APPENDIX V
AGRICULTURE AND AGRO-ECONOMY

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CHAPTER 1 GENERAL

This report entitled Appendix V "Agriculture and Agro-economy" is the supporting report on the feasibility study of the irrigation project with 14,000 ha of irrigation development area which has been formulated as the most optimum plan in the Pampanga Delta Development Plan.

This report describes present agricultural conditions, identifies the constraints encountered in the irrigation development area and provides proposed agricultural development plan.

The collection of the existing data was mainly done from the following governmental authorities concerned.

1) Bureau of Agricultural Economics
2) Region III Office, Ministry of Agriculture
3) Region III Office, Ministry of Agrarian Reform
4) Region III Office, National Census and Statistic Office
5) National Food Authority
6) National Irrigation Administration
7) Pampanga Province Governor Office
8) Municipality and Barangay Offices
9) Branches of Philippine National Bank in Pampanga province

In addition, the field surveys including reconnaissance, rice yield survey and farm economic survey for 140 farm households were carried out.

Administratively the irrigation development area forms the northern part of Pampanga province consisting of ten municipalities and 65 barangays as shown in Table 1.1.

CHAPTER 2 PRESENT CONDITION

2.1 Population and Labor Force

Basic socio economic data in the irrigation development area are shown in Table 2.1.

The population in the irrigation development area is estimated at 104,700 consisting of 16,390 households in 1980 and comprises 52% of male and 48% of female as shown on Fig. 2.1. The age distribution indicates a typical triangular form reflecting the higher population growth rate. Forty six (46) percent of the total population is less than 20 years and only 8% are above 60 years. The population growth rate is estimated at 2.1% per annum from 1975 to 1980. The population density of the irrigation development area is estimated at about 750 persons per km^2. Average family size is 6.4.

With regard to occupation, twenty eight (28) percent of total households are farmers consisting of landowner operators, lessees and share tenants in the irrigation development area as shown in Table 2.2. Most of them are engaged in rice culture. In addition landless workers who make their living primarily as farm laborers with emphasis on transplanting and harvesting of paddy occupy about twenty six (26) percent of total households. These landless workers have played an important role in supply of farm labor force in the irrigation development area. The remaining forty six (46) percent are engaged in government and private employers, businessmen, vendors, ordinary laborers, etc., considerable parts of which work in Manila.

The total farm households in the irrigation development area is estimated at about 4,600, comprising about 32,700 in population. Farm economic survey indicates that about eighteen (18) percent of the population, or about 5,900 persons is farmers. Average size of farm household shows 7.1, indicating higher than the average size for the total households.

Labor force available for farming in the irrigation area is estimated based on the following assumptions:

i) Yearly workable days/person: 365 days x 0.8 = 292 days

ii) Total labor force: 13,800 persons

from farmers	: 5,900 persons
from landless workers	: 7,900 persons

Labor force available in the development area is calculated at 4,030,000 man-days/year or 336,000 man-days/month, as shown in Table 2.3.

On the other hand, actual labor requirement for farming in the irrigation development area is estimated at 1,250,000 man-days per year on the basis of present cropping pattern and land use conditions as shown in Table 2.3. About only 30% of the total available labor force is employed by farming of rice and diversified crops in the entire irrigation development area. The balance between available labor force and actual labor requirement, or excess of labor force amounts to 2,782,000 man-days per year.

Further pupils and students with the age 10 and above who occupy thirteen (13) percent of the population of the total farm households usually carry out part time farming, so that excess of labor force is considered to occur more.

2.2 Soil and Land Classification

Soil classification was proceeded on soil series level on the basis of the established soil series of the Philippines. Five (5) soil series are identified in the irrigation development area as follows:

1) La Paz (clay loam) soil series
2) Masantol (clay) soil series
3) Quingua (clay loam) soil series
4) San Fernando (clay) soil series
5) Tagulod (clay) soil series

Characteristics of each soil series are explained in section 3.1.4, Appendix I Project Formulation.

The area occupied by each soil group and its extent are summarized in Table 2.4 and mapped on Fig. 2.2.

The study of land capability is carried out on the basis of the standard land classification system prepared by the Ministry of Agriculture, Forestry and Fisheries of Japan, of which details are described in section 3.1.4, Appendix I. Most of the soils are suitable for irrigation farming of paddy in the irrigation development area. The area classified by the standard and its extent are shown in Table 2.5 and illustrated on Fig. 2.2.

2.3 Climate

There is no meteorological observation station in the irrigation development area except rainfall station. The climatic data in the Pampanga River Basin are used for the irrigation development plan except for rainfall. The climate of the Pampanga River Basin is characterized by the distinct dry and wet seasons caused by tropical monsoon. The dry season extends usually from November to April and the wet season

during the remaining months of the year. Climate conditions are explained in this section using the data available from three meteorological stations located in the Pampanga River Basin. Summary of the climatic data is presented in Table 2.6 and 2.7.

Annual mean temperature is around 27°C in the Pampanga River Basin. January or February is the coolest month, while April or May is the hottest, and the fluctuation of the mean temperature is quite small in a year. Annual mean relative humidity in Cabanatuan City is 76.7%, maximum monthly mean relative humidity appears in August and minimum in April. Annual mean sunshine hour in San Miguel and Tarlac is 6.1 hours a day. Maximum monthly mean sunshine hour is observed in April and minimum in August.

Wind speed observed in the Pampanga River Basin is light, 2.4 km/hour and 3.8 km/hour at San Miguel, Tarlac Province and Cabanatuan City, respectively. Annaul evaporations observed in San Miguel, Tarlac Province and Cabanatuan City are 1,768 mm and 1,815 mm. Monthly maximum evaporation occurs in April and minimum in August.

Average annual rainfall in the irrigation development area which is weighted average of San Fernando, Arayat and Apalit is 1,829 mm.

2.4 Land Use

The present land use in the irrigation development area is shown in Table 2.8 and illustrated on Fig. 2.3. Farm land consisting of only paddy field is 11,500 ha or 82.2% of the irrigation development area. The area of 2,300 ha is under rainfed paddy. The remaining areas of 9,200 ha are irrigated. Non farm land is composed of grass land of 100 ha, swampy area of 900 ha and village/road/rivers/others of 1,500 ha.

With regard to irrigation system most of the gravity irrigation systems are so simple and deteriorated. In addition considerable number of pumps are used in the irrigation development area. Operation and maintenance of these pumps are not properly functioned due to increasing oil price and shortage of spare parts. Further water for irrigation is restricted during the dry season. As a result, only 25% of irrigated land or 2,300 ha is practiced by double cropping of rice per annum. Following paddy, diversified crops, mainly mongo beans, are grown in about 600 ha of paddy field after wet season paddy. The multi-cropping index in the irrigation development area is calculated at 1.25./1

/1: Total cropping area through year/total farm land

$[RWP + IDP + ISP + (ISP - OP + RWP) \times 0.1]/11,500$

where, RWP: rainfed wet season paddy, 2,300 ha
IDP: irrigated double cropping of paddy, 4,600 ha (2,300x2)
ISP: irrigated single cropping of paddy, 6,900 ha
OP: octobarial paddy, 2,900 ha

2.5 Cropping Pattern and Farming Practices

2.5.1 Cropping Pattern

The present cropping pattern prevailing into the irrigation development area is illustrated on Fig. 2.4.

