

ANNEX C

Agriculture and Agoro-economy

ANNEX-C

AGRICULTURE AND AGRO-ECONOMY

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ATTACHMENTS

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C.1 Physical and Social Features

C.1.1 Administrative Division and Population

(1) Administrative Division

In Punjab province, there are one Metropolitan Corporation in Lahore, 7 Municipal Corporation, 73 Municipal Committees, 137 Town Committees and 2,481 Union Councils as of July 1994. The Study Areas comprise 9 districts in total. The Lower Jhelum Canal System extends over Sargodha and a part of Jhang district. The Lower Chenab Canal System comprises 6 districts, namely Faisalabad, Toba Tek Singh and a part of Jhang, Sheikhupura, Hafizabad and Gujranwala. The Central Bari Doab Canal System (C.B.D.C.) are located in Lahore district and a part of Kasur district.

(2) Population

Since Population Census survey has not been conducted after 1981 Census, the data on the present situation of population are not available. The population in 1996 is estimated based on the trend during 1972 to 1981. According to this estimation, the total population of the three study areas is about 21.1 million persons, which accounts for 28.7% of the total population in Punjab province. Of this amount, about 52% or 11.0 million people lives in urban area and 48% or 10.1 million live in rural area. The annual population growth rate in urban area is higher than that in rural area, which indicates migration from rural to urban area. The estimated population for 1996 for each area is summarized below. (Details are shown in Table C.1.1-1)

		('000 persons)		
		Total	Urban	Rural
Lower Jhelum	Population	3,241	1,020	2,221
	Growth Rate*	2.35%	3.67%	1.93%
Lower Chenab	Population	10,380	4,444	5,935
	Growth Rate	1.70%	4.29%	0.78%
Central Bari Doab	Population	7,496	5,512	1,984
	Growth Rate	3.42%	3.52%	3.15%
Total	Population	21,117	10,977	10,140
	Growth Rate	2.31%	3.81%	1.33%

*: Growth rate is calculated for the period of 1972-1981.

Source: Bureau of Statistics of Punjab, 1995

The number of households in 1981 census was 2.1 million for three study areas and the average household size was 6.6 persons. Most populated area among three study areas was C.B.D.C. area where the estimated population density including urban area was 1,922 person/km². On the other hand, those in LCC and LJC are 616 and 451 persons/km² respectively.

According to the farm survey conducted by JICA Study Team, literacy rate is 45% for overall in the project areas. Among illiterate people, more than half of them are from small and marginal farm family, which implies that farmers will have better opportunity for education as the farm size become larger. The literacy rate for female is about 25.5% which is much lower

than the rate of 61.0% for male. This fact implies that female have less opportunity for education.

C.1.2 Land Holding and Tenure

Table C.1.2-1 shows the tenure classification of farm and farm area obtained through the Census of Agriculture 1990 and it is summarized as below.

Size of Farm (acre)	The Punjab		Districts*1 in The Project Area	
	Number of Farmers	Farm Area (acre)	Number of Farmers	Farm Area (acre)
under 1.0	202,703	96,588	29,012	14,886
1.0 to under 2.5	545,984	868,656	130,815	211,614
2.5 to under 5.0	593,996	2,043,855	165,840	576,537
5.0 to under 7.5	499,571	2,919,017	153,662	903,148
7.5 to under 12.5	507,345	4,868,247	163,064	1,575,633
12.5 to under 25.0	405,502	6,504,344	100,128	1,628,666
25.0 to under 50.0	147,158	4,558,882	34,471	1,065,509
50.0 to under 150.0	48,4243	3,400,890	11,400	794,724
150.0 and above	6,699	1,846,871	1,319	326,158

Size of Farm (acre)	The Punjab		Districts*1 in The Project Area	
	% of Farmers	Farm Area (%)	% of Farmers	Farm Area (%)
under 1.0	6.9	0.4	3.7	0.2
1.0 to under 2.5	18.5	3.2	16.6	3.0
2.5 to under 5.0	20.1	7.5	21.0	8.1
5.0 to under 7.5	16.9	10.8	19.5	12.7
7.5 to under 12.5	17.2	18.0	20.6	22.2
12.5 to under 25.0	13.7	24.0	12.7	22.9
25.0 to under 50.0	5.0	16.8	4.4	15.0
50.0 to under 150.0	1.6	12.5	1.4	11.2
150.0 and above	0.2	6.8	0.2	4.6

Source: Census of Agriculture 1990, Punjab Province Report

*1: Lahore, Kasur, Gujranwala, Sheikhpura, Faisalabad, T. T. Singh, Jhang, Sargoda

From the point of view of agricultural economy, land ownership was organized into four categories, namely marginal (up to 6.25 acres), small (6.25-12.5), medium (12.5-25.0) and large (above 25.0). Based on the data of the Census of Agriculture 1990, approximately 789,711 sample farmers live in and around the Study area and more than 81 % of them cultivate less than 12.5 acres, while their share of agricultural land is limited to 46.2 % of the total. It suggests that the majority of farmers are categorized into the marginal or small scale. The average holding size of agricultural land in and around the Study area is about 9.0 acres. According to the result of the Farm Survey, the average landholding size under irrigation ranged between 3.89 to 23.3 acres in four categories. Their distribution is as follows: marginal; 3.9 acres, small; 7.0 acres, medium; 12.3 acres and large; 23.3 acres.

