle slope land development area - Dam or pond area

IWRD keeps total station machines in each division

Step 6 DPR Preparatory Survey

and DGPS with RTK in Aizawl as of 2022. Total station survey result can be converted into Autocad data. Therefore, division office can receive the data even through internet.

Total station survey data has UTM coordinates. Also, the survey data can be imported with GIS software and Google Earth. Division office has to check the coordinates of the total station survey, as surveyor sometimes makes mistakes in the direction of the coordinates. An example of total station survey result is shown below.

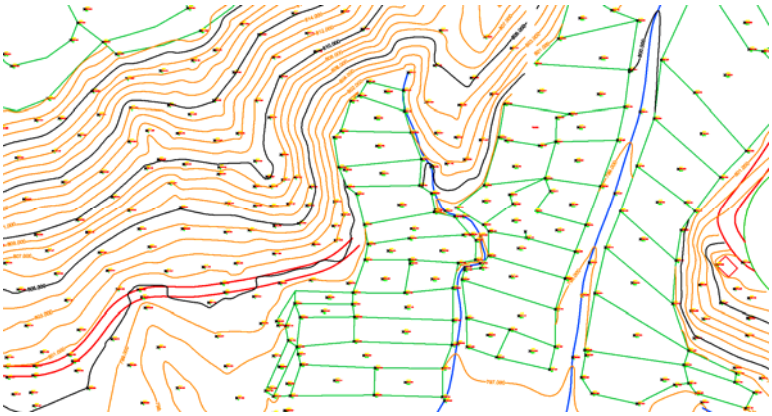


Figure 6.2 Sample of Total Station Survey Result

(3) Walkthrough Survey, Especially Potential Disaster Site Survey

Disaster survey is to be conducted to clarify existing conditions of flooding-, erosion and landslide-damaged area and grasp potential risky area. Then, the result shall be reflected in facility planning and design. The following are the main targets of the survey:

Canal Blocked with Landslide sediments

Facility planned area
Along canal, candidate alignment
Along existing river, drainage and canal

Surveyor shall visit the proposed area and conduct

STEP 6 DPR PREPARATORY SURVEY

field survey together with WUA. The surveyor shall also take necessary measurement of damaged or potential risk area, and show the result in the base map. (Example of disaster survey result is shown below.)

Survey tools are levelling staff, tape measure, GPS, camera, base map, and shovel.

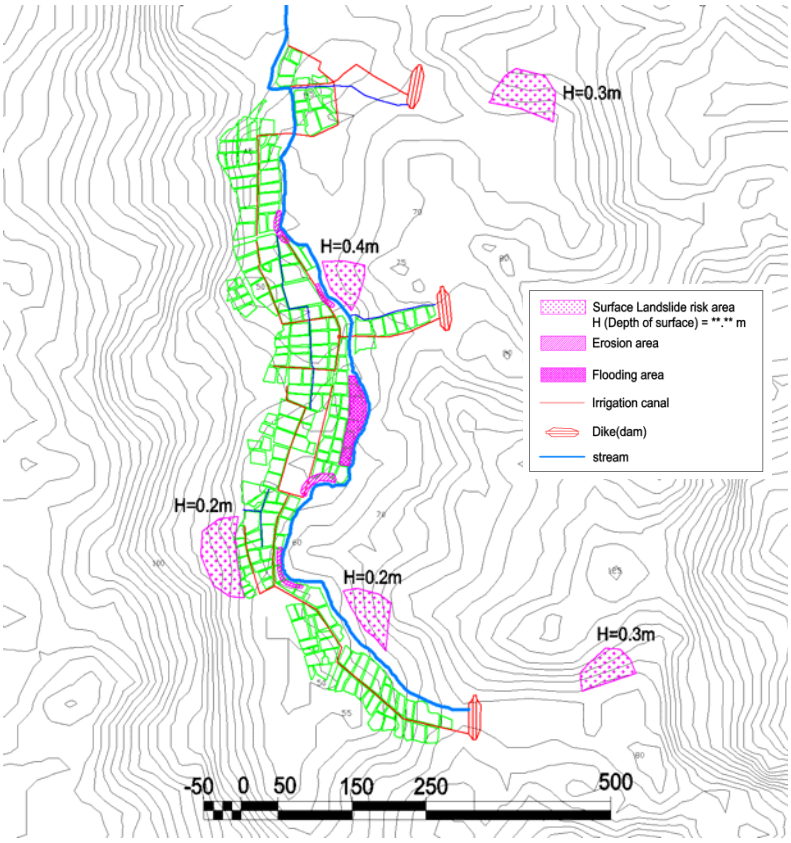


Figure 6.3 Sample of Disaster Survey Result

【FORM AND REFERENCE】

FORM 6-1; DPR preparatory survey check sheet
FORM 6-2; Soil classification test result form

STEP 7 PREPARATION OF AGRICULTURE ACTION PLAN

【MAIN RESPONSIBILITY】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer
Respective officer in IWRD head office
District agriculture officer, additional district agriculture office and block agriculture officer, DOA
District horticulture officer, additional district horticulture officer and block horticulture officer, DOH
Other concerned department officers

【SUB RESPONSIBILITY】

VCP in respective village

【DESCRIPTION OF STEP】

The objectives of Step 7 are: (1) preparation of proposed cropping pattern and (2) preparation of action plan to materialise the proposed cropping pattern. According to the inventory survey carried out in January 2014, only 51% of the created irrigation potential is used and there is a big gap between the plan and actual situation. To mitigate this gap and enforce the maximum utilisation of the developed scheme, the new guideline encourages stakeholders' involvement such as farmers, DOA and DOH in the beginning of the preparation of cropping pattern.

Since the present farmers' capacity such as amount of information and other knowledge are insufficient to prepare the action plan by themselves, participating government officers should provide necessary crop-wise information, namely: market price, water consumption, and cultivation risks, to the farmers to prepare a better cropping calendar. In addition, the collection of basic agriculture data is also an important objective in this step.

The outline of Step 7 is shown below. The sample agenda and time schedule are given in REFERENCE 7-1.

Step 7 Preparation of Agriculture Action Plan

1. Preparatory Arrangement for the Workshop

- Appoint full-time officials from relevant departments for the preparation of the agriculture action plan.
- Compile the following necessary data for the workshop and preparation of presentation document (REFERENCE 7-2: Reference for Crop Selection).
- Finalise agenda, time schedule, venue and responsibility for the workshop after necessary discussion with participants. The agenda and time schedule should be printed on a large paper for the workshop.
- Finalise preparation of necessary materials/documents/ facilities for the workshop. In addition, prepare supply of tea, snacks, and meals (see REFERENCE 5-1).

2. Discussion of Current Agriculture Practice

- Discussion of current cropping pattern (FORM 7-1) and discussion of the profitability of the crop.
- Discussion of current problems faced in agriculture (problems should be listed and categorised).
- Preparation of resource map of the cultivation area including road connection (FIGURE 7-1).

3. Discussion of Proposed Cropping Pattern

- Sharing the information on seasonal availability of the water resources in the proposed water resources development site.
- Share the crop-wise data on: (1) water requirement, (2) market price, and (3) cultivation risks and facilitate the discussion on what is the most feasible crop and cropping pattern in each respective area.
- Select strategic crop (3-4 kinds) in the respective area.
- Prepare proposed cropping pattern (FORM 7-2) which should include cultivation area,

Step 7 Preparation of Agriculture Action Plan

location or cultivator, expected yield and/or production.

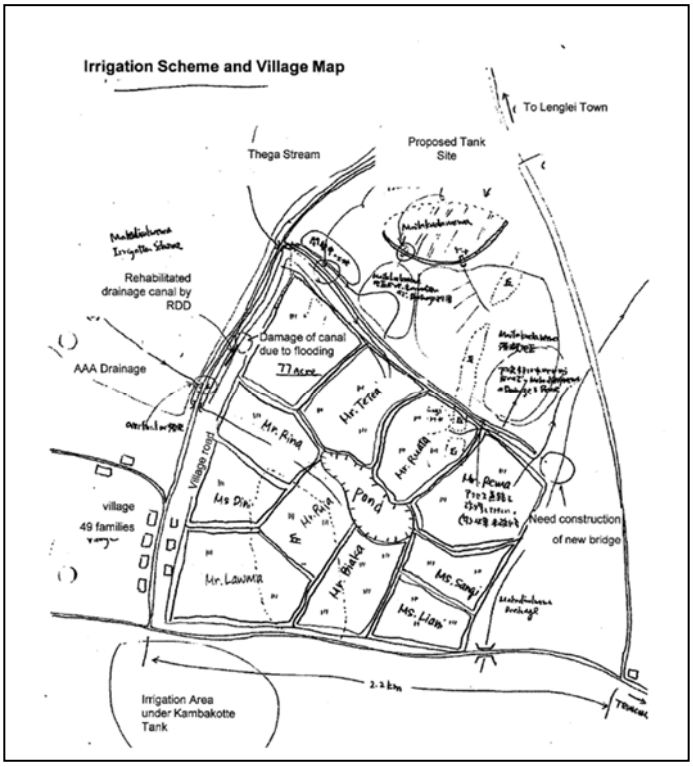


Figure 7-1 Sample of Resources Map

4. Discussion of Necessary Actions to Materialise Proposed Cropping Pattern

- The necessary actions should be prepared for: (1) increase in production of main crop (or kharif crop), (2) increase in production of sub crop (or rabi crop), (3) increase in production of fish, if available, and (4) strengthening the organisation (WUA).
- Responsible organisation or person should be decided for each action.
- If cultivator requires technical or financial support from the government or other organisation, the type and scale of support should be cleared in the workshop.
- The discussed actions are compiled in the agriculture action plan and stakeholders who participated in the workshop should sign on to the plan as proof of their commitment (FORM 7-3).

STEP 7 PREPARATION OF AGRICULTURE ACTION PLAN

【FORM AND REFERENCE】

FORM 7-1: Current Cropping Pattern

FORM 7-2: Proposed Cropping Pattern

FORM 7-3: Agriculture Action Plan

REFERENCE 7-1: Detailed Procedure for Agriculture Action Planning

REFERENCE 7-2: Reference for Crop Selection

Step 8 Irrigation Planning

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

【Sub Responsibility】

-

【Description of Step】

Irrigation planning is carried out based on the cropping pattern prepared in Step 7. Step 8 includes the following activities:

(1) Assessment of Availability of Water Resources
(2) Calculation of Water Requirement and Water Balance Study
(3) Irrigation System Design

(1) Assessment of Availability of Water Resources

Since the water resources in kharif is quite enough according to current rainfall data, estimation of water resource availability for irrigation planning is carried out focusing mainly on seasonal availability in rabi. Generally speaking, the estimation of the runoff discharge in the small catchment is not easy so this guideline recommends to assess the availability of water resources based on the field data collected in Step 2. However, this guideline also recommends to cross check field observed data with the data calculated based on basin-wise specific discharge. The overall estimation procedure is shown in Table 8-1.

Step 8 Irrigation Planning

Table 8-1 Estimation Procedure

Step		Description
1	Measurement of discharge from targeted streams	Measurement of discharge water from targeted stream or river should be conducted at least two times from the middle of January to early April in one year. (Refer to Step 2 for details.)
2	Measurement of catchment area of targeted streams	Measurement work can be conducted with GIS or Google Earth Pro. Also, catchment area map is to be prepared.
3	Identification of river basin name	Mizoram can be divided into 27 river basins. (Refer to Table 8-2.) Also, the river basin name of the targeted stream is to be identified.
4	Calculation of water resource availability	- Rabi season's water resource availability is to be estimated from river basin-wise specific discharge table, which is shown in the following pages. - Specific discharge value of "December-March (Winter)" period is to be used. - Water resource of each stream can be calculated by "specific discharge multiplied by catchment area"
5	Setting of water resource availability	Compare the result of actual measurement (Step 1) with the calculation result (Step 4). Then, the smaller value shall be used as the estimated value of water resource availability during the rabi season.

Table 8-2 below was originally prepared by WAPCOS for Mizoram Irrigation Master Plan (1995). Thereafter, the JICA Study Team (2014) checked the data with some of the available CWC data and updated rainfall data, which is equivalent to 75% dependable rainfall value (rainfall data from 1999 to 2014).

Step 8 Irrigation Planning

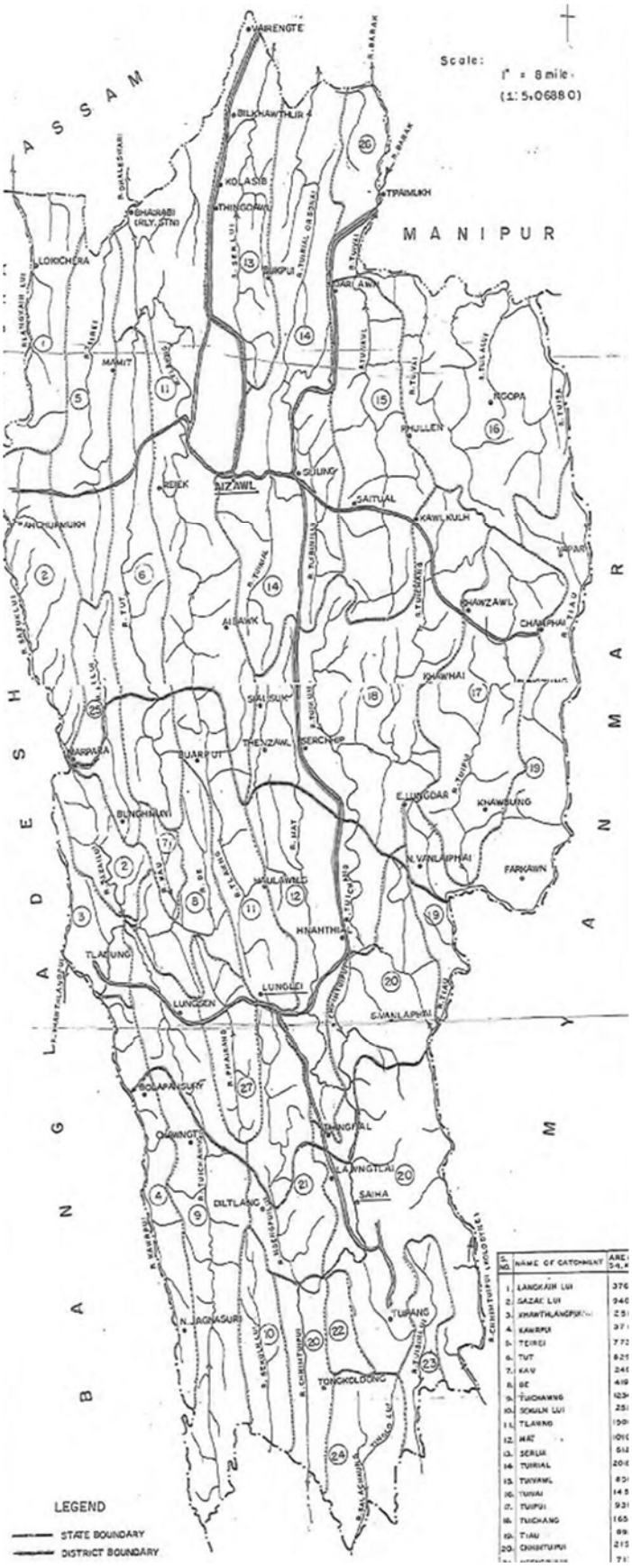


Figure 8-1 River Basin

STEP 8 IRRIGATION PLANNING

Table-8.2 Periodic Availability of Surface Water and Specific discharge in River Basin of Mizoram

(Unit: $m^3/s/km^2$)

No	Name of River Basin	Periodic water Resource Availability (Specific discharge)			
		June -Sept (Monsoon)	Oct-Nov (Post -Monsoon)	**Dec-March (Winter)**	April -May (Pre-Monsoon)
1	Langkaih lui	0.04325	0.01413	**0.00155**	0.00353
2	Sazai Lui	0.04834	0.01554	**0.00186**	0.00384
3	Khawthlangtuipui (Karnaphuli)	0.06402	0.02041	**0.00232**	0.00529
4	Kawrpui	0.06291	0.02046	**0.00236**	0.00511
5	Teirei	0.04875	0.01571	**0.00189**	0.00393
6	Tut	0.06496	0.02083	**0.00246**	0.00504
7	Kau	0.07914	0.02515	**0.00312**	0.00610
8	De	0.08104	0.02626	**0.00302**	0.00634
9	Tuichawng	0.07186	0.02306	**0.00268**	0.00569
10	Sekulh lui	0.07317	0.02343	**0.00271**	0.00605
11	Tlawng (Dhaleshwari)	0.07289	0.02340	**0.00272**	0.00569
12	Mat	0.07273	0.02348	**0.00279**	0.00564
13	Ser lui	0.07337	0.02364	**0.00283**	0.00583
14	Tuirial	0.06700	0.02155	**0.00251**	0.00527
15	Tuivawl	0.06694	0.02150	**0.00250**	0.00532
16	Tuival	0.05972	0.01929	**0.00227**	0.00469
17	Tuipui	0.05856	0.01885	**0.00218**	0.00466
18	Tuichang	0.06822	0.02192	**0.00259**	0.00539
19	Tiau	0.05438	0.01760	**0.00206**	0.00421
20	Chhimtuipui (Kolodyne)	0.07310	0.02355	**0.00275**	0.00571
21	Ngengpui Lui	0.08245	0.02646	**0.00312**	0.00662
22	Palak Lui	0.07104	0.02232	**0.00286**	0.00558
23	Tuisih lui	0.06646	0.02134	**0.00234**	0.00533
24	Tinglo lui	0.07098	0.02280	**0.00275**	0.00536
25	Mar Lui	0.06475	0.02061	**0.00244**	0.00529
26	Barak	0.05755	0.01769	**0.00247**	0.00482
27	Phairang	0.08294	0.02694	**0.00323**	0.00631

(1) Calculation of Water Requirement and Water Balance Study

To simplify the planning, the guideline recommends studying the water balance during the lean period in January. The smaller figure between the observed discharge in the field and those calculated by specific discharge is taken as the supplied discharge for water balance study and the demand is estimated based on Table 8-1 showing the crop-wise basic water requirement during the rabi season.

Diversion water requirement is estimated by using the irrigation efficiency of open channel of 45% and of pipeline of 55%.

STEP 8 IRRIGATION PLANNING

Table 8-3 Crop Water Requirement

Crops		Water Requirement (mm/d)
Group 1	Paddy	12
Group 2	Cabbage Knol-khol (Kohlrabi)	5
Group 3	Leaf Mustard / Seamum Lettuce / Potato Table beet / Maize	4
Group 4	Cow Pea / Lady's finger Soya Bean/French Bean Field pea / Chilly Brinjal / Tomato Broccoli / Cauliflower Coriander	3
Group 5	Onion	2

There are several options in water resources development such as diversion of river water, construction of reservoir, and/or pumping the groundwater. Since the state has steep ground slope in general, the unit cost for development of reservoir will be relatively high. Agriculture in Mizoram is still extensive, and intensive farming through utilization of groundwater is not feasible all the time either. Considering this situation, the diversion of river water using gravity irrigation system can be a priority in the water resources development planning in principle.

In the selection of the canal type, open channel system is more economically feasible with easy maintenance than the closed canal system. However, the pipeline system, which has high efficiency, can be employed where water shortage is observed.