The main crop grown in the area is paddy, followed by diversified crops. The wet season paddy is planted on the onset of the monsoon, generally May to August, and harvested at October to December. The dry season paddy is planted at the period of November to December for normal cases and September to October for so called Octobarial rice in the low-lying paddy field of about 2,900 ha where is inundated during the wet season. Diversified crops, mainly mongo beans, are grown in 10% of the area of single cropping of rice after wet season paddy except Octobarial rice area. The diversified crops are practiced using soil moisture remained without irrigation.

2.5.2 Farming Practices

Based on the results of the farm economic survey and field survey, farming practices and farm inputs requirement at present are analyzed.

With respect to rice varieties improved high yielding varieties such as IR series, UPLB series and BPI series prevail. Among them IR-20, IR-36 and IR-42 are the major varieties in the irrigation development area. Additionally local varieties such as Wagwag and Veser have been spread in the area. About 95 kg of seed is applied per ha.

Application of fertilizers and chemicals is practiced over the area and dosage of these varies largely depending location. The estimated dosages of fertilizer per ha range from 51 kg to 53 kg of N, 7 kg to 14 kg of P_2O_5 and 3 kg to 5 kg of K_2O. With regard to agricultural chemicals, less than 1.5 liters is applied in spite of considerable damages due to stem borer, bacterial blight, tungro, grassy stunt, etc. The estimated farm inputs for paddy are summarized in the following table.

Farm Inputs		Rainfed Paddy	Irrigated Paddy	
			Wet Season	Dry Season
1) Seed	(kg/ha)	95	95	99
2) Fertilizer				
- N	(kg/ha)	51	51	53
- P_2O_5	(")	7	9	14
- K_2O	(")	3	3	5
3) Chemicals	(ℓ/ha)	0.9	1.2	1.5

As far as farming is concerned, about 60% of land preparation work and about 80% of threshing work are carried out by farm machinery. Other farming work is practiced by manpower. Dependency on hired labor is estimated at 55% of total manpower, the balance family labor. About 90% of farming work on transplant, harvest and threshing are carried out by hired laborer.

As for diversified crops, their cultivation is very simple. No fertilizer is applied in general. Agricultural chemicals are commonly applied and estimated dosage is 1.7 ℓ per ha. Farm operation is carried out manually with primary emphasis on weeding.

Details of labor, animal power and mechanical power requirements for paddy and diversified crop cultivation are shown in Table 2.9.

2.6 Agricultural Production

2.6.1 Yield Survey for Paddy

(1) General

In order to improve the rice yield in the irrigation development area, one must first identify the defects of the cultivation on the actual paddy field. Without identifying the defects effective improvement can hardly be made.

For the purpose mentioned above, yield survey for paddy was carried out at 32 sites (see Fig. 2.5) of paddy field for both wet season and dry season paddies in and around the irrigation development area. The survey was carried out during the period from 14th to 21th September for wet season and from 19th to 25th January for dry season in 1981.

Due to shortage of survey period conventional method was applied. Thirty (30) hills were selected from each sampling site. The average number of panicles per hill was computed. Three hills which have the nearest number of panicles per hill to average value were selected as the representative hills for yield estimation. By the used of the representative hills, the yield components such as the number of panicles per m^2, the number of grains per panicle, the percentage of ripened grains and the weight of 1,000 grains were analysed and yield estimation was made. The method of analyses was applied to the method described in "Crop Science in Rice"/1 and outlined on Fig. 2.6.

/1: S. Matsushima, Crop Science in Rice - Theory of Yield Determination and its application, Fuji Publishing Co., Ltd., 1975.

(2) Defects to be Solved in Improvement of Paddy Yield

The results of analyses for yield estimation and yield components are summarized as below. Details are as shown in Table 2.10 and 2.11.

	Wet Season	Dry Season
1) Yield (paddy: ton/ha)		
- Range	1.11 - 5.95	0.98 - 8.78
- Average	3.01	3.71
2) Yield Components		
- Number of panicles per m^2	257	342
- Number of grains per panicle	75	91
- Percentage of ripened grain (%)	67	56
- The weight of 1,000 grains (gram)	23.2	21.9
3) Number of Hills per m^2	23	23

The yields range from 0.98 tons to 8.78 tons of paddy per ha for both seasons. The average yields of wet and dry season paddies are 3.01 tons and 3.71 tons per ha, respectively. It is worth noting that the yield of 8.78 tons per ha suggests the higher production potentials in the irrigation development area.

In order to clarify the relation between yield and yield components, correlation was computed and shown as follows:

Yield Component	Correlation (r) Wet Season Paddy	Dry Season Paddy
1) Number of panicles per m^2	0.70	0.40
2) Number of grains per panicle	0.77	0.51
3) Percentage of ripened grain	0.20	0.69
4) The weight of 1,000 grains	-0.27	0.15

It may be concluded from the above analyses that the yields are clearly governed by the number of grains per panicle and the number of panicles per m^2 for wet season paddy and the percentage of ripened grain for dry season paddy. Rice cultivation in the irrigation development area should be paid on increase of numbers of grain and panicle for wet season paddy and percentage of ripened grain for dry season paddy.

With regard to the numbers of grains and panicles, wet season paddy is low as compared with dry season paddy in spite of same plant density. It would be considered from the field reconnaissance that few numbers of grains and panicles are due to low root activity during the period of initial tillering stage by poor drainage, damages caused by insect and diseases and insufficient volume and untimely supply of nitrogenous fertilizers.

The countermeasures for increase of the number of grains and panicles are considered as follows:

a. To provide drainage facilities

b. To prevent the damages by insect and diseases

c. To increase the application amount of nitrogenous fertilizers

d. To timely supply nitrogen to initial tillering stage, the period before 2 weeks from neck-node differentiation period and the period after 2 or 3 weeks from neck-node differentiation period by split application

As for the dry season paddy, the percentage of ripened grains is considerably low in general. It is said that the percentage of ripened grains under normal condition indicates over 70%. It is considered that low percentage of ripened grains for dry season paddy is due to the fact that unfavourable conditions occur during the period from the panicle initiation stage to the final stage of flowering. It would be considered that the unfavourable conditions during the above period are mainly the shortage of irrigation water during the period of reduction division and heading stages and the damages caused by insect and diseases.

Based on the above, the countermeasures for increase of percentage of ripened grains are considered as follows:

a. To supply sufficient irrigation water on the said period

b. To prevent the damages by insect and diseases

c. To provide sunny weather for 15 days just before heading and about 25 days just after heading

As a result, increase of numbers of grains and panicles for wet season paddy and percentage of ripened grains for dry season paddy are essential for increase of higher yield of rice.