According to the Farm Survey, in terms of land tenure, owner proprietors were in the highest proportion (68.2 %), followed by owner-cum-tenants (21.8 %). The proportion of tenants (7.5 %) was rather low and the incidence of lease arrangements was negligible. The normal tenancy arrangement is based on a 50:50 sharing agreement.

Although existence of landless farmers is reported, no statistical data on this subject is available. According to the interview at farmers meeting and interview with the local government offices, about 50% of total farm household is considered as landless farmers. In many cases, they engage in livestock raising and/or work as farm labor under the large scale famers.

C.2 Agriculture

C.2.1 General

The Punjab province has a total area of 20.63 million ha of which about 12.1 million ha (39 %) is cultivated and about 10.7 million ha (89 %) is irrigated by gravity canal and tube well irrigation, whereas the remaining 11 % is rainfed land. The total irrigated area in the Punjab province is accounts for about 75% of the total area irrigated (17 million ha) in Pakistan. The Gross Command Area (GCA) in the Study area is estimated at 2.4 million ha and Present Cultivable Command Area (CCA) is estimated about 2.1 million ha or 87 % of GCC.

The area which have similar characteristics are termed Agro Ecological Zones (AEZs). Criteria used for defining AEZs are soils, climate, land-use, altitude, water supply, dominant crops, social infrastructure and so on. The Punjab province is divided into four (4) AEZs, namely Rice zone, Central mixed zone, Cotton zone and Barani (Rainfed) zone. The greater part of the study area is located in the Central mixed zone.

There are two seasons for cropping, namely, Kharif in summer (April-October) and Rabi in winter (October -April). Wheat which is the main subsistence crop is the major Rabi crop. The major Kharif crops varies depending on the natural and social conditions. The main Kharif crops are cotton, rice, maize and sugarcane. The Kharif crops are the main cash crops the Study area.

C.2.2 Land Use and Cropping Pattern

(1) Present Land Use

The table given below provides a graphical representation of the major land use within the Punjab province.

Land Use Class	Area (1,000 ha)
Agricultural Land	
Irrigated	10,743
Rainfed	1,316
Rangelands	
Degraded	4,466
Non-degraded	1,293
Forest/Trees	608
Barren Land	
Rock, gravel	337
Desertic	1,324
Water bodies	477
Urban	62
Total	20,626

Source: Punjab Forestry Sector Master Plan (1992)
Agricultural Research Phase-II Project (1995)

The land in the Punjab province is mainly used for crop production, rangelands, forest, barren land and residential area depending on the geographical position, soil properties and irrigation water availability. Irrigated cultivated area is the dominant land use in the area, which spreads along the irrigation canals.

Table C.2.2-1 shows the GCC, CCA and cultivated area in the Study area. The cultivable command area is estimated at about 2,116 thousand ha. The total area cropped is 2,711 thousand ha, of which 595 thousand ha is double cropped in the Study area. The crop intensity is estimated at about 128 %. Put another way, more than 30 % of CCA are left uncultivated through the both seasons. In sufficient water was given as the main reason for un-cultivated areas, establishing water supply less than its demand.

Agriculture in the area depends on irrigation. The total irrigated area in the districts which cover the Study area 6.4 million acre or 97 % of the total cultivated area (see Table C.2.2-2). The canal irrigation system was built to accommodate a cropping intensity 66 %, about half of the current cropping intensity. The table shows that the 1.8 million acre or 28 % of total irrigable land depends on the only canal for irrigation water. It suggest that the tubewells play an important role in irrigation farming in the area.

The cultivable wastelands which due mainly to waterlogging and severe salinity.