【FORM AND REFERENCE】

REFERENCE 8-1 : Irrigation Schedule and Monitoring Plan for Winter Crop

Step 9 Facility Design and Preparation of O&M Plan

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer
WUA

【Sub Responsibility】

-

【Description of Step】

Step 9 focuses on the design of facilities such as intake, reservoir, irrigation and drainage canal, canal-related structure, and access road, and operation and maintenance of these facilities. The facility design is carried out based on the irrigation plan prepared in Step 8 taking the following procedure:

(1) Preparation of facility layout map
(2) Facility design
(3) Design review
(4) Preparation of operation and maintenance plan

(1) **Preparation of Facility Layout Map**

The facility layout map is prepared based on the "base map" prepared during DPR preparatory survey stage. Layout map will include but not limited to the following information:

- Existing road, stream, river and farmland
- Direction and scale
- Grid of coordinates and contours (if necessary)
- Location and name of irrigation facilities
- Irrigation facility list, which includes name, quantity, size, and dimension

The prepared layout map will be shared with the members of WUA and other relevant government organisations for the ratification of the project and for the preparation of operation and maintenance planning. The map should be prepared in detail but in an uncomplicated way.

STEP 9 FACILITY DESIGN AND PREPARATION OF O&M PLAN

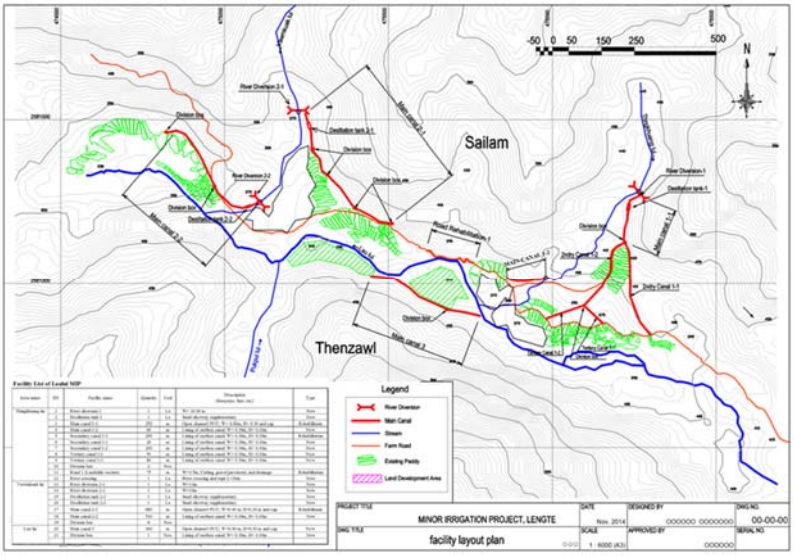


Figure 9-1 Typical Facility Layout Map

(2) **Facility Design**

The target facilities to be designed are based on the list of facilities in the facility layout map. Facility design basically includes "Basic Conditions", "Hydraulic Calculation and Drawings", and "Quantity and Preparation of DPR" as shown in Figure 9-1.

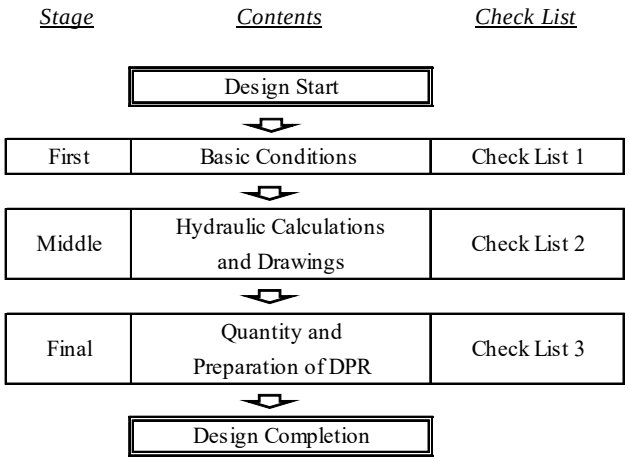


Figure-9.1 Procedure of Step 9 (Facility Design)

Setting Basic Conditions

Basic conditions include water requirement for canal design, design flow based on the peak flood for intake design, and reservoir capacity for ponds based on the irrigation water shortage during rabi season. These conditions are arranged as design conditions.

Step 9 Facility Design and Preparation of O&M Plan

Hydraulic Calculation and Preparation of Drawings

Hydraulic calculation method depends on the kind of structure (open channel, pipeline). Input data for the calculation is based on the above basic conditions. Facility dimensions are decided by the calculation. Facility drawings are prepared based on the dimensions.

Structural Calculation and Preparation of Drawings

Basically, irrigation facilities in Mizoram do not require structural calculation considering the existing facilities' conditions.
However, reinforcement concrete structures like reservoir tank and retaining walls whose height is higher than 2.0 m, are recommended to be checked with structural calculation.
Installation of structure shall be based on cutting foundation, not filling foundation. In case the base of the structure is to be constructed on filling foundation, bearing capacity checking is needed.
Rural road manual or other official standards should be followed for the design and construction of culvert in case the width of the culvert is more than 1.5 m.

The following items should be considered to prolong the durability of facilities and promote dry season irrigation. (Refer to model DPR drawings for details.)

- Haunch at corners of channel
- Using pipe or installation of concrete cover on channel in landslide risk section
- Installation of de-siltation tank after intake
- Simplified and cost-saving structure of intake
- Installation of division pipe in division box and channel for winter crop irrigation

Calculation of Work Quantity

Quantity and cost are calculated based on the

Step 9 Facility Design and Preparation of O&M Plan

drawings. DPR is prepared based on the above study.

(3) **Design Review**

Design check is basically carried out based on the list (Form 9-1) with the targeted diversion weir, canal, and pond as the main irrigation facilities. The design check is prepared in three stages, namely: first (basic conditions), middle (hydraulic calculations and drawings), and final (quantity and preparation of DPR) as shown in Figure-9.1. The list is prepared by the junior engineer, checked by the sub-divisional officer, and supervised by the executive engineer.

(4) **Preparation of Operation and Maintenance (O&M) Plan**

The O&M plan is prepared based on Form 9-2 by WUA in association with IWRD division office after the irrigation facility design. The plan targets all irrigation facilities such as diversion weir, intake, canal, and pond which are developed by IWRD. WUA selects all O&M works regarding the irrigation facilities. Items of the works are generally patrol, water management, removing sedimentation soil, removing weeds, and rehabilitation. The implementer and frequency are decided for each O&M work.

【Form and Reference】

FORM 9-1: Design Check List 1, 2, 3
FORM 9-2 O&M Plan

Step 10 Preparation of Construction and Quality Control Plan

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

【Sub Responsibility】

-

【Description of Step】

The construction plan and construction work quality control plan are prepared in Step 10. Both plans are prepared considering the following points:

Construction Plan

Standard construction plan form is to be used for this part. The following items are components of the plan. Example of construction plan is to be referred to the model DPR of the four sites.

Items		Description
1.	Project outline	Extraction and description of project outline from DPR.
2.	Management organisation	-
2.1	IWRD supervision team	Description about role and responsibility of division office team members for construction supervision works .
2.2	Safety management	(1) Preparation of contact list like hospital, police outpost, WUA, village council, relevant departments and so on. (2) Description about special safety management, safety measures and facilities, crime and pollution control measures, safety management meeting, safety patrol, and inspection, if necessary.
3.	Temporary work plan	Description about work restrictions, major temporary facilities and temporary work like diversion of drainage or pumping, and temporary access road, if necessary.
4.	Construction plan	-
4.1	Machinery utilisation plan	List to describe the name, type, specification, quantity, and use of construction machinery, like

Step 10 Preparation of Construction and Quality Control Plan

		excavation machine and concrete mixer.
4.2	Major materials	List to describe the name, specification and expected source of major construction materials, like cement, sand, aggregate, brick, stone, and wood plank.
4.3	Meeting /Inspection plan	Item should include at least kickoff meeting, regular meeting, and regular inspections.
5.	Time Schedule	Construction works schedule chart is to be prepared in consultation with EE. Progress of actual construction works should be compared and checked with this schedule chart.

Quality Control Plan

Proposed quality control works are to be conducted using mainly the following quality control materials.

- Document control checklist (before and after construction)
- Checklist for site works management
- Daily site report form
- Quality control checklist (embankment works, concrete works, canal works)
- Quality control methodology using pictures

Then, the quality control plan of each scheme shall show how and when the quality control materials are to be used. An example of quality control plan is shown in the following page.

【Form and Reference】

FORM 10-1: Standard construction plan form
FORM 10-2: Standard Quality control plan form

STEP 11 COST ESTIMATION, BENEFIT AND OTHER IMPACT ASSESSMENT

【MAIN RESPONSIBILITY】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

【SUB RESPONSIBILITY】

Department of Agriculture

Department of Horticulture

Department of Forest and Environment

Other concerned departments

【DESCRIPTION OF STEP】

Step 11 targets the estimation of the project cost, economic evaluation, and conduct of the initial environment examination.

(1) Project Cost Estimation
(2) Benefit Analysis and Economic Evaluation

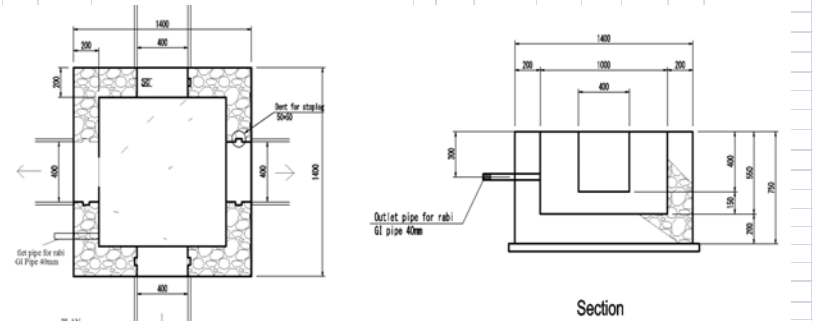
(1) Project Cost Estimation

With regard to cost estimation of DPR, IWRD basically prepares the cost estimation as it used to be. Then, the latest appropriate Schedule of Rate, approved by GOM is to be used. The certificate for SOR is to be issued in the name of the division office EE and the certificate is to be attached in the DPR.

The facility's structural drawing is to be attached in the facility-wise detailed cost estimation sheet to provide evidence of quantity calculation, as shown in the example below.

Step 11 Cost Estimation, Benefit Assessment and Other Impact Assessment

Sl.no	Item no.	Description	No.		L	B	H/T	Qty.	Unit	Amount
2	4.04	Providing and laying inposition cement concrete of specified grade excluding cost of centering and shuttering - All work upto plinth level:								
	(a)	1 : 4 : 8 (1 cement : 4 course sand : 8 stone aggregate 20mm nominal size)		1	1.4	1.40	0.2	0.392	cum	
			@	Rs	5226.00	/cum			**Rs**	**2048.59**
3	7.03	Course rubble masonary with hard stone in foundation upto one								
		(a)in cement morter 1:3 (1cement :3fine sand)								
		floor		1	1.4	1.40	0.2	0.392	cum	
		wall		4	1.4	0.55	0.2	0.616	cum	
							i	1.008	cum	
		Subtracting the division outlet		2	0.4	0.55	0.2	0.088	cum	
				1	0.2	0.55	0.2	0.022	cum	
							ii	0.110	cum	
						Total(i - ii)		0.898	cum	
			@	Rs	5282.3	/cum			**Rs**	**4,743.51**
4	21.14	20 mm cement plaster 1:3 (1cement :3 fine sand)								
		wall		4	1.4	0.55		3.1	sqm	
		floor		1	1.0	1.00		1.0	sqm	
		top		4	1.4	0.2		1.1	sqm	
							total	5.2	sqm	
			@	Rs	293	/sqm			**Rs**	**1,523.60**
						Sub Total			**Rs**	**8,401.19**
		Add cost index for Champhai district @			7.23%				**Rs**	**607.41**
							Grand total		**Rs**	**9,008.60**
								Say		**9,000.00**



"Note for earthwork rate study for irrigation pond"

Although IWRD uses the Schedule of Rates of Mizoram PWD (Building) for cost estimation, it does not include appropriate rates for relatively large-scale earthworks like open space mechanical excavation for pond.

On the other hand, the Schedule of Rates of Mizoram PWD (PMGSY) includes more suitable rate for pond earthworks, as the work is more similar to road machinery earthworks.

Therefore, the JICA Study Team proposes to use the following schedule of rates for excavation and embankment works, which was quoted from PWD (PMGSY).

Step 11 Cost Estimation, Benefit Assessment and Other Impact Assessment

Table-11-1 Proposed Schedule of Rates

	Current Rate	Proposed Rate
Excavation	PWD (Building) 2.06 Earthwork in excavation over areas (exceeding 30 cm in depth,1.5 m in width as well as 10 m^2 on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be levelled and neatly dressed. (a) Ordinary and Hard Soil	PWD (PMGSY). 8.3 1600&300 Earthwork in Hill Road (ii)Excavation in hilly areas in soil by mechanical means A) Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with a lift up to 1.5 m and a lead up to 20 m as per Technical Specification Clause 1603.1 B) Extra for every additional lift of 1.5 m or part thereof *(for dam embankment)
	INR 284.3/m^3	A) 80.62 + B) 21.66 = INR 102.28/m^3
Embankment	PWD (Building) 2.18 Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations, etc., in layers not exceeding 20 cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift up to 1.5 m.	PWD (PMGSY) 3.3 301.5 Construction of Embankment with Material Obtained from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures, graded and compacted to meet requirement of Tables 300.1 and 300.2 as per Technical Specification Clause 301.5
	INR 90.3/m^3	INR 106.44/m^3

Step 11 Cost Estimation, Benefit Assessment and Other Impact Assessment

The project cost is calculated based on the following conditions:

Interest on capital is 10% of the total cost of the project.
Depreciation of the project is 4% of the project cost.
Annual operation and maintenance cost is INR 1,175.00 per ha of CCA.
Maintenance cost of head works is 1% of the cost of head works.
Total annual cost is (a) + (b) + (c) + (d)

(2) Benefit Analysis and Economic Evaluation

It is better to evaluate benefit assessment based on farm revenue and expenditure in each local area according to the proposed cropping pattern. However, it is difficult to obtain reliable data on farm-gate price, man-days of farm work (hired and family labour), and other expenditure for farm operation at present in the state because most farmers have not kept any records of their farming practice. Therefore, basic data collection and analysis by the relevant departments based on systematic extension and monitoring activities would be indispensable.

Preparation of Cost Benefit Analysis (CBA) for Each Crop Using Format 11-1.

The analysis would be helpful in selecting beneficial crops for farmers, and it is better to provide CBA of typical common crops in the areas so that farmers can compare these crops with the crops of proposed cropping pattern. At the same time, it is important to give a demonstration of CBA calculation to farmers in this occasion in order to develop their sense of farming management and economy.

STEP 11 COST ESTIMATION, BENEFIT ASSESSMENT AND OTHER IMPACT ASSESSMENT

Preparation of Benefit Assessment with Cropping Pattern

Based on the results of CBA, prepare an easy-to-understand chart/table for farmers and it will be utilized for the ratification meeting in Step 12.

In addition, many farmers are interested in organic agriculture. Furthermore, most of them cannot properly obtain chemical fertilisers and agrichemicals on time. Therefore, if possible, it is better to calculate CBA in two ways to be able to compare organic and common farming system.

Benefit/cost ratio is calculated as total annual benefit/total annual cost. The ratio must be more than 1.

【FORM AND REFERENCE】

FORM 11-1 : B/C Calculation Sheet

REFERENCE 11-1 : Estimated Crop Budget 2014

Step 12 Consensus Building and Finalization of DPR

【Main Responsibility】

IWRD divisional officers such as executive engineer, sub-divisional engineer or junior engineer

Respective officer in IWRD head office

Department of Agriculture

Department of Horticulture

VCP of respective village

Other concerned departments

【Sub Responsibility】

-

【Description of Step】

Step 12 is the last step for DPR preparation, and involves building the consensus on the contents of the prepared DPR among the stakeholders. This step will be the most important process for both government and farmers/WUA to mitigate any risks caused by misunderstanding in the plan. Each concerned farmer should thoroughly understand and agree with each item. Therefore, the elucidator of the DPR should explain each item to the farmers in a polite way and using visual materials as needed.

The following are important points in the consensus building:

IWRD Side

- Make necessary effort for sanctioning the respective irrigation scheme implementation.
- Construct and/or rehabilitate the facilities based on the prepared DPR with sanctioned budget.
- Give the necessary support to WUA for proper operation and maintenance of the facilities based on the prepared O&M plan.

WUA Side

- Cooperate with IWRD and provide necessary support during and after construction works.
- Utilise the facilities effectively based on the prepared crop calendar and agriculture action

Step 12 Consensus Building and Finalization of DPR

plan.

- Take over the facilities from IWRD and operate and maintain the facilities in accordance with the O&M plan for 25 years after the construction and/or rehabilitation of the facilities.

Other Government Departments and Stakeholders Side

- Provide follow-up activities which are stipulated in the agriculture action plan like extension services.
- Strengthen mutual cooperation with IWRD and WUA for further necessary actions for effective utilisation of the respective irrigation scheme, if required.

If the above points are not agreed in the meeting, the DPR will be revised accordingly.

【Form and Reference】

FORM 12-1 Minute of Ratification Meeting

List of Forms

FORM 1-1

APPLICATION FORM FOR IRRIGATION DEVELOPMENT

Date: / /

To ; Executive Engineer of _____ Division, Irrigation & Water Resources Department

From;

Signature

Name of Applicant _____

Address:_____ Contact No._____

Scheme Information	
District / Village of Site	
Proposed Name of scheme	
Type of Project	☐ New Development ☐ Rehabilitation
Target CCA (ha)	
Farm accessibility by vehicle	☐ Throughout year ☐ Only in Rabi ☐ None
Expected Water Source (Name of river or stream)	(1) (2) (3)
Present Land Use	Farm Land _____ (ha) Forest _____ (ha) Others _____ (ha)
Crop to be Cultivated	(Kharif) : (Rabi) : (Summer) :

Beneficiaries' Information

	Name / Father's Name	Village / Address	Owned Land under respective scheme (ha)	Type of Farming		
				Full time	Part time	Other
1	(Leader)			☐	☐	☐
2	(Sub Leader)			☐	☐	☐
3				☐	☐	☐
4				☐	☐	☐
5				☐	☐	☐
6				☐	☐	☐
7				☐	☐	☐
8				☐	☐	☐
9				☐	☐	☐
10				☐	☐	☐
11				☐	☐	☐
12				☐	☐	☐
13				☐	☐	☐
14				☐	☐	☐
15				☐	☐	☐
16				☐	☐	☐
17				☐	☐	☐
18				☐	☐	☐
19				☐	☐	☐
20				☐	☐	☐
21				☐	☐	☐
22				☐	☐	☐
23				☐	☐	☐
24				☐	☐	☐
25				☐	☐	☐

Note : The scheme location map should be attached

FORM 2-1

PRELIMINARY TECHNICAL SITE SURVEY SHEET

Scheme Name				S/N	
Survey Date		Name of surveyor/Position			
General					
1	Location	District			
		Name of Village			
		Coordinate	X:	Y:	
2	Type of Project	☐ New Development ☐ Rehabilitation			
3	Development of Land *(Check existing conditions with Google earth, GIS data and Topo-map)*	Target CCA (ha)			
		Present Land Use	WRC : _____ (ha) Upland : _____ (ha) Forest : _____ (ha) Others : _____ (ha)		
		Slope of Land development area (%)			
		Average Elevation of farm (E.L.m)			
4	Accessibility	Distance from major town (km)			
		Distance from district headquarter (km)			
		Distance from main road (km)			
		Distance from farmers' village (km)			
		Distance from market (km)	Market Name ( ) ( ) km		
		Farm Accessibility by Vehicle	☐ Throughout year ☐ Only in Rabi ☐ None		
Water Resources					
5	Water resource	1	Name of river/ streams		
			Existing utilization of water source		
			Measured lean discharges (L/S)	( ) L/s Date ( )	
		2	Name of river/ streams		
			Existing utilization of water source		
			Measured lean discharges (L/S)	( ) L/s Date ( )	
		3	Name of river/ streams		
			Existing utilization of water source		
			Measured lean discharges (L/S)	( ) L/s Date ( )	
		4	Name of river/ streams		
			Existing utilization of water source		
			Measured lean discharges (L/S)	( ) L/s Date ( )	
Farming and Soil					
6	Farming	Existing major crops and area (ha)	(Kharif) : (Rabi) : (Summer) :		
		Expecting major crops and area (ha)	(Kharif) : (Rabi) : (Summer) :		
7	Soil condition	Any Soil problem for agriculture			
		Farm Drainage condition			
Beneficiaries' Information					
8	Existing WUA	Name : (Registration No.)			
		Name : (Registration No.)			
		Name : (Registration No.)			