2.6.2 Crop Yield and Production

Crop yield and total production of major crops at present condition are estimated on the basis of the data obtained from the Bureau of Agricultural Economics referring to the yield survey and the farm economic survey. Yield and production of major crops fluctuate year by year due to variation of annual rainfall, flood damages, unexpected damages by diseases and insects, etc. The present yield and production are estimated as an average value from 1977 to 1979 as shown in Table 2.12 to 2.14.

Average unit yield of paddy for irrigated land in the irrigation development area is 2.16 ton/ha for wet season paddy and 2.42 ton/ha for dry season paddy. For non-irrigated land unit yield is 1.87 ton/ha. These low unit yields are considered to be accrued from the following major constraints encountered.

a. No and/or insufficient irrigation water in volume and in time
b. No or insufficient provision of drainage systems
c. Low amount of farm input and limited extent of proper farming
d. Unexpected damages by insects and diseases and flood

The total production of paddy in the project area is estimated at about 30,500 tons.

With regard to unit yield of diversified crops, yields are generally low since no fertilizers are used without irrigation. Unit yield of mongo beans is estimated at 0.4 ton per ha. Total production of mongo beans in the irrigation development area amounts to about 250 tons.

2.6.3 Livestock

Livestock is not a main line of the agricultural activity in the irrigation development area. There are no large scaled livestock raising in the area. Most farm households raise a few chickens, ducks or pigs in and around the paddy field on a small scale.

Many have either carabao or oxen. The livestock plays an important role in supply of protein sources for the local people and in provision of motive power and transportation measures in the irrigation development area.

Number of livestock and poultry in the irrigation development area is estimated at 4,900 carabaos, 550 cows, 53,400 chickens and 66,600 ducks and 10,900 of pigs, as shown in Table 2.16.

2.7 Land Tenure and Holding

As mentioned in Section 3.3.5 of Appendix I, the situation of land tenure has changed in Pampanga province through the land reform programs of Operation Land Transfer and Leasehold Operation.

In order to identify the tenurial and land holding situation in the irrigation development area, 140 farm households were selected by random sampling method from total farm households of 4,600 and questionnaire survey was done for the selected farm households. The results of the survey are as shown in Table 2.16 and Fig. 2.7.

The survey results indicate that average farm size in the irrigation development area is 2.5 ha. Forty five percent (45%) of the total farm households covering thirty one percent (31%) of the farm land have less than 2.25 ha in farm size. It is considered from Fig. 2.7 that typical farm size of farm households occupying 20% of total farm households is 1.5 ha in the area.

The results of the survey on land tenure are summarized as follows:

Owner operators:	17.1% of total farm households
Amortizing owner operators:	35.0 % of total farm households
Lessees (fixed rent):	46.5% of total farm households
Share tenants	1.4% of total farm households

The representative farmer for land tenure in the irrigation development area is lessee occupying about half of total farm households.

2.8 Agricultural Support System

2.8.1 General Outline of Organization for Agricultural Development

Governmental organizations are centered in Manila or Quezon City running from there to the regional, provincial, municipal and barangay level.

The irrigation development area of the Pampanga Delta Development Project belongs to Pampanga province, Region III. The municipalities related to the area amount to ten (10) among twenty two (22) in Pampanga province.

A number of government and non government organizations plays an important role in the function of the agricultural support for increasing agricultural production through the intensification program, extension and research work, seed multiplication work, credit, land reform, etc. The national development organization for agricultural and flood production programs is shown in the Fig. 2.8.

The principal agencies are as follows;

- Ministry of Agriculture
  - Bureau of Plant Industry
  - Bureau of Agricultural Extension
  - Bureau of Agricultural Economics
  - Bureau of Cooperative Development
  - National Food and Agriculture Council
- Ministry of Public Works and Highways
- National Irrigation Administration
- Ministry of Agrarian Reform
- National Food Authority
- Central Bank of the Philippines (including Government and Rural Banks)
- Maligaya Rice Research and Training Center
- University of the Philippines College of Agriculture
- International Rice Research Institute

The type of assistance would be roughly divided in three blocks; Credit (Loans), Management (or Administration) and Research and Extension.

(1) Credit (Loans)

On the top of banking institutions, the Central Bank of the Philippines (CBP) makes available increased loan subsidy to its subordinate banks; government banks (Philippiie National Bank, Land Bank of the Philippines, Development Bank of the Philippines, Agricultural Credit Administration), rural banks and private banks. Credit technicians from the banks instruct farmers on the judicious use of the lands, assist them on the loaning procedures and act as credit collectors.

(2) Management (or Administration)

The National Economic and Development Authority (NEDA) in the central agency for national development planning and coordination of program implementation. As the central planning body of the government, the NEDA is responsible for the formulation and updating of long- and short-term national development plans as well as for the identification and coordination of policies and measures.

As the coordinating and implementing arm of the Ministry of Agriculture, the National Food Agriculture Council (NFAC) launched, in concert with the authorities and agencies concerned, a series of food production programs that filled the quest of the country for food self-sufficiency. NFAC is empowered to comprise the highest policy-making body to oversee, unify and integrate the administration of the overall food production programs. The National Food Authority (NFA), a government corporation attached to the Office of the President implements the government's price support and massive procurement program which is equally important as government's grains production and financing programs.

(3) Research & Extension

The Bureau of Plant Industry in the Ministry of Agriculture conducts researches on agricultural crops in collaboration with the research institutes such as the International Rice Research Institute (IRRI), the University of the Philippines College of Agriculture, etc. Concerning the transfer of technology to the farmers, the Bureau of Agricultural Extension plays the leading role for the improvement of rural life through the strengthening of agricultural extension services in conjunction with many organizations and in various ways and means: through a network of farm management technicians or mass media and so on.

2.8.2 Agricultural and Food Programs

Recognizing the need for the development of agriculture and food production, the national government spearheaded the numerous Agricultural and Food Programs. Thus, self-sufficiency in rice was attained, and exportation of this traditionally imported cereal followed in 1977. The significant changes in Philippine rice production have been primarily due to a concerted government drive for intensive land cultivation through supervised credit, expanded irrigation facilities, improved farm practices, use of high yielding varieties and an effectively accompanyirg price support program. Not the least among the elements responsible for production breakthrough was the Agrarian Reform proclaimed on October 21, 1972. Government and private institutions were and are directed to enjoin and extend their fullest support to the Programs; Masagana 99 (National rice program), Maisan 77 (Corn and feedgrains program), Gulayan Sa Kalusugan (Vegetable production), Multiple Cropping, Rice-Fish Culture, Crop Protection, Barangay Irrigators' Service Association (BISA), etc.

The Masagana 99/1 is a nationwide rice production program launched in May 1973 as a top national priority program to achieve self-sufficiency in rice and now on its XVII the phase of operation.