(2) Salinity and Waterlogging in the Farm Land

The farm land of Irrigated soils in Pakistan suffer from problems of soil salinity, sodicity or both. These soils are agriculturally problem soils which require special remedial measures and management practices. WAPDA in a country wise soil salinity survey assessed this agricultural problem and quantified it. Evidently, approximately 16 % of the surface soil in the Punjab province is suffering in varying degrees (from slightly to miscellaneous) and 27 % of the soil profiles were found saline. According to the results of soil survey showing status of soil salinity at the surface, carried out by the Directorate of Land Reclamation, PID out of 2,400 thousand ha surveyed in the Study area, approximately 13 % were found to show salinity and 0.3 % were found to be water logged. The yield data of crops grown in these saline area are not available. According to the results of research carried out by the University and the Research Stations, the percents of yield decrease which vary from crop to crop range from 10 % to 50 % .

Salinity and waterlogging have a close relation with the irrigation water. As the water table rises capillary action pushes salt up to the surface. If irrigation farming continue without any special remedial measures and management practices, thereby reduction of production and productivity of crops will occur in the future. As a result, the irrigated farm land will be ruined by the salinity and waterlogging.

(3) Cropping Pattern

The major part of the Study area belong to the Central Mixed Zone, while almost all the area in both of Gujranwala and Sheikhpora districts is in the Rice Zone. The major crops grown in the Study area are divided into two major cropping seasons of Pakistan, Rabi and Kharif.

The typical cropping pattern under three canal commands in the study are shown in Fig.C.2.2-1 respectively. The cultivated area classified by crops in the both cropping seasons are given Table C.2.2-3.

In the study area wheat for self-sufficiency forms a prominent part of cropping pattern in the Rabi season and, fodder is also pre-dominant crop in Rabi. The proportion of other crops like oil-seeds, and vegetables was exceedingly low. The proportion of farmers growing sugarcane in both Rabi and Kharif was low in the three canal systems. In Kharif paddy, cotton, and maize were grown in the similar proportion. However, fodder was the main Kharif crop. Other than major crops, rapeseed, grams, vegetables, were grown by a negligible portion of the farmers in the study area. It is apparent that wheat was the predominant crop for the Rabi season and fodder was the main crop for Kharif in the three canal systems.

C.2.3 Farming Practice and Agricultural Production

(1) Farming Practices

The typical farming practice of the major crops in the Study area as follows:

Wheat

Wheat is planted at the earliest during the last week of October, with the bulk of planting taking place during November, and the end of December being the latest time. Almost all farmers in the Study area were using improved varieties, among which Inqulab, Pasban and Pak 81 were prevalent. The sowing is done normally using broadcaster.

Five or six irrigations are usually applied. Fertilizer application was usually one bag (50 kg) of DAP at planting as basal, followed by one of urea at a first irrigation. This is substantially less than the recommended dose, and farmers cite unavailability and high cost as the main reasons for not adhering to recommendations. Normally farmers do not use herbicides, and weeds provide a source of fodder for the small farmers.

The major conflict in the cotton-wheat cropping pattern is the prolonged cotton harvest, which results in late planting of wheat. About half of the wheat was sown after cotton and only 30 % after fallow. Wheat planted after cotton was delayed on average 19 days compared to wheat in other rotations according the study paper. In an annual rice-wheat cropping pattern, most field are sown; an estimated 72 % of wheat in the area is now sown after rice. It is generally established that for every day's delay in planting wheat after mid-November, there is a loss in yields of about 1 % per day (Hobbs et al., 1987).

Rice

In the main rice growing area of upper Punjab, more than 90% of rice grown is of the Basmati type. The main variety now grown is Basmati 385.

The nursery is raised by the puddling method. The double ploughing with planking on standing water is carried out, and sowing takes place from mid-June for IRRI varieties until the middle or even late July for Basmati varieties. Manual transplanting is normal practice for all varieties.

Fertilizer use is substantially less than recommended doses, normally farmers use one bag (50 kg) of DAP as basal at planting followed by one bag of urea at

subsequent irrigation (roughly 25 days after sowing) as the norm, on both types of varieties. Farmers are well aware of their ability to produce higher yields if they were to use more fertilizer, their policy of sub-optimal dosage is followed because of the high cost of fertilizer and the low availability on right time.

Little or no use is made of herbicides, and given the importance of paddy weeds as fodder and shortage of alternative sources, it would seem to be low priority to use this agro-chemical. Pesticide use is common, with rice borers a frequent problem, Padan granules are used to control this.

In the Study area, the rice plant density is estimated about 130,000 plants/ha equivalent to low plant density, while the recommended rice plant density is 250,000 plants/ha. Low rice plant density can significantly reduce rice yields. Most farmers in the area are using a modest dose of fertilizer and very low plant density, indicating inefficiency in fertilizer use. Furthermore, applying high doses of fertilizer to a poor stand of rice does not significantly improve yields. The real issue facing rice cultivate farmers in the Punjab are the transplanting practice and lack of knowledge regarding the interaction between fertilizer and plant density.