9 List of Beneficiaries

Name		Village	Owned Land under respective scheme (ha)	Type of Farming	
				Full time	Part time
(1)	(Leader)			☐	☐
(2)	(Sub Leader)			☐	☐
(3)				☐	☐
(4)				☐	☐
(5)				☐	☐

(6)				☐	☐
(7)				☐	☐
(8)				☐	☐
(9)				☐	☐
(10)				☐	☐
(11)				☐	☐
(12)				☐	☐
(13)				☐	☐
(14)				☐	☐
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(18)				☐	☐
(19)				☐	☐
(20)				☐	☐
(21)				☐	☐
(22)				☐	☐
(23)				☐	☐
(24)				☐	☐
(25)				☐	☐

Others			
10	Relevant Existing schemes nearby		(Name) (Year Completion) (Activity) (Implementing Agency) (Total Budget)
			(Name) (Year Completion) (Activity) (Implementing Agency) (Total Budget)
11	History of disaster	Land-slide, including small scale	
		Flooding (Location, frequency, water level)	
12	Impact	Anticipated negative impact	
13	Other Remarks		

Note : Discharge measurement result should be attached

FORM 2-2
DISCHARGE MEASUREMENT RESULT SHEET

Date	
Surveyor	
Measured discharge	Stream Name; ******* (L/S)
Picture	
Location: Coordinates (**********, **********) Location map	

FORM 4-1
EVALUATION CRITERIA AND EVALUATION SHEET

Evaluation Criteria		Aspects to be considered	High (Big)	Middle (Medium)	Low (Small)
			3 points	2 points	1 points
Rationality	Conformity to Existing Plans	(1) Conformity to Master Plan, Regional Agriculture Development Plan or Department 5 years plan	□	□	□
	Conformity to Opinion of Relevant Government Departments and Others	(1) Opinion of Agriculture related department (2) Opinion of VCP	□	□	□
Effectiveness	Characteristic of farmers	(1) Rate of owner farmer (2) Rate of full-time farmer	□	□	□
	Marketability	(1) Access to the market	□	□	□
	Availability of Water Resources	(1) Water discharge in lean period (2) Number of water source and catchment area	□	□	□
Efficiency	Accessibility to Project Site	(1) Road condition from main road to the site (2) Distance from farmer's house to the site	□	□	□
	Government Support	(1) Number and availability of government officer concerned (2) Capacity and attitude of above officers	□	□	□
Impact	Project Scale	(1) Number of beneficiaries (2) Scale of CCA	□	□	□
	Considerable Synergy Effect to Other Projects	(1) Number and scale of on-going, past or future project available in the same village	□	□	□
Sustainability	Cooperation among Applicants	(1) Uniformity of native village of farmer (2) Present cooperative activity	□	□	□
	Positive Impact to the Surrounding Environment	(1) Included new development area (ha) (2) Distance from environmentally sensitive area	□	□	□
		Sub Total Points			
				Total Points	

FORM 6-1
DPR PREPARATORY SURVEY CHECK SHEET

Scheme Name			S/N	
Survey Period		Name of surveyor/Position		

S/N	Items	Content	Yes	Remarks
1	Preparation of base map	· Whether Contour Map is created with GIS?	☐	Map should be attached
		· Existing facilities are traced?	☐	
		· The result of walking survey reflected to the base map?	☐	
		· The land owners and boundaries data are incorporated?	☐	
2	Soil clarification	· Soil samples are collected properly?	☐	
		· Site soil testing is to be conducted.	☐	
3	Potential disaster site survey	· Following survey is conducted ? Disaster survey is to be conducted to clarify existing condition of flooding, erosion and land sliding damaged area and grasp potential risky area. And the result is to be reflected to facility planning and designing. Followings are main target of the Survey - Facility planned area - Along canal candidate alignment - Along existing river, drainage and canal	☐	Map should be attached
4	Topological survey for specific area	· Dam or Pond construction work is planned?	☐	
		Whether area survey is conducted?	☐	
		Whether profile and cross section survey for dam axis is conducted?	☐	
		· Relatively large-scale river diversion weir is planned?	☐	
		Whether river profile survey is conducted?	☐	
		· Gentle slope land canal work is planned?	☐	
		Whether profile and cross section survey is conducted?	☐	
		· Gentle slope Land development is planned?	☐	
		Whether area survey is conducted?	☐	
5	Preparation of layout map	· Whether facility layout map is drafted?	☐	Map should be attached

FORM 6-2
SOIL CLASSIFICATION TEST RESULT FORM

Soil classification test(In-situ) Date

Scheme Name Name of Surveyor

Instruction

1) Visit the survey together with village chairperson and villagers.

Visit the proposed area and choose typical soil in the area with the consultation of the village chairperson and villagers.

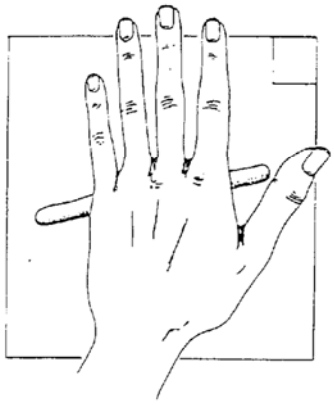
2) Sampling of the soil

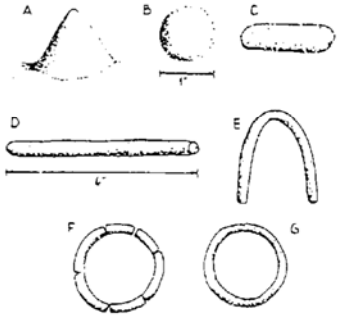
Gather a soil sample from the soil surface (sample should be about 10 x 10 x 10 cm).

3) Knead the soil with water.

Add some water to the soil sample so it is moist but not wet. Knead it well. Pebbles should be removed.

4) Try to create ring shapes with the soil sample and choose the most advanced shape that can be made.





A: Soil can only be shaped into a cone. No other shapes hold together.
B: Soil can be formed into a circle, but not a rod shape.
C: Soil can be formed into a stout rod shape.
D: A thin rod (about 6 mm diameter) can be formed but not bent.
E: Thin rod can be bent without breaking
F: Circle can be formed with some breaks.
G: Complete circle with no breaks can be formed.

5) Evaluate the soil texture

According to the result of 4), circle one of the detailed soil texture types and choose a General soil texture type by conversion of the detailed soil texture type.

Detail soil texture type		conversion	General soil texture type	
Shape A Sand	☐	if you choose Shape A →	Sand	☐
Shape B Loamy sand	☐	if you choose Shape B or C →	Sandy Loam	☐
Shape C Silty Loam	☐			
Shape D Loam	☐	if you choose Shape D or E →	Clay Loam	☐
Shape E Clay Loam	☐			
Shape F Light Clay	☐	if you choose Shape F or G →	Clay	☐
Shape G Heavy Clay	☐			

6) Notable Soil Characteristics

If there are any notable soil characteristics such as high rock outcrop, shallow soil depth and symptom of salt accumulation, please note.

Note:

Note: Picture of the test is to be attached in following page.

FORM 7-1
CURRENT CROPPING PATTERN

Irrigated Paddy Land: Paddy

	Variety	Application	Work	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ranking: Easy-to-cultivate	Ranking: Want-to-cultivate	Ranking: Taste
1)	**IR-64**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 20 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													2	2	1
	Amount of yield 1,000 Kg/Ac	Chemicals (0)%	Harvest															
2)	**Jaya/Gongosh**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 20 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													1	1	3
	Amount of yield 1,500 Kg/Ac	Chemicals (0)%	Harvest															
3)	**Biruan: Buhban**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 20 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													3	3	2
	Amount of yield 800 Kg/Ac	Chemicals (0)%	Harvest															

Irrigated Paddy Land: Horticulture

	Variety	Application	Work	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ranking: Easy-to-cultivate	Ranking: Want-to-cultivate	Ranking: Benefit
1)	**Cabbage / Culiflower**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 0.25 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													4	6	5
	Amount of yield 1,700 Kg/Ac	Chemicals (0)%	Harvest															
2)	**Tomato (Samuruti)**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 0.001 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													4	4	6
	Amount of yield 400-500 Kg/Ac	Chemicals (0)%	Harvest															
3)	**Field Pea**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 52.5 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													1	2	1
	Amount of yield 1,400 Kg/Ac	Chemicals (0)%	Harvest															
4)	**Brinjal (pusa)**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 0.001 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													3	3	4
	Amount of yield 2,000 Kg/Ac	Chemicals (0)%	Harvest															
5)	**Rice bean (rajima)**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 15 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													2	7	7
	Amount of yield 100 Kg/Ac	Chemicals (0)%	Harvest															
6)	**Leafy Mustard (antam)**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 0.25 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													2	1	2
	Amount of yield 0 - 1,000 Kg/Ac	Chemicals (0)%	Harvest															
7)	**String bean (leaf & bean)**	Inorganic Fertiliser (0)%	Land preparation															
	Amount of seed 3 Kg/Ac	Organic Fertiliser (0)%	Sowing/ Planting													2	5	3
	Amount of yield 1,500 Kg /Ac	Chemicals (0)%	Harvest															

Permanent Cropping Land

	Variety	Application	Work	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ranking: Easy-to-cultivate	Ranking: Want-to-cultivate	Ranking: Benefit
1)	**Oil Palm**	Inorganic Fertiliser ( )%	Land preparation															
	Amount of seed 143seedlings/ha	Organic Fertiliser ( )%	Sowing/ Planting													-	-	-
	Amount of yield - Kg/ha	Chemicals ( )%	Harvest					Peak season										
2)	**Areca nut**	Inorganic Fertiliser ( )%	Land preparation															
	Amount of seed - Kg/ha	Organic Fertiliser ( )%	Sowing/ Planting													-	-	-
	Amount of yield 1,600 Kg/ha	Chemicals ( )%	Harvest															

Jhum Cultivation Land

	Variety	Application	Work	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Ranking: Easy-to-cultivate	Ranking: Want-to-cultivate	Ranking: Benefit
1)	**Nil**	Inorganic Fertiliser ( )%	Land preparation															
	Amount of seed _____ kg/Ac	Organic Fertiliser ( )%	Sowing/ Planting			Not cultivating												
	Amount of yield _____ kg/Ac	Chemicals ( )%	Harvest															

Fish

	Variety	Application	Work	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb			
1)	**Fish** (at least 3 species)	Organic Manure ( )%	Pond preparation															
	Amount of fingerings 2,000 no./ha	Inorganic Fertiliser ( )%	Fingerling stocking													-	-	-
	Harvested amount 130 Kg/ha	Lime ( )%	Growing out															
		Fish feed (ND)%	Harvesting															

FORM 7-2
Proposed Cropping Pattern

Agriculture Action Plan (Cropping Pattern)

Name of WUA :

Name of Irrigation Scheme :

No	Name of Crop	Variety	Expected Yield (ton/ha)	Cultivator (nos.)	Cultivated Area (ha)	Necessary Input	Schedule: Mar 1 2 3	Apr 1 2 3	May 1 2 3	Jun 1 2 3	Jul 1 2 3	Aug 1 2 3	Sep 1 2 3	Oct 1 2 3	Nov 1 2 3	Dec 1 2 3	Jan 1 2 3	Feb 1 2 3
							Cultivation Season	Rabi				Kharif					Summer	
Year 2015																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
Year 2016																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
Year 2017																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		

Prepared by :

President of WUA

Vice President of WUA

Approved by :

SDO, IWRD

Agriculture Extension Officer, DOA

Horticulture Extension Officer, DOH

FORM 7-3
AGRICULTURE ACTION PLAN

Agriculture Action Plan (Overall Actions) Name of WUA :

Main Target !! Name of Irrigation Scheme :

No	Action Item	Schedule																						Responsibility	Technical Assisted by
		2015												2016											
		M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
	Cultivation Season	←			Rabi			Kharif			Summer			→	←		Rabi			Kharif			Summer		→
Sub Target 1:																									
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
Sub Target 2 :																									
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									

Prepared by :

President of WUA

Vice President of WUA

Approved by :

SDO, IWRD

Agriculture Extension Officer, DOA

Horticulture Extension Officer, DOH

Fishery Extension Officer, DOF

FORM 9-1

DESIGN CHECK LIST 1, 2, 3

Check List 1 | **Canal**

[First Stage] : Basic Conditions

1. Outline

1.1 Land Use ☐ Paddy ☐Upland ☐ Both

1.2 Type ☐ Open Channel ☐Pipeline ☐ Both

1.3 Canal Type and Dimension

Name	Type	Length (m)	Flow (m3/s)	Slope	Remarks
[Examle] No.1 Canal	*Open Channel*	*1,000*	*0.200*	*1/1,000*	

1.4 Supplementary facilities of Canals

Facilities	Number	Remarks
Divisin works		
Regulating reservoir		
Management Road		
Culvert/Bridge		
Regulator (gate)		
Other ( )		

1.5 Consultation 1.5.1 River ☐ Need ☐ No need 1.5.2 Drinking Water ☐ Need ☐ No need

1.5.3 Other ( ) ☐ Need ☐ No need

2. Basic Conditions

SN.	Items	Contents	Object	Confirmation	Reasons
3	***[Example]*** *Field survey*	*3.1 Whether the pictures are taken.*	☐	☐	*DPR Annexure II*
1	Design purpose	1.1 Whether the purpose is understood.	☐	☐	
		1.2 Whether the scope, quantity, items of design are understood.	☐	☐	
2	Basic design conditions	2.1 Whether the irrigation system is understood.	☐	☐	
		2.2 Whether the intake points are understood.	☐	☐	
		2.3 Whether the water users are grasped.	☐	☐	
		2.4 Whether the consultation items are understood.	☐	☐	
3	Field survey	3.1 Whether the pictures are taken.	☐	☐	
		3.2 Whether the field conditions (topography, soil, landuse etc.) are grasped.	☐	☐	
		3.3 Whether the river and road conditions are grasped.	☐	☐	
		3.4 Whether the points of the planned main faciities are grasped.	☐	☐	
		3.5 Whether the difficulty or issues are grasped.	☐	☐	
		3.6 Whether the important points of the construction are grasped.	☐	☐	
4	Design plan	4.1 Whether the selected canal types are suitable.	☐	☐	
		4.2 Whether the facility layout is suiiable.	☐	☐	
		4.3 Whether the canal standard structure is suitable.	☐	☐	
		4.4 Whether the maintenance is considered.	☐	☐	

Certification

Date : Checked by : (Sub-Divisional Officer) Countersigned by : (Executive Engineer)

Place : Prepared by (Junior Engineer)

Check List 2 | **Canal**

[Middle Stage] : Drawings

1. Detailed Conditions

SN.	Items	Contents	Object	Confirmation	Reasons
3	***[Example]*** *Drawings*	*3.1 Whether the cross drawings are prepared,*	▱	▱	*DPR Chapter 6*
1	Design Plan (supplementary facility)	1.1 Whether the following supplementary facility layout and scale are sutiable.			
		- Division works	☐	☐	
		- Regulator reservoir	☐	☐	
		- Management road	☐	☐	
		- Bridge/Culvert	☐	☐	
		- Regulator (gate)	☐	☐	
		- Other ( )	☐	☐	
2	Hydraulics Calculation	2.1 Whether the formulas and coefficients used in hydraulic calculation are suitable.	☐	☐	
3	Drawings	3.1 Whether the cross drawings are prepared,	☐	☐	
		3.2 Whether the drawings are consistent in hydrauics calculation.	☐	☐	
		3.3 Whether the indication of drawings is appropriate.	☐	☐	
		3.4 Whether the special mention is appropriate.	☐	☐	
4	Construction Plan	4.1 Whether the access road for construction is appropriate.	☐	☐	

Certification

Date : _____ Checked by : (Sub-Divisional Officer) _____

Place : _____ Prepared by: (Junior Engineer) _____

Countersigned by : (Executive Engineer) _____

Check List 3 | **Canal**

[Final Stage] : Quantity and DPR

1. Quantity

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** Quantity	*1.2 Whether the quantity is prepared for each material.*	▱	▱	*DPR Chapter 6*
1	Quantity	1.1 Whether the sizes used in the quantity calculation are consistent in the drawings.	☐	☐	
		1.2 Whether the quantity is prepared for each material and each facility.	☐	☐	

2. DPR

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** *DPR*	*1.1 Whether the table of contents of DPR is based on the "Gidelines of preparation of DPR".*	▱	▱	*DPR Contents*
1	DPR	1.1 Whether the table of contents of DPR is based on the "Gidelines of preparation of DPR".	☐	☐	
		1.2 Whether the reasons of the formulas and coefficients are wrote clearly.	☐	☐	
		1.3 Whether the calculation process are arranged clearly.	☐	☐	

Certification

Date : _____ Checked by : (Sub-Divisional Officer) _____

Place : _____ Prepared by: (Junior Engineer) _____

Countersigned by : (Executive Engineer) _____

Check List 1 | **Diversion Weir**

[First Stage] : Basic Conditions

1. Outline

1.1 Name of Diversion		
1.2 Rive conditions	1.2.1 Gross Catchment Area of the Weir	sq.km
	.12.2 Droughty Water Discharge	cumec
	1.2.3 River Width	m
1.3 Weir	1.3.1 Crest Length	m
	1.3.2 Intake Flow	cumec

1.4 Gates

SN.	Function	Type	Number	Size (m)	
				Height	Width
1	*[Exampe] Intake*	*Slide*	*2*	*0.80*	*0.40*
1					
2					
3					

1.4 Consultation	1.4.1 River	☐ Need ☐ No need	1.4.2 Drinking Water	☐ Need ☐ No need
	1.4.3 Fisheries	☐ Need ☐ No need	1.4.4 Other ( )	☐ Need ☐ No need