/1: The word "Masagana" means bountiful and 99 quantities the goal of the program to increase yields up to 99 cavans per hectare. This is 4.4 tons of unmilled rice as paddy per hectare.

In ten (10) municipalities covering the irrigation development area, about 685 farmers take part in Masagana (with credit only) in Phase III (May to October 1979), 403 farmers in Phase XIV (Nov. 1979 to March 1980), 25 farmers in Phase XV (May to October 1980) and 466 farmers in Phase XVI (Nov. 1980 to April 1981). The Masagana area (with credit) devotes to about 18% in Phase XIII, 17% in Phase XIV, 7% in Phase XV and 23% in Phase XVI for total planted area of paddy. The repayment of loan is relatively low, being around 60% on the average of last three phases. (see Tables 2.17 and 2.18)

As figures in the Table 2.17 show, at any given season, the standing crop is often damaged by various causes; typhoon(especially in Phase XV), floods, prolonged drought, etc.

In addition to the natural calamities, the following problems and constraints encountered in the execution of the Masagana 99 program are pointed out as well as its strategy of implementation./1

Constraints	Strategy of Implementation
1. High cost of farm inputs	Initiate farmers on compost making and green manuring and other several organic fertilizer
2. Tight credit limitations of financial institutions	Amend credit policies of financial institution to extend loan to fully paid farmers' members of deliquent selda/damayan
3. Inadequate irrigation and drainage facilities	Construction of check gates, deepening and widening of river and irrigation canals
4. Poor conditions of some farm to market roads due to increasing cost of transportation	Faciliate the improvement of more farm to market roads by the local Provincial Government
5. Incidence of pests and diseases	More surveillance monitoring teams to be deployed in the field and recommend appropriate insecticide, fungicide, to specific pest and disease incidence
6. Weak farmers' association cooperative activity and development	Campaign, strengthen, rehabilitate farmers' organizations and cooperatives
7. Inadequate rice driers during wet season harvest	More rice driers dispersed in the barangay

/1: Source: Ministry of Agriculture, Provincial Executive Office, Integrated Food and Nutrition Program, 1981.

2.8.3 Agricultural Credit

The policy of government requires all financing institutions, whether government or private, to give special priority to agricultural financing and set aside at least 25% of their loanable funds for agricultural credit. Food production financing is directed primarily toward increasing the productive capability of the small farmer through a convinient rural credit system.

As the organizational components of the Masagana program, the seldas (composed of 5-7 farmers with close ties, contiguous or proximate farm areas) act as joint liability groups in the securing of production loans.

The outstanding innovation introduced by Masagana 99 program into the rural credit system was the acceptance of the principle of non-collateral short-term credit which enabled the small farmers to purchase the indispensable inputs to enhance their production capabilities. At the same time, the program innovated rediscounting system of the involved financing institutions, making them more aware of and responsive to the demands of a farmer-oriented and more socialized rural credit system.

Food production financing loans in the Philippines can be classified into crop and commodity loans (or operating capital loans). Under the Masagana program, the PNB can release crop loans from ₱500 to ₱1,600 per hectare of crop land to farmers who are first willing to participate in the program and adopt the rice or corn technology package. Interest rates range from the authorized 12% per annum. The Agricultural Credit Administration (ACA) also assist in the financing for the production and commodity loans to farmers as well as the marketing, facility and operating capital loans to cooperatives.

Special financing assistance for the purchase of processing and storage facilities and irrigation are granted in programs of the Development Bank of the Philippines (DBP), Land Bank of the Philippines (LBP), Farm Systems Development Corporation (FSDC) and National Irrigation Administration (NIA).

The credit assistance extended usually by banking institutions in the Philippines could be summarized as follows:

1. Loans to farmers
   a. Production loans
   b. Commodity loans
2. Loans to cooperatives
   a. Marketing loans
   b. Facility loans
   c. Operating capital loans

2.8.4 Research and Extension

The country's formula in attaining rice self-sufficiency can be attributed to the new technology, development of high yielding varieties, supervised credit, irrigation development, massive extension and information services and intensified marketing services extended jointly by the government and private sector.

The ramification of these technical know-how with the proper usage of farm inputs is the product of unceasing researches of different agencies whose function and pledge are to increase production and higher farm income. Mentioning some agencies directly or indirectly responsible for research work are the following: International Rice Research Institute (IRRI) at Los Baños, University of the Philippines College of Agriculture (UPCA) at Los Baños, Maligaya Rice Research and Training Center (MRRTC) at Muñoz, Central Luzon State University (CLSU) at Muñoz, National Irrigation Administration (NIA), Ministry of Agriculture (MA) and other private agency.

The IRRI alone carries hybridization of rice that is high yielding and resistent to diseases and plant pests. It also identifies unusual performance stability grown in varying environment of hot and cold.

UPCA and CLSU are responsible for researches of all crops in different angles to boost production and help in molding stronger agriculture.

MRRTC which is operated by the Bureau of Plant Industry, condusts researches on rice varieties and improvement, crop production and processing, intensification of cultural and management practices, seed certification, etc. It also trains technicians and farmers who will directly apply the know-how to the farm.

NIA whose main function is to supply irrigation water now under research. It undertakes water management and study of land classification, irrigation extension and agro-economic research.

The Bureau of Plant Industry (BPI) carries the research and field trials on rice, and other field legumes, vegetables, fiber, beverage, spices, ornamental plants and others. The BPI carries out the work with regard to climatic condition, cultural practices and control of plants pests and diseases. The Bureau of Animal Industry helps to dessiminate animals and increase animal production. The Bureau of Agricultural Extension (BAEx) maintains extension work.

Private agency whose motive is either personal or help government in food production campaign found themselves involved and can not just ignore research like the chemical dealers and corporate farm.

Ultimately, the research effort would be meaningful and effective through better technology transfer and bridge the wide productivity gap between experiment station and farmers fields. Technology dissemination is carried out by efficient BAEx and BPI personnels and other private sectors like the bankers whose function are alike.

BAEx is responsible for the improvement of rural life through strengthening of agricultural extension and dissemination of useful and practical information on agriculture, soil conservation, livestock, home economics and rural life through field demonstrations, lectures, and other means of imparting information. This extension work is completed by BPI on giving knowledge on plant care, insects and disease control and others.

In ten municipalities covering the irrigation development area, seven (7) Irrigators' Service Associations (ISAs) undertake the seed production project (total area: 2.75 ha) which serves also as well for the demonstration farm according to the FSDC's (Farm Systems Development Corporation) development scheme. Under the Masagana-99 program, there exist 85 production technicians or extension workers. (see Table 2.19)

2.8.5 Farmer's Organization

In the national development scheme, the government has been stepping up efforts to organize farmers into cooperatives or associations. As a result, some kind of farmer's organization was established in almost every province, municipality and barangay in the country.

In ten municipalities covering the irrigation development area, there exist the following farmer's organizations:

- Communal Irrigation Association (CIA):

  Group of farmers based on community systems. The main objective is to erect some kind of temporary structure to divert water from a river or stream adjacent to their land. The irrigation systems are owned, operated and maintained by their own funds.

  · No. of Units: 25
  · No. of member: 4,815

- Agrarian Reform Beneficiaries Association (ARBA):

  Homogenous organization of agrarian reform beneficiaries. In order to achieve total development of its members. ARBA intends to provide socio-political support to all components of the agrarian reform program. The close linkage with the Ministry of Agrarian Reform is established.

  · No. of Units: 64
  · No. of member: 2,279

- Irrigation Service Association (ISA):

Farm-based organization set up for the operation of small-scale (1,000 ha and below) pump irrigation system. The program aims to provide production, processing and marketing assistance. The Farm Systems Development Corporation (FSDC) takes the responsibility of its institutionalization.

· No. of Units: 13
· No. of member: 1,382

- Compact farm:

Voluntary groupings of small individually-cultivated farms. A compact farm normally consists of from 30-50 ha. This is under the agency of the Masagana 99 production program. A compact firm's role in the marketing of rice is similar to that of an AMC.

· No. of Units: 34
· No. of member: 3,602

- Corporate farm:

Managed by private corporations having a minimum of 500 employees. The main objective is the provision for the cereal needs of the companies employees. The overall supervision of the program is handled by the NFA.

· No. of Units: 3
· No. of member: 6,050 (total No. of employees)

- Area Marketing Cooperative (AMC):

Group of farmers residing in proximity with each other within a geographic unit (barangay) organized by the local government as a cooperative association to attain marketing and production efficiency. At present, the AMC plays a major role in serving as an agent through which farm product is bought by the NFA at the set support price.

· No. of Unit: 1
· No. of member: No available data

- Kilusang ng Bayan:

Group of economically viable Samahan Nayon pooling their resources together to organize the AMC. This organization aims to obtain financing assistance for the purpose of agricultural supplies and inputs through the channel from the Cooperative Developing Loan Fund (CDLF), the Cooperative Marketing System of the Philippines (CMSP), the AMC to Samahang Nayon.

· No. of Units: 8
· No. of member: No available data

- Samahang Nayon:

Farmer's organization the most important in terms of geographical coverage and size of membership. Composed primarily of some 25 to 200 farmers and other rural workers. Being a barrio-based organization, its specifically aims to educate the tenant-farmers on saving and different aspects of organization.

· No. of Units: 139
· No. of member: 10,169

The Kilusang Kabuhayan at Kaunlaran (K.K.K.) or national livelihood program was lately adopted as a current priority program. To set this program in motion the national government allocated ₱1 billion. The nation-wide movement aims to achieve the followings:

(1) To promote attitudes in the communities, especially in the countryside;

(2) To encourage people to use their local resources effectively for livelihood activities;

(3) To promote the establishment of viable local productive enterprises in every town;

(4) To mobilize existing financial program

These farmers' organizations do not compete nor contend each other, even though they seem to have similar legitimate objectives in the same area. Their organizations are vertically set up with a view to answer to needs of the farmers in various types and levels.

However, many inconveniences and problems experienced by farmers are pointed out. At first, most programs lack an integrated approach in transferring modern technology as well as extending financial assistance to the farmers. Traditional banking system and credit sources are easily available from government banks with extensive branch networks, rural banks and private development banks, while technology transfers are separatedly carried out by government and private research institutions.

Secondly, farmers are periodically faced to extreme natural calamities, usually beyond their means of control: i.e. typhoon, floods, prolonged drought and heavy infestations of rats, pests and diseases. In the Phase XV of Masagana 99, total area affected by typhoons was 11,952 ha and around 8,264 ha was completely damaged. Thirdly, farmers complain of the weak farmers' organization whereby they have sesious operational and financial troubles. At all events, farmers want to be delivered on schedule the agricultural inputs (seeds and fertilizers), crude oil for the irrigation pumps (or irrigation water), etc.

Furthermore, it is noticed that the terms of loan are too severe for them to repay. This is the reason why the farmers don't want to avail of the loan mainly due to the short term of repayment which is for one cropping season only. This default can be seen in the results of the Masagana 99. The number of farmers with credit is only 1,324 against 21,889 farmers without credit or 5.7% of the total participants in Masagana 99, Phase XV (see Table 2.20).

The problems or constraints that farmer's organization encountered for rice production could be summarized as follows:

(1) Natural calamities

- Bad weather conditions (drought, floods, etc.)
- Typhoon
- Rat infestation
- Incidence of pests and diseases

(2) Organizational and personnel constaints

- Weak farmers' association, cooperative activity and development
- Lack of trained members

(3) Financial and physical constraints

- Tight credit limitations of financial institutions
- Lack of funds to pursue the plans and programs
- Lack of funds for training and logistic support
- Inadequate irrigation and drainage facilities
- Poor conditions of market roads
- Inadequate rice driers during wet season harvest

2.9 Processing and Storage Facilities

The number and capacity of rice mills and warehouses in the irrigation development area are shown in Tables 2.21, 2.22 and 2.23. The total number of rice mills amounts to 107. The milling capacity is estimated at about 460 tons per day of which value would be sufficient at present output. However, present processing facilities except the one owned by the NFA are so old that the NFA has encouraged to upgrade these facilities. The total number of warehouses is 64. The total capacity is around 50,000 tons which would be sufficient at present output.

2.10 Marketing and Prices

2.10.1 Marketing of Agricultural Output and Inputs

(1) Marketing Structure of Rice

There exist three kinds of marketing channels for rice distribution from farmers to consumers. (see Fig. 2.9) The one is the channel from the National Food Authority (NFA), the government agency charged primarily with price and supply stabilization, and the overall marketing phase of cereal industry. The NFA procures paddy or rice from farmer-producers in quantities at government support price (see Table 2.24) through the following several systems.

1. Direct Procurement - Procurement transaction between the NFA procurement teams and the farmer-sellers without intermediaries or middlemen.

2. Procurement through Quedan Financing Program - The farmer simply deposits his harvest to a bonded warehouse and in turn issued a negotiable receipt called "quedan" as proof of absolute ownership of the goods which can be pledged by cereal trading for commodity loans with the authorized lending banks. The deposited goods can be sold to another party by mere transfer of possession of the guedan with the need of withdrawing the items.

3. Procurement through Payment-in-kind - The NFA has entered into agreement with the various financial institutions and other government agencies that lend out financial and material help to farmers whereby the farmers deliver their produce to NFA as their payment-in-kind for the loans with respective agencies. This scheme is designed to ensure loan repayments under the Masagana programs, and at the same time develop an efficient marketing system that enables the farmer-borrowers to dispose their farm produce at favorable prices.

Rice procured by NFA is delivered to consumers through its own selling agencies (Kadiwa Centers).

The NFA is the sole authorized exporting agent. The main determinant of export volume is the available in-country surplus after reserving a quantity equivalent to 90-day buffer stock level. The volume comes from existing NFA inventory as well as those purchased from the private sector.