2. Basic Conditions

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** *Design Purpose*	*1.1 Whether the purpose is understood.*	▱	▱	*DPR Chapter 4*
1	Design purpose	1.1 Whether the purpose is understood.	☐	☐	
		1.2 Whether the scope, quantity, items of design are understood.	☐	☐	
2	Basic design conditions	2.1 Whether the water users are grasped.	☐	☐	
		2.2 Whether the maximum intake quantity is grasped.	☐	☐	
		2.3 Whether the intake point is understood.	☐	☐	
		2.4 Whether the consultation items are understood.	☐	☐	
3	Field survey	3.1 Whether the pictures are taken.	☐	☐	
		3.2 Whether the flood and scour conditions are grasped.	☐	☐	
		3.3 Whether the both bank conditions of the planned point are grasped.	☐	☐	
		3.4 Whether the road conditions are grasped.	☐	☐	
		3.5 Whether the difficulty or issues are grasped.	☐	☐	
		3.6 Whether the important points of the construction are grasped.	☐	☐	
4	Design plan	4.1 Whether the river flow is steady.	☐	☐	
		4.2 Whether the irrigation water can be certainly taken during the dry season.	☐	☐	
		4.3 Whether the soil inflow does not happen.	☐	☐	
		4.4 Whether the weir structure is staedy and reasonable.	☐	☐	
		4.5 Whether the maintenance is considered.	☐	☐	
		4.6 Whether the scouring measures are considered.	☐	☐	

Certification

Date : _____ Checked by : (Sub-Divisional Officer)

Place : _____ Prepared by: (Junior Engineer)

Countersigned by : (Executive Engineer)

Check List 2 | **Diversion Weir**

[Middle Stage] : Drawings

1. Detailed Conditions

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** *Drawings*	*1.2 Whether the wate rand ground level are shown.*	▱	▱	*DPR Chapter 6 Estimetes & Drawings*
1	Drawings	1.1 Whether the layout and cross and profile drawings are prepared.	☐	☐	
		1.2 Whether the water and ground level are shown.	☐	☐	
		1.3 Whether the indication of the drawings is appropriate.	☐	☐	
		1.4 Whether the special mention is considered.	☐	☐	
2	Construction Plan	2.1 Whether the access road for the construction is appropriate.	☐	☐	
		2.2 Whether the temporary drainage of the river is considered.	☐	☐	

Certification

Date : _____ Checked by : (Msub-Divisional Officer

Place : _____ Prepared by (Junior Engineer)

Countersigned by : (Exective Engineer)

Check List 3 | **Diversion Weir**

[Final Stage] : Quantity and DPR

1. Quantity

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** Quantity	*1.2 Whether the quantity is prepared for each material.*	▱	▱	*DPR Chapter 6*
1	Quantity	1.1 Whether the sizes used in the quantity calculation are consistent in the drawings.	☐	☐	
		1.2 Whether the quantity is prepared for each material and each facility.	☐	☐	

2. DPR

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** *DPR*	*1.1 Whether the table of contents of DPR is based on the "Gidelines of preparation of DPR".*	▱	▱	*DPR Contents*
1	DPR	1.1 Whether the table of contents of DPR is based on the "Gidelines of preparation of DPR".	☐	☐	
		1.2 Whether the reasons of the formulas and coefficients are wrote clearly.	☐	☐	
		1.3 Whether the calculation process are arranged clearly.	☐	☐	

Certification

Date : _____ Checked by : (Sub-Divisional Officer)

Place : _____ Prepared by: (Junior Engineer)

Countersigned by : (Exective Engineer)

Check List 1 | **Pond**

[First Stage] : Basic Conditions

1. Outline

1.1 Purpose ☐ Irrigtion ☐ Fisheries ☐ Other

1.2 Pond Dimension
- 1.2.1 Embankment — Length ____ m — Height ____ m
- 1.2.2 Gross Catchment Area ____ ha
- 1.2.3 Reservoir Volume Approx. ____ cum
- 1.2.4 Command Area ____ ha

1.3 Supplementary Facilities
- 1.3.1 Spillway ☐ Need ☐ No need
- 1.3.2 Intake Facility ☐ Need ☐ No need

1.4 Consultation
- 1.4.1 River ☐ Need ☐ No need
- 1.4.2 Drinking Water ☐ Need ☐ No need
- 1.4.3 Fisheries ☐ Need ☐ No need
- 1.4.4 Other ( ) ☐ Need ☐ No need

2. Basic Conditions

SN.	Items	Contents	Object	Confirmation	Reasons
	[Example]				
3	*Field survey*	*3.1 Whether the pictures are taken.*	▱	▱	*DPR Annexure*
1	Design purpose	1.1 Whether the purpose is understood.	☐	☐	
		1.2 Whether the scope, quantity, items of design are understood.	☐	☐	
2	Basic design conditions	2.1 Whether the water users are grasped.	☐	☐	
		2.2 Whether the gross catchment and command area are grasped.	☐	☐	
		2.3 Whether the layout of the embankment and supplementary facilities are appropriate as topography and irrigation.	☐	☐	
		2.4 Whether the necessity of the emergency discharge is considered.	☐	☐	
		2.5 Whether the cousultation items are understood.	☐	☐	
3	Field survey	3.1 Whether the pictures are taken.	☐	☐	
		3.2 Whether the land use of the plan site is grasped.	☐	☐	
		3.3 Whether the road conditions are grasped.	☐	☐	
		3.4 Whether the difficulty or issues (downstream fisharies etc.) are grasped.	☐	☐	
		3.5 Whether the borrow pit conditions are grasped.	☐	☐	
		3.6 Whether the important points of the construction are grasped.	☐	☐	
4	Design plan	4.1 Whether the embankment layout is sutiable.	☐	☐	
		4.2 Whether the embankment structure is sutiable.	☐	☐	
		4.3 Whether the location and structure of the spillawy are appropriate.	☐	☐	
		4.4 Whether the location and structure of the intake facility are appropriate.	☐	☐	
		4.5 Whether the land acquisition and compensation are confirmed.	☐	☐	
		4.6 Whether the maintenance is considered.	☐	☐	

Certification

Date : ____ Checked by : (Sub-Divisional Officer)

Place : ____ Prepared by (Junior Engineer)

Countersigned by : (Executive Engineer)

Check List 2 **Pond**

[Middle Stage] : Drawings

1. Detailed Conditions

SN.	Items	Contents	Object	Confirmation	Reasons
2	***[Example]*** *Construction Plan*	*2.1 Whether the access road for the construction is appropriate.*	*☐*	*☐*	*DPR Chapter 8*
1	Drawings	1.1 Whether the layout and cross and profile drawings are prepared.	☐	☐	
		1.2 Whether the water and ground level are shown.	☐	☐	
		1.3 Whether the indication of the drawings is appropriate.	☐	☐	
		1.4 Whether the special mention is considered.	☐	☐	
2	Construction Plan	2.1 Whether the access road for the construction is appropriate.	☐	☐	
		2.2 Whether the temporary drainage of the river is considered.	☐	☐	

Certification

Date : _____ Checked by : (Sub-Divisional Officer) _____ Countersigned by : (Executive Engineer) _____

Place : _____ Prepared by (Junior Engineer) _____

Check List 3 **Canal**

[Final Stage] : Quantity and DPR

1. Quantity

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** Quantity	*1.2 Whether the quantity is prepared for each material.*	*☐*	*☐*	*DPR Chapter 6*
1	Quantity	1.1 Whether the sizes used in the quantity calculation are consistent in the drawings.	☐	☐	
		1.2 Whether the quantity is prepared for each material and each facility.	☐	☐	

2. DPR

SN.	Items	Contents	Object	Confirmation	Reasons
1	***[Example]*** *DPR*	*1.1 Whether the table of contents of DPR is based on the "Gidelines of preparation of DPR".*	*☐*	*☐*	*DPR Contents*
1	DPR	1.1 Whether the table of contents of DPR is based on the "Gidelines of preparation of DPR".	☐	☐	
		1.2 Whether the reasons of the formulas and coefficients are wrote clearly.	☐	☐	
		1.3 Whether the calculation process are arranged clearly.	☐	☐	

Certification

Date : _____ Checked by : (Sub-Divisional Engineer) _____ Countersigned by : (Executive Engineer) _____

Place : _____ Prepared by (Junior Engineer) _____

FORM 9-2

O&M PLAN

Operation and Maintenance Plan

1. Outline of WUA

1.1 Name of MIP :

1.2 Name of WUA :

1.3 Location of WUA : Division : Village/Town :

1.4 Command Area :

Command Area (ha)				Beneficiary
Paddy	Upland	Orchard	Total	(household)
[Exampke] *30.0*	*5.0*	*15.0*	*50.0*	*45*

2. List of facilities managed by WUA

SN.	Name of Facilities	Completion Year (Plan)	Outline of Facilities	
			Structure	Dimension
1	*[Example] No.1 Diversion Weir*	*2017*	*Reinforced Concrete*	*Weir L = 10 m*
4	*No.3 Main Canal*	*2019*	*Brick, Cement Lining*	*L = 2,000 m*
1				
2				
3				
4				
5				

3. Operation and Maintenance Plan

[Example]

SN.	Name of Facilities	Items		Implementer	Frequency	Schedule											
						Jan.	Feb.	Mar.	Apr.	May	Jun	Jnl.	Aug.	Sep.	Oct.	Nov.	Dec.
1	*No.1 Diversion Weir*	*Patrol*		*Person in charge*	*Every week*												
		Water management		*Person in charge*	*Every day*												
		Maintenance	*Removing sedimentation soil*	*All beneficiaries*	*Every month*	●	●	●	●	●	●	●	●	●	●	●	●
			Removing weeds	*All beneficiaries*	*4 times per year*			●			●			●			●
		Rehabilitation		*All beneficiaries*	*2 times per year*						●						●
4	*No.3 Main Canal*	*Patrol*		*Person in charge*	*Every week*												
		Water management		*Person in charge*	*Every day*												
		Maintenance	*Removing sedimentation soil*	*All beneficiaries*	*Every month*	●	●	●	●	●	●	●	●	●	●	●	●
			Removing weeds	*All beneficiaries*	*4 times per year*			●			●			●			●
		Rehabilitation		*All beneficiaries*	*2 times per year*						●						●
Crop season						Dry (Rabi)		Summer			Rainy (Kharif)					Dry (Rabi)	

SN.	Name of Facilities	Items		Implementer	Frequency	Schedule											
						Jan.	Feb.	Mar.	Apr.	May	Jun	Jnl.	Aug.	Sep.	Oct.	Nov.	Dec.
1		Patrol															
		Water management															
		Maintenance	Removing sedimentation soil														
			Removing weeds														
		Rehabilitation															
2		Patrol															
		Water management															
		Maintenance	Removing sedimentation soil														
			Removing weeds														
		Rehabilitation															
3		Patrol															
		Water management															
		Maintenance	Removing sedimentation soil														
			Removing weeds														
		Rehabilitation															
4		Patrol															
		Water management															
		Maintenance	Removing sedimentation soil														
			Removing weeds														
		Rehabilitation															
5		Patrol															
		Water management															
		Maintenance	Removing sedimentation soil														
			Removing weeds														
		Rehabilitation															
Crop season						Dry (Rabi)		Summer			Rainy (Kharif)					Dry (Rabi)	

Date: Place:

Checked by: Prepared by: Countersigned by:

(Sub-Divisional Engineer) (Junior Engineer and WUA) (Executive Engineer)

FORM 10-1
STANDARD CONSTRUCTION PLAN FORM

1. Project outline

Name of Project	
IWRD office in charge	
Site location	
Construction budget	
Construction facilities	
Objective of the Project	

2. Management organization

2-1 IWRD supervision team ;

Position	Responsibility

2-2 Safety management;

(1) Contact list

Organization/status	Name	Contact number
Hospital		
Police Post		
Water users organization		
Village council		
Relevant Department		

(2) Safety measures

Description about special safety management, safety measures and facilities, crime and pollution control measures, safety management meeting, safety patrol, inspection, if necessary. General Safety measures should be referred to Contractors agreement Form 8.

3. Temporary work plan

Describe equipment specified in design documents and major temporary facilities (temporary work, diversion drainage, access road), if necessary.

4. Construction plan

4.1 Construction machinery utilization plan:

Machine Name	Specification	Nos	Work to use	Remarks
Excavator				
Concrete Mixer				

4.2 Major materials:

Name of materials	Description	Quantity	Unit	Source of Procurement	Remarks
Cement					
Aggregate					
Sand					
Reinforcement bar					
Brick					
Wood plank					

4.3 Meeting /Inspection plan

Meeting/Inspection	Date	Document to prepare	Attendant	Remarks
Kick off meeting				
Regular meeting				
Regular Inspection				

5. Construction Time Schedule :

Following page Construction Time Schedule chart is used not only for construction plan but also for time schedule controlling works.

****** Project Construction Schedule Plan Chart

Works	Unit	Quantity	Plan Actual	November	December	2nd year January	February	March	April	May	Remarks
1. General											
Preliminary/ Mobilization	L.S	1	Plan								
			Actual								

: Planed Progress : Actual Progress

FORM 10-2
STANDARD QUALITY CONTROL PLAN FORM

1. Target of Quality control works

	Items	Quantity	Unit	Remarks
Construction Facilities				
Documents	- Contact document , BOQ, Drawing, specification - Quality control checklist - Daily site report, site test result - Quality control related pictures - Meeting and inspection materials			

2. Quality control action plan

Name of work	Control items	Control Methodology

Notes;

- Detailed requirements of Quality control should be refer to contact document and PWD technical specification.
- When IWRD conducts inspection works for payment, WUA is also recommend to participate in inspection works for witnesses.
- After construction work, IWRD is to prepare as built drawings based on alteration of construction works.
- Above Quality control related documents are to be filed and kept in division office as evidence of the works after construction.

FORM 11-1
B/C CALCULATION SHEET

1. Total Estimated cost of the Project (lakhs)

2. Total cost of the headworks

a1. Diversion weir (1 nos.)			(lakhs)
a2. Intake (1 nos.)			(lakhs)
a3. Desiltaion tank (1 nos.)			(lakhs)
	Total headwaorks	0.0	(lakhs)

3. GCA (ha)

4. CCA (ha)

SN	Description	Pre-Project (lakhs)	Post-Project (lakhs)
1	a. Gross Receipts Gross annual receipts (estimated value of farm produce)		
	b. Expenses (Cost of Production)		
	c. Net Value of Farm Produce (a.-b.)	0.00	0.00
2	d1. Estimated Annual Benefits after Project Completion (Post benefits - Pre benefits)	-	0.00
3	Annual Cost		
	d2. Interest on capital @ 10% of total cost of the project	-	0.00
	e. Depreciation of the project @ 4% of the project cost	-	0.00
	f. Annual operation & maintenance const @ Rs 1,175.00 per ha of CCA	-	0.00
	g. Maintenance cost of head works @ 1% of cost of head works	-	0.00
	h. Total Annual Cost (Σ d2.～g.)	-	0.00
	i. Benefit Cost Ratio (d1./h.)	-	
	j. Potenrial to be Created (ha)		
	k. Total Project Cost per Hectare (1./4.)		

FORM 12-1
MINUTE OF RATIFICATION MEETING

Minute of Ratification Meeting Laului Minor Irrigation Scheme

(Draft)

The ratification meeting on **Laului Minor Irrigation Scheme** was held on 4th December, 2014 discussing the contents of DPR prepared by MID and other stakeholders based on the result of the workshop held from 8th to 10th October, 2014.
Each party have clearly understand the contents of the DPR and mutually agreed the followings if the DPR is sanctioned.

MID

- Making necessary effort for sanctioning the respective Laului Minor Irrigation Scheme implementation.
- Construct and/or rehabilitate the facilities based on the prepared DPR with sanctioning budget.
- Giving the necessary support to WUA for proper operation and maintenance of the facilities based on prepared O&M plan.

WUA

- Cooperate with MID and provide necessary support during and after construction works
- Utilizing the facilities effectively based on the prepared crop calendar and agriculture action plan
- Taking over the facilities from MID and operates and maintains the facilities in accordance with O&M plan for 25 years after construction and/or rehabilitation of the facilities

Other Government Departments and Stakeholders

- Giving follow-up activities which are stipulated in the agriculture action plan, like extension services.
- Strengthening mutual cooperation with MID and WUA for further necessary actions for effective utilization of the respective Laului Minor Irrigation Scheme, if required.

The President of WUA
Laului Minor Irrigation Project (MS. DAWNGLIANA)
Chairman
Lauphai User Association
Sailam, Mizoram

Executive Engineer
Aizawl Irrigation Division

District Agriculture Officer
Aizawl District
(Dr. H. SAITHANTLUANGA)
District Agriculture Officer
Aizawl District, Aizawl

District Horticulture Officer
Aizawl District
(LALTHLAMUANA)
Divisional Horticulture Officer
Aizawl Division Aizawl.