The second one is the channel through farmer's cooperative: Area Marketing Cooperative (AMC) and Farm Cooperative Marketing Association (FACOMA), etc. These organizations are composed of small farmers. The farmers deliver to the AMC or FACOMA which in turn sells to its supermarkets or Kadiwa Centers (stores selling essential food items at much lower prices than the ordinary outlets) or direct to consumers.

The third one is the commercial channel through middlemen; Local assemblers, millers, warehousemen, wholesalers, viajeros (merchant-truckers), retailers. In the irrigation development area, there exist about 400 rice wholesalers and retailers (see Table 2.25). To sum up, rice distribution in Philippines leads through the general levels of markets: (1) local assembly market, (2) regional assembly or transit market, (3) terminal market (Manila) and (4) export market.

About 10 to 15% of total market rice is through the channel of the NFA and the remainder through commercial and other organizations.

(2) Balance of Supply and Demand of Rice

For the rough estimation of marketable surplus of rice in Pampanga province, balance of demand and supply of rice is examined from 1970 to 1979 on the basis of following assumption.

1) Waste and seed requirement are taken as 10% of total production of paddy,

2) Milling recovery rate from paddy to rice is 1:0.63,

3) Annual per capita consumption of rice is 120 kg taking into consideration of results of farm economic survey/1 and food consumption patterns survey/2.

The results are shown in Table 3.3.10 in Appendix I. Pampanga province is the middle producer with 146,000 tons of paddy in 1979, but classified as a deficit province with its population of 1,150,000. The shortage of rice reaches about 50,000 tons on average from 1977 to 1979. This shortage of rice is made up with the supply mainly from Nueva Ecija province which produces around 50% of total paddy production in the Region III. The marketable surplus of rice in the Region III except Zambales province are estimated at about 60,000 to 130,000 tons. It is considered that most of these marketable surplus of rice has been inflowed into Metro Manila through the said channels: NFA (Government), Farmer's Cooperatives and Commercial.

Table 3.3.11 in Appendix I shows the amount of rice inflows into the NFA, Metro Manila. The total amount in 1979 is about 90,000 tons of which about 1.22% or 1,100 tons is derived from Pampanga province.

/1: About 150 kg of annual per capita consumption is obtained from questionnaire survey for about 100 farmers.

/2: Food consumption patterns by staff of special study and division and the NFA, March 1980.

Supposing that the NFA treats the rice of 15% of total marketed rice in Metro Manila, total marketed inflow into Manila is estimated at about 600,000 tons through all channels. On the other hand, the amount from Pampanga province is estimated at 7,320 tons of rice.

In the irrigation development area, the paddy production is estimated at about 30,500 tons (19,200 tons in rice) which represent about 20% of the total rice production in Pampanga province. From the population (104,700) in 1980, the marketable surplus of rice in the irrigation development area is estimated at 6,600 tons. This surplus is considered to inflow into the area around the irrigation development area as well as Metro Manila.

(3) Distribution of Agricultural Inputs

Some 1,300 tons of paddy seed are used in the irrigation development area. These amounts of seeds are obtained by retention from the farmer's production. In addition, the rice farmers get the registered and/or certified seed from seed growers under control of the Bureau of Plant Industry, but less than seven (7) percent of total rice seeds planted are certified. Non-certified seeds make rice plants lodge as a result of improper fertilizer absorption. The number of seed growers is 13 in the irrigation development area. Fertilizers and agricultural chemicals are distributed to the farmers by 23 dealers (see Tables 2.26 and 2.27).

2.10.2 Prices of Agricultural Output and Inputs

For the economic evaluation, the estimation of economic prices for rice and fertilizer is examined on the basis of the information obtained from the governmental agencies and the some publications/1. The economic farm gate prices are as follows:

Economic Farm Gate Price

Year	Paddy	Fertilizer		
		N	P	K
	(₱/t)	(₱/kg)	(₱/kg)	(₱/kg)
1980	1,490	5.2	5.6	2.9
1985	1,870	6.2	7.4	3.1

The economic and financial prices for rice and fertilizers are shown in Tables 2.28 and 2.29.

/1: Price Prospects for Major Primary Commodities prepared by the World Bank and Philippines Estimates of Shadow Prices and Country Parameters prepared by the World Bank.

2.11 Farmer's Economy

2.11.1 Farm Economic Survey

In order to grasp economic activities of farmer in the irrigation development area, farm economic survey was carried out for sample farm households selected by random sampling method.

Procedure of survey and analysis is as shown on Fig. 2.10. Sample size for the survey was decided by following expression:

$$n = \frac{[Z\alpha(\delta/\bar{x})]^2}{\varepsilon^2}$$

where, n: sample size
α: alpha risk (0.1)
$Z\alpha$: normal deviate (1.645)
ε: error rate (0.1)
$\delta/\bar{x}$: coefficient of variation (0.60)/1

According to the above calculation, 114 samples are considered to be enough but the survey was conservatively made on 140 samples.

Survey items and results of farm economic survey are as shown in Table 2.30 to 2.33.

2.11.2 Farmer's Economy

Based on the survey results, analysis of farm economy for typical farmer is made for lessees having typical farm size of 1.5 ha. According to the land use categories, typical farmer is categorized further into three types: single cropping of rice per annum under rainfed condition, single cropping or rice per annum under irrigated condition and double cropping or rice per annum under irrigated condition. Farm budgets for three types are prepared as shown in Table 2.34 and summarized below.

/1: For coefficient of variation in the irrigation development area, no data are available. It was assumed at 0.6 conservatively.

(Unit: ₱1,000)

Item		Single Crop of Paddy (Rainfed)	Single Crop of Paddy (Irrigated)	Double Crop of Paddy (Irrigated)
I)	Gross Income	13.8	14.4	18.6
	- Farm income	4.8	5.5	10.5
	- Off-farm income	9.0	8.9	8.1
II)	Gross Outgo	13.8	14.4	18.6
	- Production cost	3.4	4.0	8.2
	- Living expenses	10.4	10.4	10.4
III)	Net Reserve (I - II)	0	0	0

Living expense of typical farmer having family size of 7.1 persons is estimated at about ₱10,400 per household on the basis of the results of analysis for living expense per a person by farm size category as shown in Fig. 2.11.

The study on farm budget makes it clear that economy for the typical farmers in the irrigation development area remains on the subsistence level. The characteristics on the farm economy are summarized as follows:

i) About half of the gross income is derived from off-farm incomes consisting of wage earning from farm work and non-farm work and remittance from their family working at Metro Manila or abroad.

ii) More than 80% of the gross farm income is derived from paddy production. Farm income from diversified crop production and animal husbandry are very limited.

iii) In spite of sufficient family labor, farming such as transplanting, harvesting and threshing, which requires much labor requirement, has been traditionally carried out by hired labors. This fact reflects increasing production cost. Production cost of paddy occupies about 80% of the gross farm income.

iv) From the standpoint of productivities of labor and land, such productivities of the farmers in the project area are low, indicating ₱15 per/1 family labor and ₱823/2 per ha, respectively.

/1: Productivity of labor on an average of 3 typical farmers
= Net farm income except livestock/Input of family labor
= ₱1,234/80 man-days = ₱15/man-day

/2: Productivity of land on an average of 3 typical farmers
= ₱1,234/1.5 ha = ₱823

2.12 Farmer's Intention

In order to clarify farmer's intentions for improvement of present farm management, survey was carried out for 140 farmers. The ranking on the following seven items was given from 1st to 7th by each farmer through the survey.

a. To acquire irrigation water
b. To drain excess water
c. To prevent pests and diseases
d. To introduce mechanization for deducting farm labor
e. To get high yielding variety
f. To get proper fertilizer in volume and at the right time
g. To improve farm road for transportation of farm products

The summary of results is shown in Table 2.35, which indicates that about 90% of farmers in the irrigation development area put stress on acquiring irrigation water, followed by prevention from pests and diseases and drain out of excess water.

In addition farmer's intention survey on double cropping of rice and irrigation fee was done. Supposed that irrigation water becomes available for both wet and dry seasons and drainage conditions also become well in wet season after implementation of the project, the following question was made for the said farmers.

1. Do you pay 6/1 cavans of paddy equivalent per ha as irrigation fee for each season?

2. Do you carry out double cropping of paddy per year?

As a result, over 95% of farmers answered "yes".

It is concluded from the results that double cropping of rice per annum under year round irrigation would be easily introduced in the irrigation development.

/1: Present irrigation fee per ha prevailing in the National Irrigation Systems that is 2 cavans in wet season paddy and 3 cavans in dry season paddy, is equivalent 5 to 6% of unit yield in the project area. Six cavans is about 5-6% of target unit yield in this project.

CHAPTER 3 AGRICULTURAL DEVELOPMENT PLAN

3.1 General

3.1.1 Basic Concept for Development

The basic concept for agriculture and irrigation development in the irrigation development area is set to increase rice production by increase of unit yields of paddy and expansion of irrigated land as following reasons.

(1) Rice Marketing in Metro Manila

As studied in section 3.3.6, Appendix I, Region III except Zambales province is one of the rice supply bases to Metro Manila supplying about 25% of the total consumption of rice in Metro Manila at present. The population of Metro Manila will increase with high growth rate year by year and the demand of rice in Metro Manila will subsequently increase. This fact indicates that Region III except Zambales will be expected to keep the role of rice supply center to Metro Manila for the projected future. Demand of rice in Metro Manila in the target year of 2000 is estimated 1,140,000 tons. Supposed that the share of rice supply from provinces to the total demand of Metro Manila is kept to be about 25% as present, amounts of rice to be supplied by region III except Zambales will account for 285,000 tons of rice in the target year. On the other hand, marketable rice produced in the Region III except Zambales province is estimated at about 112,400 tons in the target year. The difference between supply and demand in rice reaches 172,600 tons of which value indicates that the incremental rice production made by new irrigation projects will be able to find out in the market of Metro Manila. The irrigation development area will be expected to play an important role in supply of rice to Metro Manila.

(2) Farmer's Economy

In view of farmer's economy, the farmers in the irrigation area get their incomes from farming activities, mainly from rice cultivation. Farm income, however, is low due to low production and net reserves for the farmers are negligible small. The farmers in the area are familiar with paddy cultivation and have superior ability for irrigation farming. Farmer's interview survey indicates that they have strong intention to produce paddy whenever provision of available irrigation water were permitted.

(3) Price of Rice

The ceiling price and floor price of rice are set by the Government and the price of rice is stabilized by the National Food Authority. It is expected that stabilization of price will be continued in the future. On the contrary, price of common crops other than rice is not stabilized. The farmer's interview survey indicates that most of individual farmers do not want to cultivate other common crops if irrigation water is available. Further, rice is the one of the highest crops in profitability.

(4) Increase of Employment Opportunity

About 70% of the total labor force from farmers and landless workers is estimated to be in unemployment in the irrigation development area. Introduction of intensive irrigation farming will be expected to reduce unemployment of the said people.

3.1.2 Strategy for Development

For the purpose of increase of rice production, strategy for agriculture and irrigation development are formulated as follows:

- To introduce improved irrigation farming practice
- To provide irrigation facilities supplying perennial irrigation water
- To provide drainage facilities

3.2 Proposed Land Use

The irrigation project, Diversion Dam Scheme or Pump Scheme, will provide bases to increase unit yield of paddy and rice production through the implementation of irrigation and drainage facilities.

After the implementation of the project, present land use conditions will considerably change. Two thousands (2,000) ha of rainfed paddy field, one hundred (100) ha of grassland and eight hundreds (800) ha of swampy area will convert into the irrigated paddy field. Eight thousand and one hundred (8,100) ha of existing irrigated land including Octobarial paddy area will be completely or mostly irrigated in both wet and dry seasons. Four hundreds (400) ha consisting of rainfed and irrigated paddy field, however, still remain as what it is. One thousand (1,000) ha of paddy field and one hundred (100) ha of swampy area will convert to the land for the right of way for newly installed irrigation and drainage facilities. The land use at present and future with project conditions is shown in the following Tables.

Present Condition	Area (ha)	Future Project Condition	Area (ha)
Rainfed paddy field	2,300	Irr. paddy field/1	2,000
		Right of way/2	200
		Rainfed area/3	100
Irr. paddy field	9,200	Irr. paddy field/1	8,100
		Right of way/2	800
		Irr. land/3	300
Grassland	100	Irr. paddy field/1	100
Swampy area	900	Irr. paddy field	800
		Right of way/2	100
Village/Road/ Rivers/Others	1,500	Village/Road/Rivers/ Others	1,500
Total	14,000		14,000

The summary of land use in future project condition is as follows:

Land Use Category	Area (ha)
1) Paddy field	11,400
- Irrigated land under the project	11,000
- Existing irrigation area and rainfed area/3	400
2) Right of way	1,100
3) Village, road, rivers and others	1,500
Total	14,000

/1: Irrigated land under the project

/2: The right of way for the land where new irrigation facilities are installed.

/3: The rainfed and irrigated lands which are not covered in the project.

3.3 Proposed Cropping Pattern and Farming Practices

3.3.1 General

As mentioned in section 2.6.1, the countermeasures to the present constraints for increase of paddy yield in the irrigation development area are considered as follows;

- To supply sufficient irrigation water on time in accordance with the water requirement for growing stage of paddy
- To drain excess water
- To prevent damages caused by insects and diseases
- To increase the application amount of nitrogenous fertilizers
- To timely supply nitrogenous fertilizer by split application method
- To provide sunny weather for ripenning period of rice plant

Taking into consideration of the above countermeasures, the proposed cropping pattern and farming practices are studied in the irrigation development area.