Witness:
VCP, Sailam Village (LALTHANSANGA)
Secretary
Village Council/Court
Sailam, Aizawl District

List of Reference

REFERENCE 5-1

NECESSARY TOOLS AND MATERIALS FOR WUA ESTABLISHMENT WORKSHOP

(All listed items are available in Mizoram)

No.	Description of Items	Spec.	Unit	No	Remarks
1	Flip Paper (Chart paper / Newsprint paper)	white	no.	20	Using for presentation etc.: Do not purchase expensive one, and select paper, available even in local shop
2	Do.	yellow	no.	4	
3	Do.	Pink	no.	4	
4	Do.	red	no.	4	
5	Do.	Green	no.	4	
6	Do.	**Total**		36	
7	Typing paper (A-4)	-	bundle	0.25	for making draft, calculation, memo etc.
8	Felt-tip pen (sketch pen)	set	no.	3 - 5	Locally available sketch pen is the most suitable.
9	Marker Pen (permanent)	Red	no.	1	not absolutely necessary
10	Do.	Black	no.	1	
11	Do.	Blue	no.	1	
12	Masking paper (white colour)	off-white	roll	1	
13	Hard Paper for Name Card	(A-3)	no.	5	with pin
14	Plastic rope or stringto fix Flip paper with clip	1	roll	1	Thick and strong string is better
15	Field book	-		30	Provide only for the first occasion
16	Ball-point pen (blue or black)	-	no.	30	Provide only for the first occasion
17	Carbon paper	Blue	sheet	5	to make copy
Other Equipment					
1	Display Easels	-	no.	1	if it is available
2	Projector to show Power-Point Doc.	-	no.	1	
3	Speaker for Projector / Computer	-	no.	1	
4	Extension code for electricity	5	meter	3	
5	Generator for Projector	1 KVA	no.	1	
Note: Name of paper and size in India					
1)	Bristol Board (572mm x 724mm)				
2)	Double Demy (572mm x 889mm)				
3)	Quad Demy (889mm x 1143mm)				
4)	News print paper is cheap and easy to handle				

REFERENCE 5-2

SAMPLE AGENDA AND TIME SCHEDULE FOR ESTABLISHMENT OF WUA

Session -1

1. Introduction of the day's agenda and objective 09:00 - 09:15
2. Introduction of participants 09:15 - 09:35
3. Introduction of workshop 09:40 - 10:00
   - Explanation of agenda & goal
   - Preparation of ground rules etc.
4. Introduction about present WUA 10:00 - 10:30
   - Explain according to given items
5. Comments on present WUA activities (refer to Action Plan) 10:30 - 10:45
6. Break 10:45 - 11:00
7. **Video showing**(*need Electricity / Generator) 11:05 - 11:45
8. Free Discussion about Video 11:45 - 12:10
9. Introduction of CBO development concept & Discussion 12:10 - 12:40
10. Lunch (snack) 12:40 - 13:40

Session – 2

11. Game or sing a song for refreshment 13:40 - 13:55
12. Preparation of WUA's vision and objectives 13:55 - 14:25
    - Group Discussion: ' What is vision / objective and tasks/functions of our WUA'?
    - Presentation by each group about 'Our WUA' refer to Vision & Objectives
13. Preparation of rules and regulation of WUA 14:25 - 15:50
    - Introducing necessary items for preparation of WUA's rules and regulation (by-law)
    - Preparation of draft rules and regulation based on a model documentation of WUA by-law
    - Presentation of draft rules and regulation
    - Finalization of the draft rules and regulation
14. Tea break 15:50 - 16:05
15. Implement Model General / Committee meeting by WUA 16:05 - 17:15
    - Selection of Committee member and Office-bearers if necessary.
    - Express each one's wishes as office-bearer
    - ***Assent and seconded WUA's vision and tasks, draft rules & regulation**, etc.
    - Hand over necessary document to IWRD for the next step.
16. Wrap-up & Closing session 17:15 - 17:45

REFERENCE 5-3
LIST OF DOCUMENT NECESSARY FOR WUA MANAGEMENT

I	**General**
1.	Registry of WUA
2.	Rules and Regulation
3.	WUA Members Information List with Land-use Map
II	**For Accounting and management**
1.	Receipt Book
2.	Cash book
3.	Petty Cash a/c
4.	Asset Register
5.	Invoice Book
6.	Requisition Book
7.	Order Book
8.	Bank Account Details
III	**Other Management (Reporting / Recording / Schedule)**
1.	Farmers Demand for Water Register and Irrigation Schedule
2.	Minutes book
3.	Financial Report
4.	Financial Audit
5.	Crop area record book
6.	Register of members' fee due and paid

REFERENCE 5-4
REFERENCE OF WUA RULES AND REGULATION

【SAMPLE】

1. Area of Operation and WUA's Vision

The area of operation of a WUA will be the area served by XX.
The Vision of WUA shared among members is; ----------

2. Formation of WUA

The following persons shall be eligible for the membership of a WUA:

1) All the shareholders of Irrigation XX as per approved Current System under Section of ZZ Act, 202X.
2) Actual owner or his/her representative of the owner of land located within the jurisdiction of a WUA.
3) XXX Engineer of YYY Irrigation & Water Resources Department as an ex-officio member, without any voting right.

3. The other conditions for membership are;

1) That the person should be- (i) major, (ii) having sound mind and (iii) is not insolvent.
2) In case the Board of Committee or the General Body / Meeting refuses to admit an otherwise eligible person, it shall record the reasons and communicate to the person.
3) Such a person can appeal to the Divisional Office within XX week of communication of such decision and the decision of the Divisional Office will be a binding on the society.

4. Aims and Objectives of Water User's Association

The main aims of the WUA shall be as under:

1) Equitable and uniform distribution of available canal water among all users on the basis of approved Current System under Section YY of the ZZ Irrigation Act, 202X.
2) Adequate operation & maintenance of watercourses and keep it in running condition by clearance of the silt & vegetation etc.
3) Ensure efficient and economical use of irrigation water.
4) Agriculture Action Plan to decide type of crop & Cropping Pattern for optimum utilization of available water.
5) Activities for the welfare of all the users / members.
6) Protection of environment and ecological balance by involving shareholders in implementation of water budget and operational plan.

5. Functions of WUA

The WUA will have following functions in general:

1) Help prepare Current System under section XX of XX Irrigation Act, 202X and implement the approved Water Schedule for each cultivation season.
2) Prepare an action plan for O&M of irrigation system and carry out work as per plan.
3) Regulate supply of canal water among shareholders economically.
4) Assist in various activities like maintenance charges assessment (booking), raising of maintenance charges and collection etc.
5) Maintain a register of landowners as per the revenue record and also keep record of tenants.
6) Maintain an inventory of the irrigation system within the area of operation.
7) Generate resources and maintain accounts of WUA.
8) Get annual audit of the accounts and report.
9) Assist in the conduct of elections to the Board of Committee.
10) Settle conflict among shareholders amicably.
11) Keep close liaison with the XX Division of Irrigation & Water Resources Department for technical assistance and other necessary assistance.
12) Conduct General meetings as scheduled.
13) Arrange agricultural extension programs / training etc. to determine the most suitable crop for the area and marketing etc.

14) Conduct water budgeting and crop budgeting with the help of DOA, DOH and IWRD.

6. General Body / General Meeting

The General Body / Meeting of a WUA will consist of the members as detailed above. The powers and functions of the General Body will be as under;

1) The General Body / Meeting will elect a Board of Committee by ballot, which will perform essential functions of the WUA.
2) It may suspend or remove the elected members of the Managing Committee.
3) It will have minimum two meetings in a year, one before each cultivation season.
4) The meeting can also be convened at the request of at least one third of total members.
5) The meeting will be convened with a clear notice of seven days by the manner prescribed under rules.
6) It will approve the program of the WUA for each year with a clear agenda of improving irrigation efficiency.
7) The General Body / Meeting will be the final authority in finalizing the yearly budget and accounts, as submitted by the Board of Committee.

7. Model Guidelines for formation

Water User's Association

1) It will take all major decisions for fulfilment of the objectives and for betterment of the shareholders of the WUA.
2) It will authorize its elected President (to execute MOU with the Government).
3) It may amend bylaws.

Managing Committee

Constitution

1) The Board of Committee shall consist of XX members or as fixed by the General Body / Meeting and will be duly democratically elected by the General Body / Meeting of WUA.
2) The term of the members of Board of Committee will be YY year(s) and fresh elections will be held on completion of term.
3) It will elect its President, Vice-President, Secretary, Asst. Secretary, Treasurer, Financial Secretary and other functionaries as per requirement.
4) If one-third members desire not to serve the as members of Board of Committee, elections for the same shall be held by calling the meeting of General Body / Meeting.
5) If less than one-third members resign, the Board of Committee will co-opt the members of the same area.
6) If more than half members resign, fresh elections for the Board of Committee shall be held.
7) No person shall be eligible for election as a member of the Board of Committee if he/she is;
    - Paid employee of the society.
    - Of unsound mind.
    - Defaulter under XX Irrigation Act, 202X.
    - Held any place of profit under the society/outlet society.

Duties

1) It will observe all the rules laid down in the by-laws, adopted by the General Body / Meeting.
2) It will perform all activities to fulfil the objectives of the WUA as laid down in the adopted by-laws.
3) It will manage the entire finances of the WUA as per the adopted by-laws.
4) It will maintain true and accurate account of funds received and spent.
5) It will keep a register of members correct and up to date.
6) It will summon General Body Meeting as per by-laws.
7) It will meet monthly or earlier, if required earlier to discuss the affairs of the WUA.
8) It will discuss and finalize operation and maintenance plan, action taken and action to be taken to fulfil the objectives of the WUA.
9) It will carry out beneficial schemes as prepared by the State Govt. from time to time.

Funds

The WUA may raise funds for its functions and other activities such as group loan etc.

1) Voluntary deposits from its members.
2) Contributions in emergency.
3) Budget grant from the Govt. and other financial assistance from the Govt.
4) Any savings from the works / contract undertaken by the WUA.
5) Resources raised from other financing agency for undertaking any economic development activities in the area.
6) Money received from any other source.

Management of funds

1) All the capital investment of WUA will be in long term fixed deposits, with instructions to deposit the interest in the savings account every XX month(s).
2) The WUA will deposit its operative funds in a savings account in the approved Bank.
3) The savings account will be operated jointly by the treasurer and any other member, nominated by the Board of Committee.
4) The Board of Committee can spend Rs.XXX/= at one time subjected to a maximum of Rs.YYY/= in one year without obtaining prior formal technical/administrative sanction from the competent authority in XXX IWRD.
5) Only such amount should be drawn from the savings account (operational fund), which is required to cover running expenses for approved work. The maximum cash in hand be restricted to Rs.ZZZ/=.

Default in payment

If a shareholder fails to pay his share as fixed by the WUA and it remains unpaid for XX month(s), penalty as deemed appropriate by the WUA will be imposed.

Financial Year

The financial year of the WUA shall be from X month to Y month. The accounts should be audited and placed in the General Body Meeting.

Winding Up

In case the society has to be wound up, the property and funds remaining after discharge of liability shall be transferred to XXX Department, which is already engaged in similar activities. Further, if the WUA is dissolved on the request of the General Body / Meeting or IWRD, the funds shall be returned to the same authority from where these were collected.

Miscellaneous

1) The services of the members of the Board of Committee shall be honorary.
2) Any person employed by the WUA shall be appointed with the approval of the General Body / Meeting & pay, allowances, terms of services shall be decided by the General Body / Meeting and such a person shall work under the guidance of the Managing Committee / Meeting of the WUA.
3) Once a year a list giving details of the members of the Board of Committee of the WUA shall be filed in the month of January with the Registrar of Firms and Societies.
4) The movable and immovable property of the WUA shall be deemed to be vested in the Board of Committee of the WUA and in all proceedings of the civil & criminal may be described as the property of the WUA by its proper title.
5) The society may sue or may be sued in the name of the President, Secretary or Treasurer, Financial Secretary or any other member as determined by the General Body / Meeting.
6) In the normal course, the Secretary of the society may sue or be sued.

REFERENCE 7-1

Sample Agenda and Time Schedule for Agriculture Action Planning

DAY 1st

Session -1

1. Welcome & Key-note Speech by IWRD & others 09:00 - 09:20
2. Introduction of participants 09:20 - 09:40
3. Introduction of workshop 09:40 - 10:00
   - Explanation of agenda & goal
   - Preparation of ground rules etc.
4. Forming Group (if necessary) 10:00 - 10:10
   - Nominating Group Leader and Assistant (if necessary)
5. Preparation of **Current Cropping Pattern**/ Resources Maps & Lists 10:10 - 11:30
   - Current Cropping Pattern: Irrigated Paddy Land (paddy & horticulture), Permanent Cropping Land, Jhum Cultivation (paddy & other crop):
6. Problem Analysis 11:30 - 12:30
   - Prioritization of problems
   - Presentation and discussion with resources persons
   - Make clear core problems and share them among participants
7. Lunch 12:30 - 13:30

Session -2

8. Game or sing a song for refreshment 13:30 - 14:00
9. Review last activities and explain this session's activity & goal 14:00 - 14:20
10. Preparation of Proposed Cropping Pattern 14:20 - 15:30
    - Review area map, resources map, list & **priority issues**
    - Review current cropping pattern
    - Explanation of **present irrigation system & improvement plan** etc.
    - Receiving information from DOA / DOH / DOF, **Market price** etc.
    - Checking up suitable crop in the area from soil, pH, technology, etc.

    Finalization of Strategic crops & Prepare Draft Proposed Cropping Pattern
11. Tea break 15:30 - 15:45
12. Presentation of Draft Proposed Cropping Pattern 15:45 - 16:45
    - **Receiving comments from resources person**
    - Taking final confirmation among farmers
    - Finalization of Proposed Cropping Pattern
13. Wrap-up & Closing session 16:45 - 17:00

DAY 2nd

Session -1

1. Introduction of the day's agenda and objective 09:00 - 09:15
2. Review last day's work 09:15 - 09:40
3. Preparation of Agriculture Action Plan 09:40 - 11:00
   - Review of priority problem list & resources list etc. of the previous day
   - Prepare draft Action Plan by group through discussion
   - Presentation of the draft Action Plan
   - Discussion with relevant departments and make clear all issues concern to the draft Action Plan
4. Tea break 11:00 - 11:15
5. Finalization of Agriculture Action Plan 11:15 - 12:00
   - Receiving practical ideas from relevant departments
6. Lunch 12:00 - 13:00

Session -2

7. Presentation of Agriculture Action plan 13:00 - 13:45
   - **Receiving comments** from relevant resources persons
8. Finalize set of document for the Agriculture Action Plan for each relevant departments and signed each other, and submit them 13:45 - 14:30
9. Wrap-up & Closing session 14:30 - 15:00

REFERENCE 7-2

REFERENCE FOR CROP SELECTION

The selection of crops is one of the key elements to prepare a proper cropping pattern, meanwhile most of the farmers have difficulty accessing to the necessary information. In the DPR workshops, basic information was provided by the JICA study team as mentioned below. It is required that concerned departments of the state government revise such information appropriately to meet the needs of farmers.

1. Classification of Crops

It is important to select appropriate crops based on a thorough examination of the water condition and availability, the level of farmers' skills, the profitability, and the risks of cultivation. The classification of crops under each condition is shown in the table below.

Crop	Water require-ment	Level of farming skills	Profit-ability	Risks/ Remarks
Leaf Mustard	Middle	Low	Mid	Use labour intensively for harvesting & bundling/ Replant failure
Cabbage	High	Mid	Mid	Insect damage/ High transportation cost/ Price fluctuation/ Replant failure
Cowpea	Low	Low	Low	Low-temperature damage/ Use labour intensively for harvesting
Lady's finger	Middle	Mid	Mid	Low-temperature damage
French bean	Low	Low	Low	Acidic soil damage / Replant failure
Maize	Middle	Mid	Mid	High demand for nutrients/ Insect damage
Field pea	Low	Low	Mid	Acidic soil damage/ / Replant failure/ Use labour intensively for harvesting
Chilly	Low	Mid	Mid	Low-temperature damage/ Replant failure
Brinjal	Low	Mid	Mid	Low-temperature damage/ Replant failure
Tomato	Low	High	High	Replant failure/ High transportation cost/ Postharvest loss (spoil quickly)
Onion	Low	Mid	Mid	Acidic soil damage/ High transportation cost
Broccoli	Low	High	High	Difficult to access market channels/ Postharvest loss (spoil quickly)/ Replant failure
Cauliflower	Low	High	High	Difficult to access market channels/ Postharvest loss (spoil quickly)/ Replant failure
Knol-khol	High	High	High	Difficult to access market channels/ Postharvest loss (spoil quickly)/ Replant failure
Lettuce	Middle	High	High	Difficult to access market channels/ Postharvest loss (spoil quickly)/ Acidic soil damage/ Replant failure
Potato	Middle	Mid	Mid	High transportation cost/ Difficult to procure seed potato
Table beet	Middle	High	Mid	High transportation cost/ Uncertainty of market demand
Coriander	Low	Mid	Mid	Difficult to access market channels/ Postharvest loss (spoil quickly)/ Use labour intensively for harvesting

Note 1: Profitability is estimated by (Average Yield) x (Market Price)
Note 2: If a hybrid variety is selected; higher profitability is expected, meanwhile, very high level of farming skills and high input cost are required.

2. Remarkable Points for Sales of Products

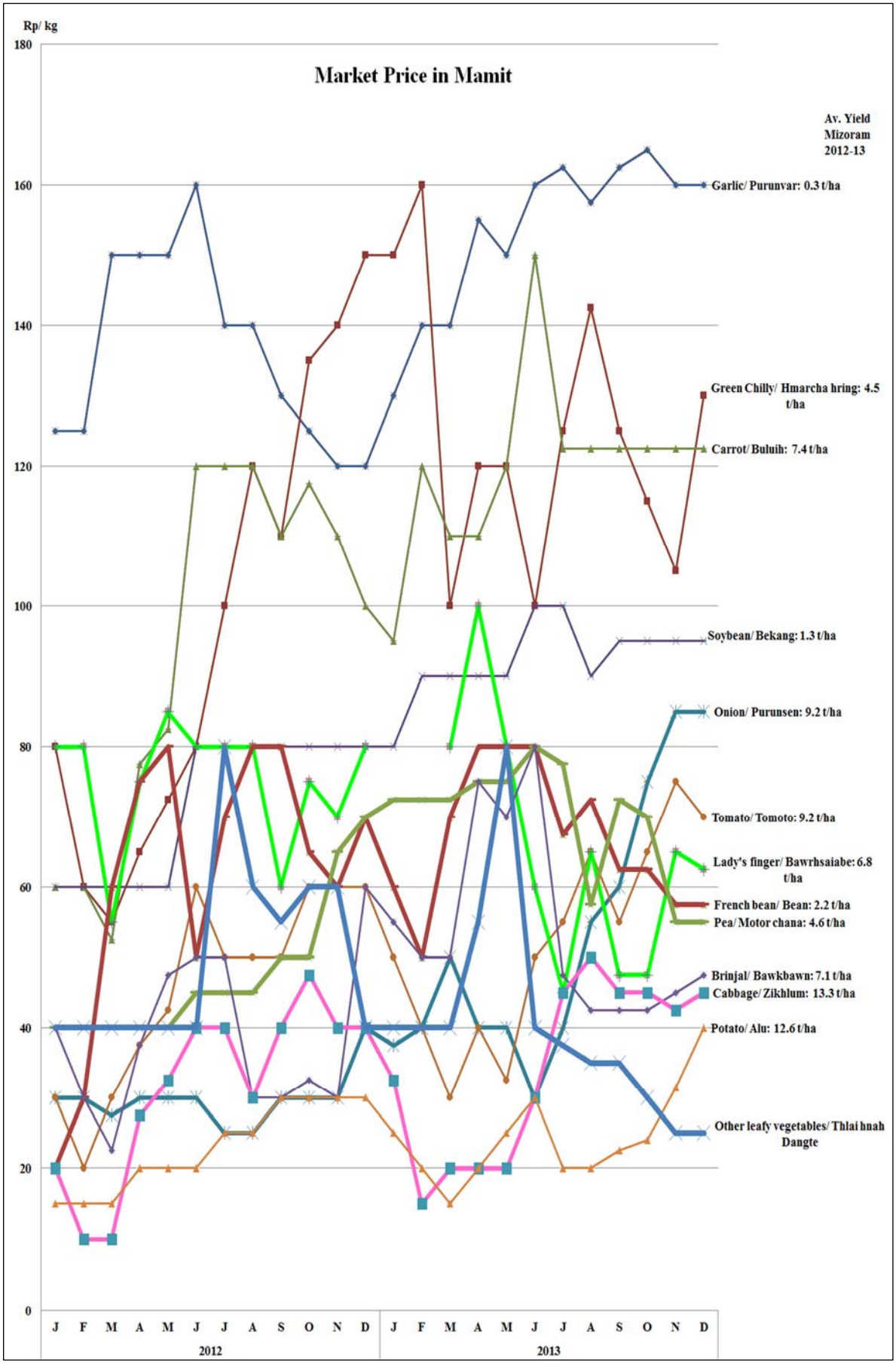
It is important to take into account of not only the production condition but also the sales environment in order to select appropriate crops. Furthermore, diversification of sales channels contributes to the improvement of profit and the reduction of risks. Remarkable points for sales are shown in the table

below.

To whom/ *Tu hnenah*	Where/ *Hralhna hmun*	Sales price/ *Hralhna man*	Sales volume/ *A tam zawng*	Cost & time of Transportation & packaging/ *Thlai phurhna leh dahna a senso*	Skills for selling/ *Zuar tur a thiamna neih*
Trader/ *Sumdawng*	Pickup point/ *Lak khawmna*	Low/ *Tlawm*	As much as you want/ *Duh zah zah*	Very low/ *Tam lo*	Very low/ *Hniam tak*
Wholesaler & Retailer/ *Zuar chhawngtu*	Market in Town/ *Bazarah*	Middle/ *Pangai*	Negotiation/ *Inbiakremna*	Low to middle/ *A laihawl*	High/ *Sang*
Neighbours / *Thenawmte*	Town or Village/ *Khaw chhungah leh veng chhungah*	Low to middle/ *Tlawm atanga pangai*	Small/ *Tlem*	Low/ *Tlem*	Low/ *Hniam*
Produce stand/ *Thutpuitute*	Roadside/ *Kawngsirah*	High/ *To*	Dependent on your effort/ *Mimal theihna azirin*	Low to middle/ *A laihawl*	High/ *Sang*
Farmers' Organisation/ *Kuthnathawktute pawl*	Collection centre/ *Lak khawmna hmunah*	Middle to high/ *Pangai atanga to*	Dependent on organisation's capacity/ *Pawl ina a theih tawk*	Middle/ *A laihawl*	Middle/ *Pangai*
Customer directly/ *Dawr tu te*	Each customer's house/ *Dawr tut e inah*	Very high/ *To lutuk*	Dependent on your effort/ *Mimal theihna azirin*	Very high/ *Tam lutuk*	Very high/ *Sang lutuk*

3. Trends in Market Price and Crop Yield

Since the price of crops fluctuates a lot, it is necessary to collect the market information to obtain a reasonable benefit. The crop selection with a market-oriented approach provides more benefit to the farmers. The benefit is calculated by multiplying the volume of product by the unit price, therefore the selection of crops is also needed to concern the balance between the crop yield and the sales price. The trends of market price in the seven towns are shown in the figures below.


Rp/ kg
Market Price in Mamit
Av. Yield Mizoram 2012-13
Garlic/ Purunvar: 0.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
Carrot/ Buluih: 7.4 t/ha
Soybean/ Bekang: 1.3 t/ha
Onion/ Purunsen: 9.2 t/ha
Tomato/ Tomoto: 9.2 t/ha
Lady's finger/ Bawrhsaiabe: 6.8 t/ha
French bean/ Bean: 2.2 t/ha
Pea/ Motor chana: 4.6 t/ha
Brinjal/ Bawkbawn: 7.1 t/ha
Cabbage/ Zikhlum: 13.3 t/ha
Potato/ Alu: 12.6 t/ha
Other leafy vegetables/ Thlai hnah Dangte
180
160
140
120
100
80
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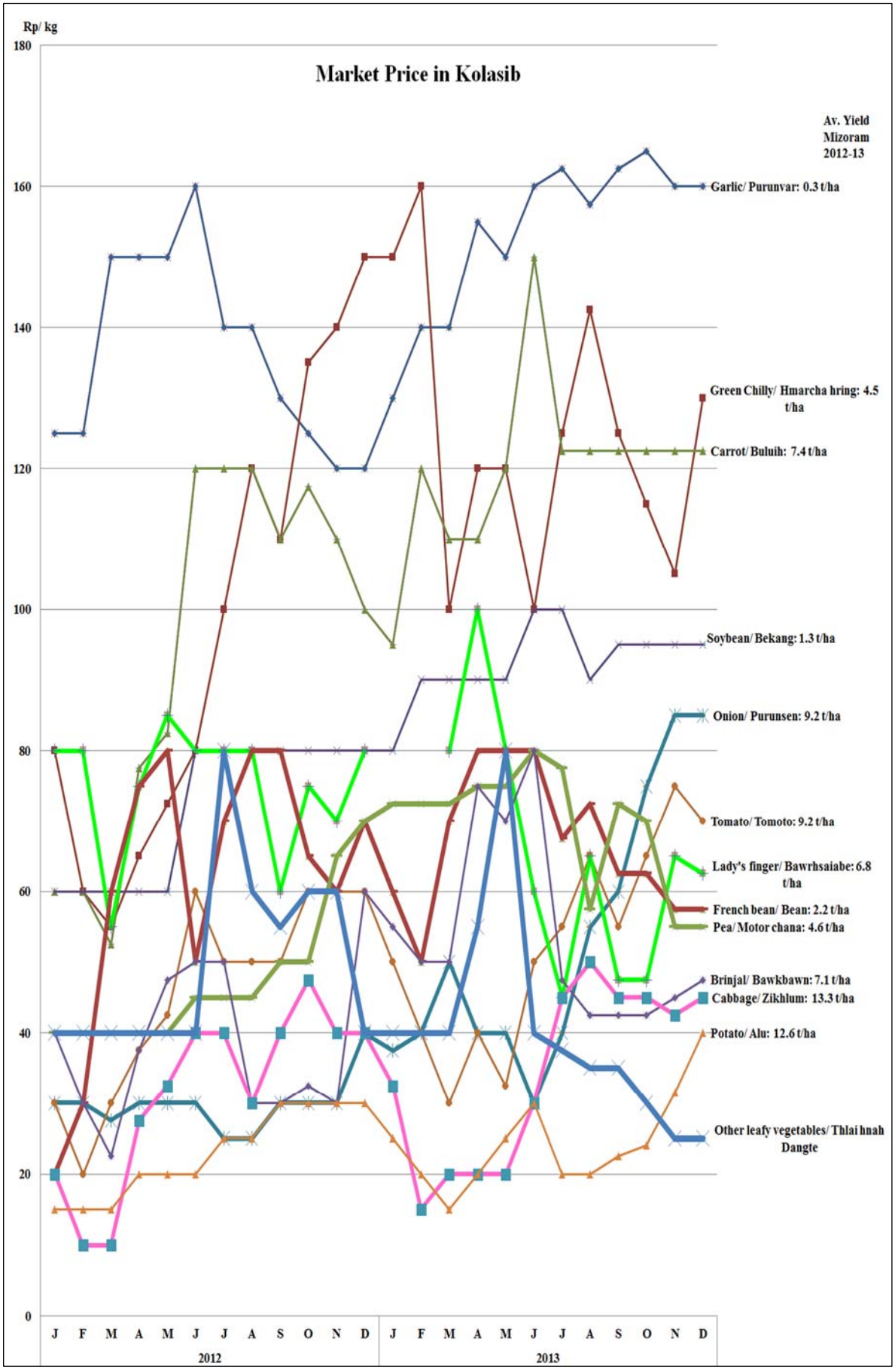
40
20
0
J F M A M J J A S O N D
2012
J F M A M J J A S O N D
2013


Rp/ kg
Market Price in Kolasib
Av. Yield
Mizoram
2012-13
Garlic/ Purunvar: 0.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
Carrot/ Buluih: 7.4 t/ha
Soybean/ Bekang: 1.3 t/ha
Onion/ Purunsen: 9.2 t/ha
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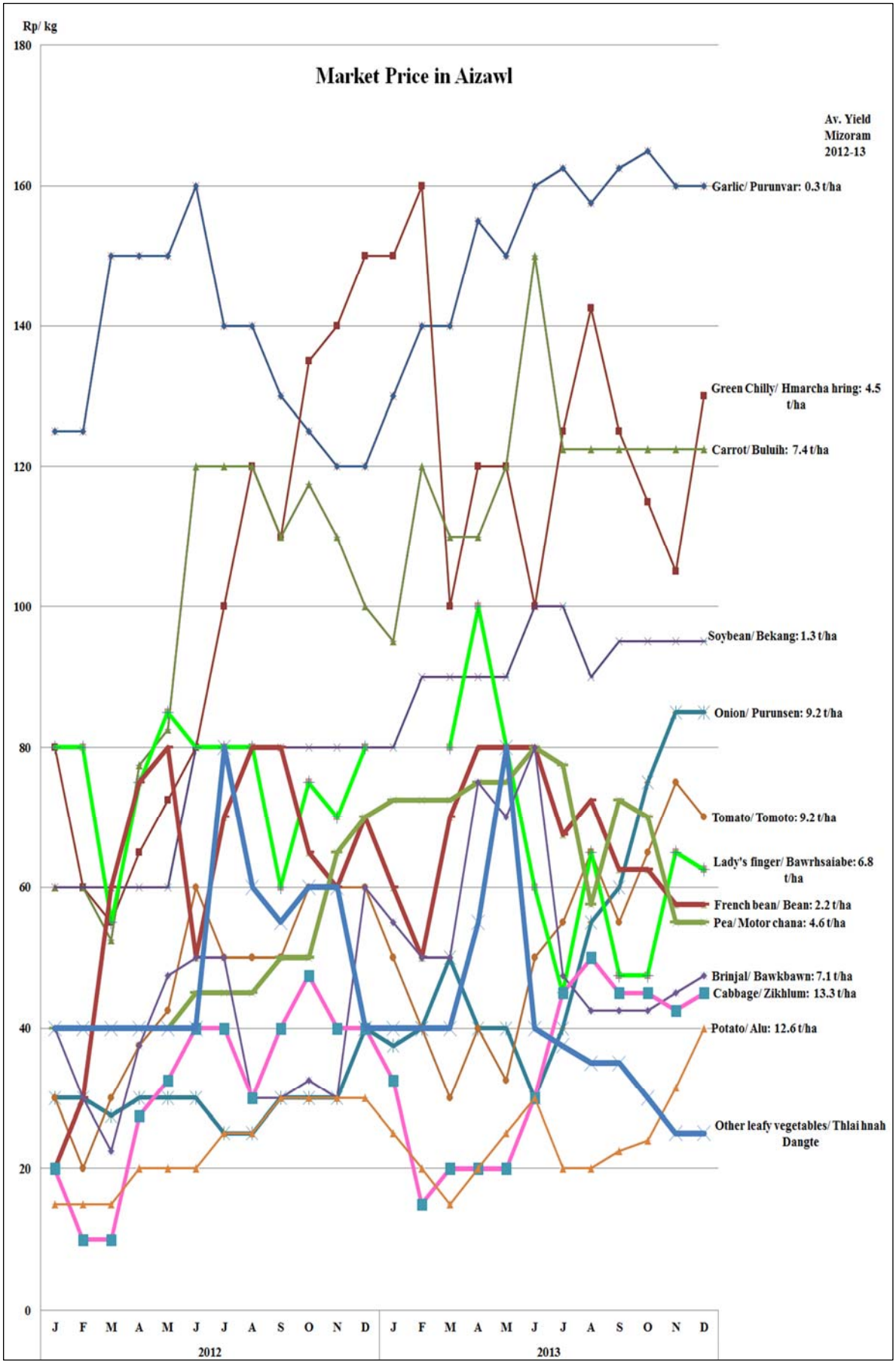
Rp/ kg
Market Price in Aizawl
Av. Yield
Mizoram
2012-13
Garlic/ Purunvar: 0.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
Carrot/ Buluih: 7.4 t/ha
Soybean/ Bekang: 1.3 t/ha
Onion/ Purunsen: 9.2 t/ha
Tomato/ Tomoto: 9.2 t/ha
Lady's finger/ Bawrhsaiabe: 6.8 t/ha
French bean/ Bean: 2.2 t/ha
Pea/ Motor chana: 4.6 t/ha
Brinjal/ Bawkbawn: 7.1 t/ha
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Potato/ Alu: 12.6 t/ha
Other leafy vegetables/ Thlai hnah Dangte
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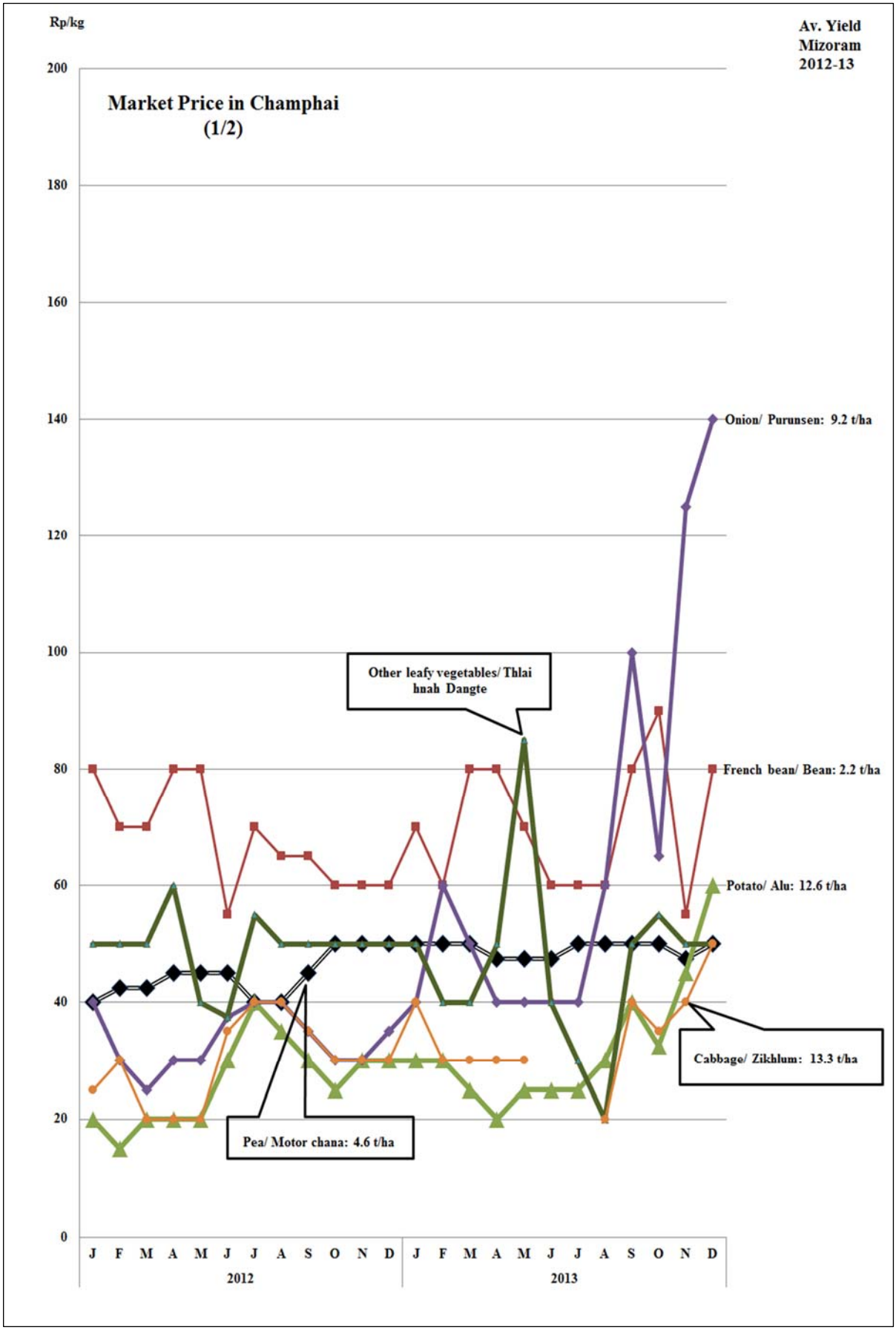
J F M A M J J A S O N D
2012
J F M A M J J A S O N D
2013


Rp/kg
Av. Yield
Mizoram
2012-13
Market Price in Champhai
(1/2)
200
180
160
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100
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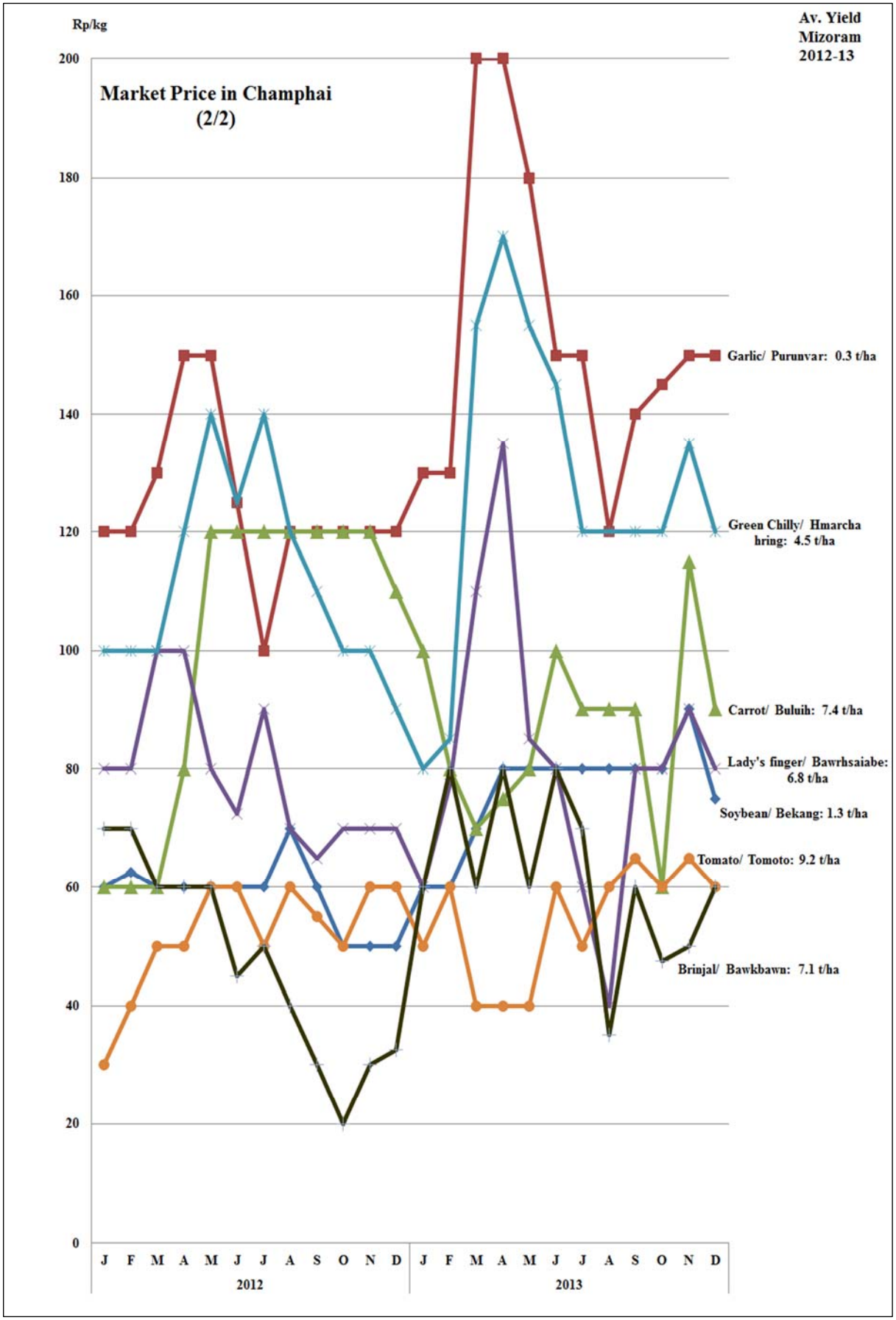
Onion/ Purunsen: 9.2 t/ha
Other leafy vegetables/ Thlai hnah Dangte
French bean/ Bean: 2.2 t/ha
Potato/ Alu: 12.6 t/ha
Cabbage/ Zikhlum: 13.3 t/ha
Pea/ Motor chana: 4.6 t/ha
J F M A M J J A S O N D
2012
J F M A M J J A S O N D
2013