3.3.2 Proposed Cropping Pattern

The basic concept for agricultural development for the irrigation development area is to increase rice production. It is proposed that double cropping of paddy per annum will be practiced under proper irrigation and drainage facilities. The proposed cropping calendar is framed as shown in Fig. 3.1, taking into consideration the following conditions: climate, irrigation water supply, agronomic characteristics, etc.

The climatic condition of the irrigation development area is favourable for paddy cultivation in view of high temperature, high relative humidity and sufficient sunshine hours. Since there is no limiting or adverse factor for germination of seed and reduction division of paddy because of low or high temperature throughout the year, seeding of paddy can be practised at any time. However, setting of harvested period is considered so as to exclude the period with high rainfall intensity and long rainy days for the smooth operation of harvest and processing. Plantphysiologically important factor for attaining high yield of paddy is how to increase the photosynthetic efficiency of the rice plant. Critical growth periods in terms of sunlight requirement are about 15 days just before heading and about 25 days just after heading. The framework of cropping calendar should be designed so as to get sunny weather during these periods as much as possible. Furthermore, special attention was paid on expansion of irrigable area as much as possible, taking into consideration the balance of consumptive use of rice plant and effective rainfall and river discharge available for irrigation water.

Annual cropping areas of the Diversion Dam Scheme and the Pump Scheme are determined as follows:

	Diversion Dam Scheme	Pump Scheme
I) Cropping Area (ha)	22,000	18,700
1) Paddy	22,000	18,300
- wet season	(11,000)	(11,000)
- dry season	(11,000)	(7,300)
2) Diversified crop	-	400
II) Farm Area (ha)	11,000	11,000
III) Multi-cropping Index (I/II)	2.0	1.7

The multi-cropping index is estimated at 2.0 for the Diversion Dam Scheme and 1.7 for the Pump Scheme.

3.3.3 Proposed Farming Practice

Proper farming practices is the most essential factor for realizing full exploitation of the agricultural potentiality in the area. For the purpose high yielding and/or improved varieties will be introduced. Proper amount of fertilizer and chemicals will be applied through proper farming practices with project condition. It is, however, expected that there will be no substantial changes in farming practices and farm input for future without project conditions. The farm inputs and design criteria for irrigation farming in with project condition are shown in the following table.

Design Criteria of Proposed Farming Practices for Paddy with Project

1.	Varieties	IR series
2.	Growing period	130 days
3.	Amount of seed	60 kg
4.	Nursery period	15 - 20 days
5.	Area of nursery fed	1/20 - 1/25 of paddy field
6.	Land preparation	One time of ploughing, and three times of hallowing-leveling

7.	Planting method	Transplanting
8.	Planting density	30 cm x 15 cm, 3 seedlings per hill
9.	Planting depth	Within 3 cm from the surface
10.	Fertilization	
	Nursery bed	2 kg of N/ha
	Paddy field	- 68 kg of N/ha and 20 kg of P/ha for wet season paddy
		- 88 kg of N/ha and 20 kg of P/ha for dry season paddy
	Time in paddy field	
	All P	Basic dressing
	35% of N	Basic dressing at transplanting time
	25% of N	First top dressing at two weeks after transplanting time
	40% of N	2nd top dressing in the late period of young panicle formation stage
11.	Application of chemicals	2 ℓ/ha
12.	Weeding	Two times about 25th and 50th day after

Labour, animal power and mechanical power requirements with and without project are estimated as shown in Table 3.1 and 3.2. Out of total labour requirements of 125 man-days per ha with project for paddy cultivation, about 50% or 63 man-days will be occupied by hired labour.

Based on the proposed cropping pattern, farming practices and labor requirement per ha of each crop, monthly labor requirement with project condition is estimated in the entire irrigation development area as shown in Table 3.3. The peak of labor requirement is estimated at 358,000 man-days in June, 338,000 man-days in October and 376,000 man-days in November for the Diversion Dam Scheme and 337,000 man-days in November for the Pump Scheme. On the other hand, labor force available in the irrigation development area is estimated at 336,000 man-days/month as shown in Table 2.3. As a result, shortage of labor force occurs 2,000 man-days to 40,000 man-days for the Diversion Dam Scheme and 1,000 man-days for the Pump Scheme. This shortage of labor force would be supplemented by landless workers around the irrigation development area.

3.4 Anticipated Yield and Production

3.4.1 Anticipated Yield

Unit yields of farm crops are estimated both for future without and with project conditions.

Unit yield of farm crops without project condition is estimated on the basis of past trend of unit yield presented in Appendix I. It is expected in future without project that yield of paddy will increase 0.2 ton per ha more than present unit yield. As for the yield of diversified crop, the trend shows decreasing or no tendency. Accordingly, unit yield of diversified crop without project is set as same value of present unit yield.

Unit yield of farm crops in future with project condition is estimated on the basis of the results of yield survey on well irrigated paddy field in and around the irrigation development area, the experimental data of the Maligaya Rice Research and Training Center and the International Rice Research Institute and the past data of Masagana-99 program.

The expected unit yield of crops in without and with project conditions is estimated as follows:

	Without Project	With Project
Irrigated Paddy		
- Wet season (t/ha)	2.36	4.5
- Dry season (")	2.62	5.0
Rainfed Paddy (")	2.07	-
Diversified Crop (")	0.40	0.40

For the achievement of the anticipated yield, optimum application of farm inputs will be required together with effective water management.

The yield will increase gradually from the present level and reach the target yield in the 5th year after the completion of the irrigation and drainage facilities.

3.4.2 Crop Production

Total production of the farm crops is estimated by multiplying the anticipated unit yield with the future cultivation area for both future without and with project conditions.

Production of paddy for future with project condition is estimated at 104,500 tons for the Diversion Dam Scheme and 86,000 tons for the Pump Scheme, as shown in Table 3.4.

3.5 Marketing of Rice and Processing and Warehouse Facilities

A marketable rice in the irrigation development area after the implementation of the irrigation project is estimated based on the following assumptions.

a) Population in the irrigation development area will increase at 2.09% per annum.

b) Waste and seed requirement are taken as 10% of total production.

c) Milling recovery rate from paddy to rice is 63%.

d) Per capita consumption of rice is assumed at 120 kgs per annum.

In the target year of 2000 the marketable rice will be expected about 30,000 tons for the Pump Scheme and 40,000 tons for the Diversion Dam Scheme as follows:

	Pump Scheme	Diversion Dam Scheme
Population in 2000	158,300	158,300
Rice requirement in 2000 (ton)	19,000	19,000
Total production of paddy (ton)	86,000	104,500
Waste and seed requirement (ton)	8,600	10,500
Total production of rice (ton)	48,800	59,200
Marketable rice (ton)	29,800	40,200

As for present processing and warehouse facilities of rice, milling capacity of rice and warehouse capacity are estimated at 460 tons per day and 51,000 tons, respectively. Supposing that working days for milling are 210 days in the year, about 97,000 tons of rice can be milled by the present milling facilities which indicates sufficient milling capacity for rice production in the future with project condition. Further warehouse capacity is also sufficient for the said rice production.