Rp/kg
Av. Yield
Mizoram
2012-13
Market Price in Champhai
(2/2)
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140
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100
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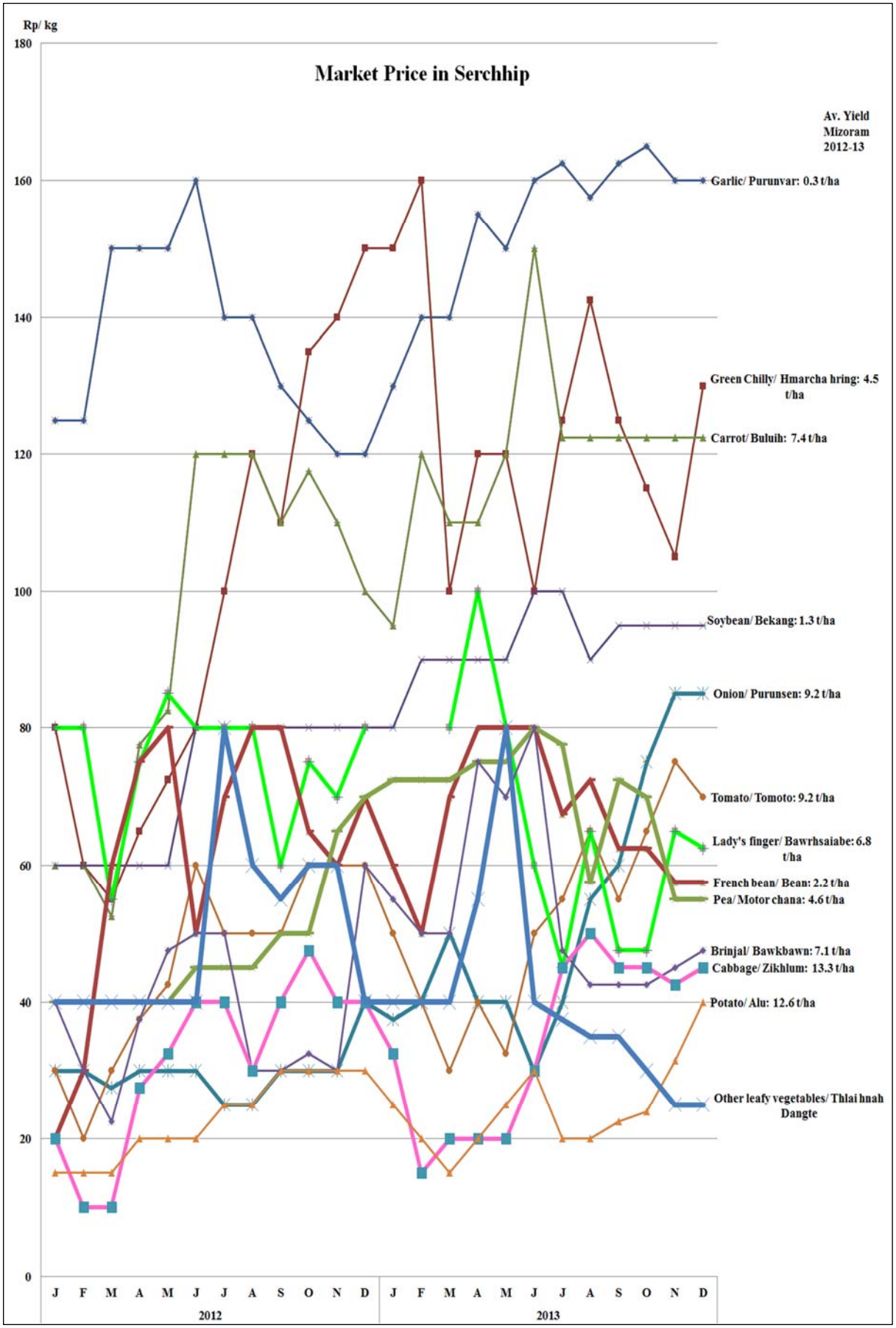
Garlic/ Purunvar: 0.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
Carrot/ Buluih: 7.4 t/ha
Lady's finger/ Bawrhsaiabe: 6.8 t/ha
Soybean/ Bekang: 1.3 t/ha
Tomato/ Tomoto: 9.2 t/ha
Brinjal/ Bawkbawn: 7.1 t/ha
J F M A M J J A S O N D J F M A M J J A S O N D
2012
2013


Rp/ kg
Market Price in Serchhip
Av. Yield Mizoram 2012-13
Garlic/ Purunvar: 0.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
Carrot/ Buluih: 7.4 t/ha
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Other leafy vegetables/ Thlai hnah Dangte
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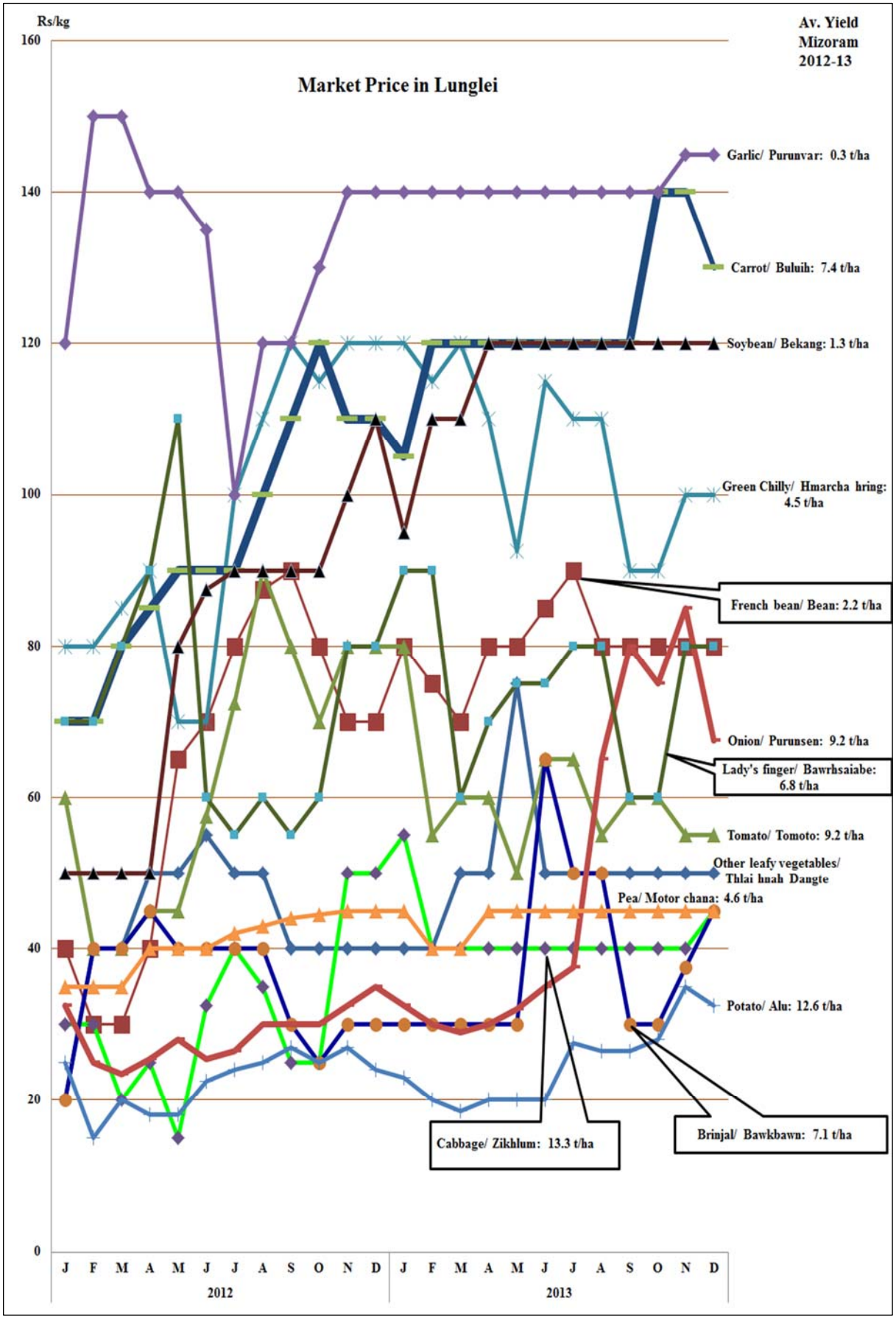
Rs/kg
Av. Yield
Mizoram
2012-13
Market Price in Lunglei
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0
Garlic/ Purunvar: 0.3 t/ha
Carrot/ Buluih: 7.4 t/ha
Soybean/ Bekang: 1.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
French bean/ Bean: 2.2 t/ha
Onion/ Purunsen: 9.2 t/ha
Lady's finger/ Bawrhsaiabe: 6.8 t/ha
Tomato/ Tomoto: 9.2 t/ha
Other leafy vegetables/ Thlai hnah Dangte
Pea/ Motor chana: 4.6 t/ha
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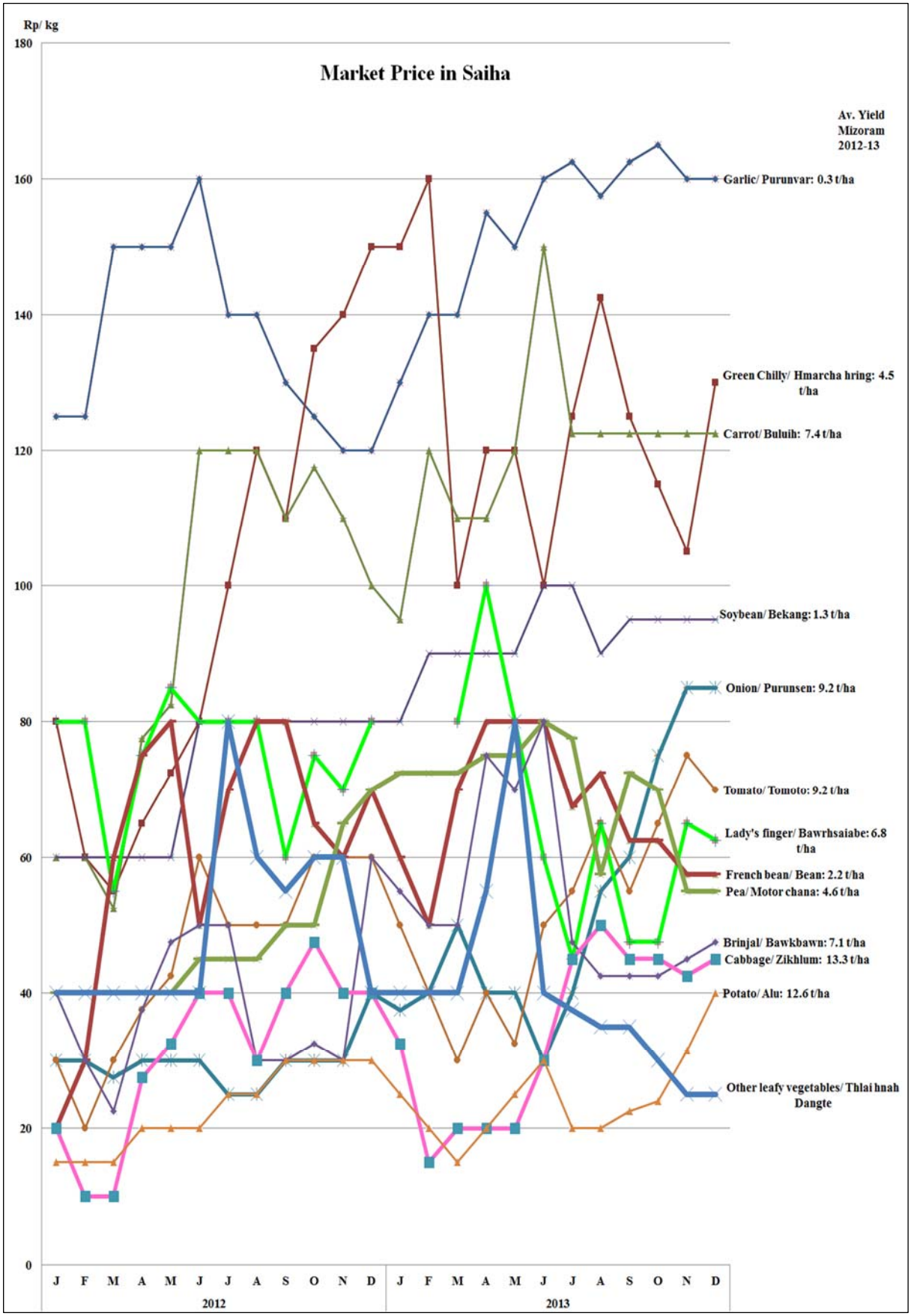
Cabbage/ Zikhlum: 13.3 t/ha
Brinjal/ Bawkbawn: 7.1 t/ha
J F M A M J J A S O N D
2012
J F M A M J J A S O N D
2013


Rp/ kg
Market Price in Saiha
Av. Yield Mizoram 2012-13
Garlic/ Purunvar: 0.3 t/ha
Green Chilly/ Hmarcha hring: 4.5 t/ha
Carrot/ Buluih: 7.4 t/ha
Soybean/ Bekang: 1.3 t/ha
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2013

REFERENCE 8-1
IRRIGATION SCHEDULE AND MONITORING PLAN FOR WINTER CROP

(a) General

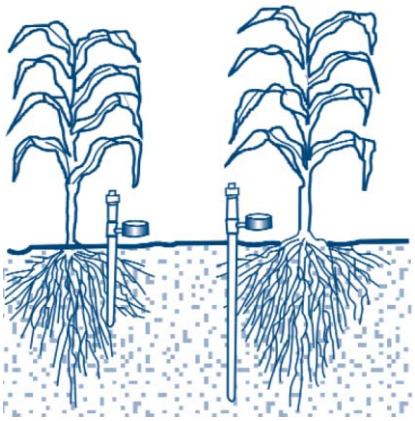
- ✓ As Non-monsoon season irrigation water resource is limited and precious, farmers have to be aware that winter-crops irrigation water is not free to use unlike monsoon season water, and well-planned and monitored utilization of water is crucial for winter-crop irrigation. However, while Irrigation scheme farmers have lots of experience of Paddy irrigation, Most of them do not have experience of winter-crops irrigation.
- ✓ Therefore IWRD has to provide instructions for winter-crops irrigation management before and after the project. Besides, it is recommendable that each WUA sets water use fees for winter-crops water separately from paddy water, as winter-crops can be cash crops and source of income generation.
- ✓ From above mentioned reason, here standard “Irrigation schedule and Monitoring plan for winter crops” are prepared.

(b) Irrigation schedule plan

- ✓ IWRD should be able to prepare theoretical Irrigation schedule plan to provide instruction to farmers.
- ✓ Cropwat (FAO free software) can be easily operated and used to calculate irrigation schedule based on Penman-Monteith method.
- ✓ Typical Irrigation schedule plan result, which was calculated on small vegetable and Aizawl meteorological condition, is shown in following page.
- ✓ Following page Typical Irrigation schedule plan can be also used for other part of Mizoram as a reference result, supposing that there are not so big differences of Penman-Monteith method calculation factors. However, In case IWRD needs special calculation, changing calculating conditions like variety of crops, season, soil condition and meteorological condition, calculation with Cropwat should be conducted.
- ✓ JICA study had provided training of Cropwat software operation to IWRD engineers, subsequent instructions within IWRD should be conducted by each division office.

(c) Irrigation monitoring plan

- ✓ Monitoring of available soil moisture of the farmland is the best way to check water requirement condition of winter crops indirect method. In other words, sufficiency of water in canal or intake point cannot be enough condition for winter crops growth. Therefore, Irrigation monitoring for winter crops will be conducted with soil moisture checking by the tensiometer, which is widely used, reasonable cost, easy to handle.
- ✓ Typical monitoring plan is shown in the page one after the next



Typical Irrigation schedule and Monitoring plan for winter crops (Example)

1. Irrigation schedule

   Result of typical Irrigation schedule calculation, which was prepared with cropwat software, is attached below.

CROP IRRIGATION SCHEDULE

ETo station: aizawl — Crop: small vegtable — Planting date: 10/11
Rain station: Aizawl — Soil: RED LOAMY — Harvest date: 12/02

Yield red.: 0.0 %

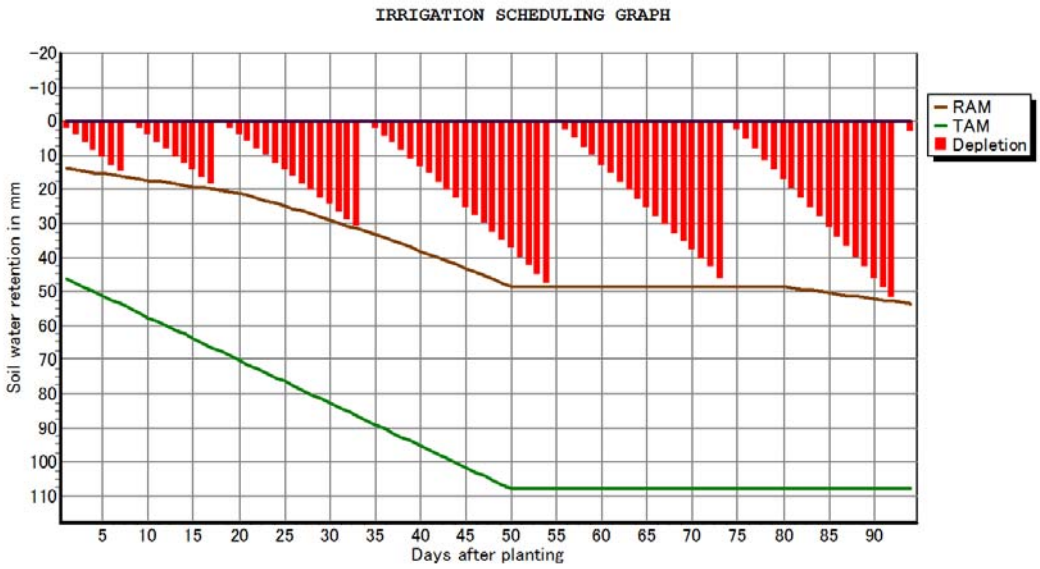
Crop scheduling options
Timing: Irrigate at 100 % depletion
Application: Refill to 100 % of field capacity
Field eff. 50 %

Table format: Irrigation schedule

Date	Day	Stage	Rain mm	Ks fract.	Eta %	Depl %	Net Irr mm	Deficit mm	Loss mm	Gr. Irr mm	Flow l/s/ha
17 Nov	8	Init	0.0	1.00	100	31	17.1	0.0	0.0	34.1	0.49
27 Nov	18	Init	0.0	1.00	100	30	20.4	0.0	0.0	40.8	0.47
13 Dec	34	Dev	0.0	1.00	100	38	33.3	0.0	0.0	66.5	0.48
3 Jan	55	Mid	0.0	1.00	100	47	50.2	0.0	0.0	100.4	0.55
22 Jan	74	Mid	0.0	1.00	100	45	48.8	0.0	0.0	97.6	0.59
10 Feb	93	End	0.0	1.00	100	51	54.9	0.0	0.0	109.9	0.67
12 Feb	End	End	0.0	1.00	0	3					

Totals:

Total gross irrigation	449.3	mm	Total rainfall	0.0	mm
Total net irrigation	224.7	mm	Effective rainfall	0.0	mm
Total irrigation losses	0.0	mm	Total rain loss	0.0	mm
Actual water use by crop	227.8	mm	Moist deficit at harvest	3.1	mm
Potential water use by crop	227.8	mm	Actual irrigation requirement	227.8	mm
Efficiency irrigation schedule	100.0	%	Efficiency rain	-	%
Deficiency irrigation schedule	0.0	%			



2. Monitoring plan

Water in the soil can be measured by measuring the soil water potential. A relationship exists between soil water content and matric potential, which is sometimes called the soil moisture retention curve and/or desorption curve. It describes the relationship between the volumetric water content (SMv) and matric potential (ym).
This potential can be measured with a tensiometer. Tensiometers operate by allowing the soil solution to come into equilibrium with a reference pressure indicator through a permeable ceramic cup placed in contact with the soil. Their use is widespread in irrigated fields of the world.

Monitoring point of Tensiometer should be selected with famers, selecting representing points of the winter crops farm land.

It is expected that 30-40centibar will be the irrigation start point from the table below. And actual irrigation should be adjusted in accordance with actual field conditions.

READING	INTERPRETATION	ACTION
ZERO	Can be expected after heavy rain or deep irrigation. Signifies surrounding soil is completely saturated with water.	If it persists, it can result in oxygen starvation and the development of plan diseases. Could be indicative of poor drainage conditions
0-10 Centibar (0.0.1 Bar)	Large surplus available for fostering plant growth. Will drain off within a few days	Could be indicative of poor drainage conditions.
10-20 Centibar (0.1-0.2 Bar)	Shows there is ample moisture and air in the soil. It means the soil has reached its capacity for water. Additional water will drain out of the root zone in a couple of days.	Heavy clay soils & medium textured soils : No irrigation required Sandy soils : irrigation usually not required. But if water-sensitive plants such as potatoes are grown, irrigation could commence particularly if in coarse sandy soil.
20-40 Centibar (0.2-0.4 Bar)	Available moisture and aeration good for plant growth	Heavy clay soils & medium textured soils : irrigation not required Coarser sandy soils : irrigation should be started in the 20-30 Centibar range Finer sandy soils : irrigation should be undertaken in the 30-40 Centibar range.
40-60 Centibar (0.4-0.6 Bar)	Available moisture and aeration good for plant growth in finer textured soils	Heavy clay soils : irrigation not required Medium textured soils : irrigation should be started. The finer the texture, the later you start Sandy soils : start irrigatiing immediately This is too dry : plant damage can result
60-80 Centibar (0.6-0.8 Bar)	Readily available moisture scarce, except in heavy clay soil	Heavy clay soils : as soon as soil suction values reach 70-80 Centibar, irrigation should be initiated Medium textured soils : plant damage can result because it is too dry Sandy soils : irreversible plant damge may result

Suggested tensiometer installation depths (cms)

CROP TYPE	TENSIOMETER 1	TENSIOMETER 2	TENSIOMETER 3
Apples	50	100	150
Bananas	30	60	
Broccoli	30	50	
Brussel sprouts	30	50	
Cabbage	30	50	
Carrots	30	50	
Cauliflower	30	60	
Celery	20	40	
Cherries	60	120	
Citrus fruits	40	80	
Coffee	50	100	
Cotton	40	80	120
Cucumber	40	80	
Grapes	60	120	150
Hops	60	120	150
Lettuce	30		
Maize	40	80	
Melons	40	80	
Olives	60	120	150
Onions	20	30	
Parsnips	40	80	
Peas	40	80	
Pears	40	80	120
Potatoes	20	30	50
Raspberries	40	80	
Sorghum	40	80	
Spinach	30	60	
Strawberries	15	30	
Sugar beet	40	80	
Sugar cane	40	80	
Sunflowers	60	120	150
Tea	30	60	
Tobacco	20	40	70
Tomatoes	40	80	
Turnips	40	80	

1 bar = 100 centibar (cbar)

1 bar = 1000 millibar (mbar)

1 centibar (cbar) = 10 millibar (mbar)

1 millibar (mbar) = 1 hectoPascal (hPa)

1 kiloPascal (kPa) = 10 hectoPascal (hPa)

1 atmosphere (atm) x 1013.25 = 1 millibar (mbar)

1 pounds / square inch (psi) x 68.946 = 1 millibar (mbar)

1 millimetres of mercury (mmHg) x 1.33322 = 1 millibar (mbar)

1 inches of mercury (inHg) x 33.864 = 1 millibar (mbar)

REFERENCE 11-1
ESTIMATED CROP BUDGET 2014

Description						
1. Unit Cost of Materials / Others	**Units**	**Paddy**	**Maize**	**Green Chilli**	**Onion**	**Leaf Mustard**
1 Seed	Rs./Kg	45	120	416	4,500	110
2 Fertilizer: Urea	Rs./Kg	11	11	11	11	11
3 Fertilizer: SSP	Rs./Kg	25	25	25	25	25
4 Fertilizer: MOP	Rs./Kg	12	12	12	12	12
5 Organic Manure	Rs./Kg	-	-	-	-	-
6 herbicide	Rs./Ltr.	300	300	300	300	300
7 Pesticides	Rs./Ltr.	60	60	60	60	60
8 Cattle-draft	Rs./ha	2,625	2,625	2,625	2,625	2,625
9 Others cost / transport	Rs./ha	900	900	900	1,500	900
10 Machinery cost-harvest/threshing	Rs./ha	1,800	-	-	-	-
11 Supports (pole)	Rs./pole	-	-	-	-	-
2. Requirements of Materials						
1 Materials-Seed	Kg/ha	100	20.0	0.6	3.0	20
2 Fertilizer: Urea	Kg/ha	-	-	-	-	-
3 Fertilizer: SSP	Kg/ha	-	-	-	-	-
4 Fertilizer: MOP	Kg/ha	-	-	-	-	-
5 Manure	ton/ha	20	25	25	20	20
6 herbicide	Unit/ha	1	2	2	2	-
7 Pesticides	Unit/ha	2	5	5	1	-
8 Animal-Drafiting: Plough etc.	Times/ha	1	1	1	1	1
9 Others, Transport	Times/ha	5	3	20	5	10
10 Machinery cost-harvest/threshing	Times/ha	1	-	-	-	-
11 Supports (pole)	Bundle/ha	-	-	-	-	-
Total of Material Cost (A)	Rs./ha	13,845	8,625	21,775	24,285	13,825
3. Unit cost of Labour						
1 Labour	Rs./day	250	250	250	250	250
4. Labour Requrement						
a) Land preparation						
1 Drains	Md/ha	5	10	10	10	5
2 Cleaning	Md/ha	5	5	5	5	5
3 Ploughing & Harrowing	Md/ha	8	12	12	12	15
5 Plastering bunds	Md/ha	3	-	-	-	-
7 Nursery preparation	Md/ha	2	-	6	15	-
b). Planting		-	-	-	-	-
1 Digging holes	Md/ha	-	15	30	15	5
2 Filling holes or / Transplanting	Md/ha	28	9	40	15	5
3 Irrigation	Md/ha	8	10	15	15	10
c) Maintence		-	-	-	-	-
1 Weeding	Md/ha	30	40	45	20	45
2 Irrigation	Md/ha	13	20	30	10	25
3 Fertilize application	Md/ha	-	-	-	-	-
4 Pest and disease control	Md/ha	6	6	20	10	6
d) Harvesting		-	-	-	-	-
1 Harvesting	Md/ha	38	25	80	34	80
2 Processing / Threshing / Bagging	Md/ha	26	10	40	24	40
Total Labour (including family labour)	Md/ha	172	162	333	185	241
Total Labour cost (B)	Rs./ha	42,938	40,500	83,250	46,250	60,250
5. Total Cultivation Cost (A) + (B)	Rs./ha	56,783	49,125	105,025	70,535	74,075
Excluding Family Labour Cost: 85% (C)	Rs./ha	6,441	6,075	12,488	6,938	9,038
6. Total Cultivation Cost (A) + (C)	Rs./ha	**20,286**	**14,700**	**34,263**	**31,223**	**22,863**
1 Yield Current (25% to Expect. Yield)	Kg/ha	1,250	1,250	4,500	5,000	5,000
2 Estimated Producer Price *1	Rs./kg	28	18	39	28	18
7. Sales Income (Gross Income)	Rs./ha	35,000	22,500	175,500	140,000	90,000
8. Net Income	Rs./ha	14,714	7,800	141,237	108,777	67,137

Description						
1. Unit Cost of Materials / Others	**Units**	**Leaf Coriander**	**Cabbage**	**Cauliflower**	**Potato**	**Carrot**
1 Seed	Rs./Kg	510	520	1,300	50	565
2 Fertilizer: Urea	Rs./Kg	11	11	11	11	11
3 Fertilizer: SSP	Rs./Kg	25	25	25	25	25
4 Fertilizer: MOP	Rs./Kg	12	12	12	12	12
5 Organic Manure	Rs./Kg	-	-	-	-	-
6 herbicide	Rs./Ltr.	300	300	300	300	300
7 Pesticides	Rs./Ltr.	60	60	60	60	60
8 Cattle-draft	Rs./ha	2,625	2,625	2,625	2,625	2,625
9 Others cost / transport	Rs./ha	900	900	900	900	900
10 Machinery cost-harvest/threshing	Rs./ha	-	-	-	-	-
11 Supports (pole)	Rs./pole	-	-	-	-	-
2. Requirements of Materials						
1 Materials-Seed	Kg/ha	20	0.5	0.6	1,200	4
2 Fertilizer: Urea	Kg/ha	-	-	-	-	-
3 Fertilizer: SSP	Kg/ha	-	-	-	-	-
4 Fertilizer: MOP	Kg/ha	-	-	-	-	-
5 Manure	ton/ha	20	25	25	25	25
6 herbicide	Unit/ha	-	2	1	1	1
7 Pesticides	Unit/ha	-	2	2	1	1
8 Animal-Drafiting: Plough etc.	Times/ha	1	1	1	-	1
9 Others, Transport	Times/ha	10	5	5	3	3
10 Machinery cost-harvest/threshing	Times/ha	-	-	-	-	-
11 Supports (pole)	Bundle/ha	-	-	-	-	-
Total of Material Cost (A)	Rs./ha	21,825	8,105	8,325	63,060	7,945
3. Unit cost of Labour						
1 Labour	Rs./day	250	250	250	250	250
4. Labour Requrement						
a) Land preparation						
1 Drains	Md/ha	5	5	5	10	5
2 Cleaning	Md/ha	5	5	5	5	5
3 Ploughing & Harrowing	Md/ha	10	15	15	10	15
5 Plastering bunds	Md/ha	-	-	-	-	-
7 Nursery preparation	Md/ha	-	10	10	-	-
b). Planting		-	-	-	-	-
1 Digging holes	Md/ha	5	10	10	10	10
2 Filling holes or / Transplanting	Md/ha	5	15	15	25	5
3 Irrigation	Md/ha	10	10	10	10	10
c) Maintence		-	-	-	-	-
1 Weeding	Md/ha	30	40	40	30	30
2 Irrigation	Md/ha	20	20	20	-	20
3 Fertilize application	Md/ha	-	-	-	-	-
4 Pest and disease control	Md/ha	6	6	6	6	6
d) Harvesting		-	-	-	-	-
1 Harvesting	Md/ha	80	25	25	50	50
2 Processing / Threshing / Bagging	Md/ha	40	15	15	10	40
Total Labour (including family labour)	Md/ha	216	176	176	166	196
Total Labour cost (B)	Rs./ha	54,000	44,000	44,000	41,500	49,000
5. Total Cultivation Cost (A) + (B)	Rs./ha	75,825	52,105	52,325	104,560	56,945
Excluding Family Labour Cost: 85% (C)	Rs./ha	8,100	6,600	6,600	6,225	7,350
6. Total Cultivation Cost (A) + (C)	Rs./ha	**29,925**	**14,705**	**14,925**	**69,285**	**15,295**
1 Yield Current (25% to Expect. Yield)	Kg/ha	2,500	6,250	6,250	5,000	5,000
2 Estimated Producer Price *1	Rs./kg	18	15	22	21	46
7. Sales Income (Gross Income)	Rs./ha	45,000	93,750	137,500	105,000	230,000
8. Net Income	Rs./ha	15,075	79,045	122,575	35,715	214,705

Description						
1. Unit Cost of Materials / Others	**Units**	**Pumpkin Leaf**	**Brinjawl**	**Field Pea**	**Chick Pea**	**Soyabean**
1 Seed	Rs./Kg	358	468	98	120	110
2 Fertilizer: Urea	Rs./Kg	11	11	11	11	11
3 Fertilizer: SSP	Rs./Kg	25	25	25	25	25
4 Fertilizer: MOP	Rs./Kg	12	12	12	12	12
5 Organic Manure	Rs./Kg	-	-	-	-	-
6 herbicide	Rs./Ltr.	300	300	300	300	300
7 Pesticides	Rs./Ltr.	60	60	60	60	60
8 Cattle-draft	Rs./ha	-	2,625	2,625	2,625	2,625
9 Others cost / transport	Rs./ha	900	900	900	900	900
10 Machinery cost-harvest/threshing	Rs./ha		-	-	-	-
11 Supports (pole)	Rs./pole		-	-	-	-
2. Requirements of Materials						
1 Materials-Seed	Kg/ha	1.0	0.2	45	80	70
2 Fertilizer: Urea	Kg/ha	-	-	-	-	-
3 Fertilizer: SSP	Kg/ha	-	-	-	-	-
4 Fertilizer: MOP	Kg/ha	-	-	-	-	-
5 Manure	ton/ha	10	20	5	10	5
6 herbicide	Unit/ha	-	1	1	-	-
7 Pesticides	Unit/ha	-	2	1	1	1
8 Animal-Drafiting: Plough etc.	Times/ha	-	1	1	1	1
9 Others, Transport	Times/ha	5	10	2	2	2
10 Machinery cost-harvest/threshing	Times/ha	-	-	-	-	-
11 Supports (pole)	Bundle/ha	-	-	-	-	-
Total of Material Cost (A)	Rs./ha	4,858	12,139	9,195	14,085	12,185
3. Unit cost of Labour						
1 Labour	Rs./day	250	250	250	250	250
4. Labour Requrement						
a) Land preparation						
1 Drains	Md/ha	-	12	5	5	5
2 Cleaning	Md/ha	5	5	5	5	5
3 Ploughing & Harrowing	Md/ha	12	15	12	12	12
5 Plastering bunds	Md/ha	-	-	-	-	-
7 Nursery preparation	Md/ha	-	50	-	-	-
b). Planting		-	-	-	-	-
1 Digging holes	Md/ha	5	30	5	5	5
2 Filling holes or / Transplanting	Md/ha	5	15	5	5	5
3 Irrigation	Md/ha	5	15	5	5	5
c) Maintence		-	-	-	-	-
1 Weeding	Md/ha	30	60	30	30	30
2 Irrigation	Md/ha	12	30	20	10	10
3 Fertilize application	Md/ha	-	-	-	-	-
4 Pest and disease control	Md/ha	6	20	6	6	6
d) Harvesting		-	-	-	-	-
1 Harvesting	Md/ha	30	80	40	40	30
2 Processing / Threshing / Bagging	Md/ha	10	40	20	15	15
Total Labour (including family labour)	Md/ha	120	372	153	138	128
Total Labour cost (B)	Rs./ha	30,000	93,000	38,250	34,500	32,000
5. Total Cultivation Cost (A) + (B)	Rs./ha	34,858	105,139	47,445	48,585	44,185
Excluding Family Labour Cost: 85% (C)	Rs./ha	4,500	13,950	5,738	5,175	4,800
6. Total Cultivation Cost (A) + (C)	Rs./ha	**9,358**	**26,089**	**14,933**	**19,260**	**16,985**
1 Yield Current (25% to Expect. Yield)	Kg/ha	45	6,000	2,750	600	600
2 Estimated Producer Price *1	Rs./kg	240	30	22	35	37
7. Sales Income (Gross Income)	Rs./ha	10,800	180,000	60,500	21,000	22,200
8. Net Income	Rs./ha	1,442	153,911	45,567	1,740	5,215

Description			
1. Unit Cost of Materials / Others	**Units**	**Pigeon Pea**	**French bean**
1 Seed	Rs./Kg	120	202
2 Fertilizer: Urea	Rs./Kg	11	11
3 Fertilizer: SSP	Rs./Kg	25	25
4 Fertilizer: MOP	Rs./Kg	12	12
5 Organic Manure	Rs./Kg	-	-
6 herbicide	Rs./Ltr.	300	300
7 Pesticides	Rs./Ltr.	60	60
8 Cattle-draft	Rs./ha	2,625	2,625
9 Others cost / transport	Rs./ha	900	900
10 Machinery cost-harvest/threshing	Rs./ha	-	-
11 Supports (pole)	Rs./pole	-	10
2. Requirements of Materials			
1 Materials-Seed	Kg/ha	20	25
2 Fertilizer: Urea	Kg/ha	-	-
3 Fertilizer: SSP	Kg/ha	-	-
4 Fertilizer: MOP	Kg/ha	-	-
5 Manure	ton/ha	5	5
6 herbicide	Unit/ha	-	1
7 Pesticides	Unit/ha	1	2
8 Animal-Drafiting: Plough etc.	Times/ha	1	1
9 Others, Transport	Times/ha	2	10
10 Machinery cost-harvest/threshing	Times/ha	-	-
11 Supports (pole)	Bundle/ha	-	300
Total of Material Cost (A)	Rs./ha	6,885	20,095
3. Unit cost of Labour			
1 Labour	Rs./day	250	250
4. Labour Requrement			
a) Land preparation			
1 Drains	Md/ha	5	5
2 Cleaning	Md/ha	5	5
3 Ploughing & Harrowing	Md/ha	12	12
5 Plastering bunds	Md/ha	-	-
7 Nursery preparation	Md/ha	-	-
b). Planting		-	-
1 Digging holes	Md/ha	5	5
2 Filling holes or / Transplanting	Md/ha	5	5
3 Irrigation	Md/ha	5	5
c) Maintence		-	-
1 Weeding	Md/ha	30	30
2 Irrigation	Md/ha	10	15
3 Fertilize application	Md/ha	-	-
4 Pest and disease control	Md/ha	6	6
d) Harvesting		-	-
1 Harvesting	Md/ha	30	80
2 Processing / Threshing / Bagging	Md/ha	15	40
Total Labour (including family labour)	Md/ha	128	208
Total Labour cost (B)	Rs./ha	32,000	52,000
5. Total Cultivation Cost (A) + (B)	Rs./ha	38,885	72,095
Excluding Family Labour Cost: 85% (C)	Rs./ha	4,800	7,800
6. Total Cultivation Cost (A) + (C)	Rs./ha	**11,685**	**27,895**
1 Yield Current (25% to Expect. Yield)	Kg/ha	480	2,000
2 Estimated Producer Price *1	Rs./kg	25	31
7. Sales Income (Gross Income)	Rs./ha	12,000	62,000
8. Net Income	Rs./ha	315	34,105