Cotton

The land is ploughed once by using soil inverting plough. Then 2 - 3 times ploughings with planking each time are done normally following an initial ploughing. The sowing is done with the single row cotton drill. Before sowing, the seed is delinted with sulphuric acid.

Fertilizer levels would seem to support the theory that cotton production in this system is less than vital, farmers are applying less than one bag urea per acre, which is below the recommended doses.

Picking time is determined by maturity. The maturity is judged by the amount of opened cotton bolls, the quantity of dry leaves and moisture content of the seed cotton. Hand picking is common in the area.

Cotton Leaf Curl Virus (CLCV) is now widespread in the Study area, and almost all farmers who grow cotton face this problem. During 1990, CLCV appeared for the first time as an economic proposition. About 2,000 acres were affected by this menace. However, the disease jumped up during 1991, 1992 and 1993 by affecting 35,000 acres, 293,949 acres and 554,000 acres respectively. The affected area in turn reduced the yield.

Sugarcane

Land preparations for sugarcane are done 4 or 5 times normally following an initial ploughing. Six to eight ploughings are essential to prepare the better seedbed. Deep ploughing was sometimes part of the schedule, however not always. Planting normally takes place towards February and into March. There are two methods of sowing i. e. wet method and dry method.

Fertilizer application is varied, using often one bag of DAP as basal at planting followed by one to four bags of urea during subsequent irrigations. This is substantially less than recommended doses, and farmers reported that lack of availability and high cost were the reasons for not applying more, they were fully aware that higher levels of fertilizer would lead to better yields. Potassic fertilizer is not used. Herbicides are not normally used.

Although a number of varieties are in use such as BL-4, Triton, and BF-162, by far the most popular variety of cane is called 'India' by farmers, which is in fact CO-1148. This variety is seemingly popular because of its capacity to be ratooned 4 or 5 times, and also because of its capacity to yield well even under conditions of relative moisture stress. The cane tops of the variety stayed greener for longer, which is an additional advantage for livestock feeding, too. The problem for the industry is that the recovery rate of CO-1148 are very low, particularly in the early part of season.

The number of irrigations depends on the source and quantity of water available, however farmers aim to apply around 12-14 irrigations during the year. Irrigation is the main constraint for cane cultivation in the study area. Canal water supplies does not cope up with full water requirement of cane. Moisture stress has detrimental effect on the yield of cane. In one of the studies, a yield reduction of 11.5%, 26.5%, 48.8% was observed with irrigation stress of 20%, 40%, and 60% respectively.

Maize

Maize is grown in this region as a dual purpose crop, being for either human grain consumption or for animal fodder. The most common variety grown is Neelum. 3 - 4 ploughings with planking are done. The sowing normally takes place towards July and into August.

Farmers tend to increase the area held under maize as a replacement for cotton. The main advantage of maize is that it could be used either as a grain for sale/consumption, or as fodder, which again could either be sold or retained for domestic livestock, making it a versatile option.

Fodder

During the year, Fodder crops in the study area provide are generally grown in two seasons i. e. Kharif and Rabi which occupy about 22 % of the total cropped area. The major kharif fodder are sorghum, sadabahar, bajra and maize/mezenta. The main Rabi fodders are Berseem and Oats. A limited acreage is also covered by lucerne. The Rabi fodders i. e. Berseem and Lucerne are multicut and their regrowth occurs after every cutting.

Inspite of the availability of the high yielding varieties and hybrids of Kharif and Rabi fodders are improved production technology, the yield of fodder at the farmer's field is low. This low yield at the farmers field is due to the following reasons: using inferior quality of local types, lack of technical know-how and high cost of inputs etc.

(2) Crop Yield and Production

Average unit yields and annual production of the major crops from 1992-93 to 1995-96 are obtained from the Crop Reporting Division of DOA and given in the Table C.2.3-1. The average unit yields and annual production of major crops in and around the Study area are summarized below:

Crops Year	Area (1,000ha)	Production (1,000ton)	Yield (ton/ha)
Wheat (Irrigable)	1,681	3,589	2.13
Paddy (Basmati)	557	618	1.11
Cotton*1	205	566	2.76
Sugarcane (Irrigable)	338	13,693	40.53
Maize (Irrigable)	153	220	1.43

Source: Crop Reporting
the Study area: Lahore, Kasur, Gujranwala, Sheikhupura, Faisalabad, T. T. Singh, Jhang, Sargoda
*1: Unit bales

Wheat is the main staple in Pakistan. The Punjab produces about 73 % of National production. Rice is the second most important food cereal and export commodity. Punjab is the leading rice growing province with about 59 % of cropped area and 44 % of total production. In the Punjab, peak levels of cotton production were obtained in 1991, with about 11.4 million bales.

However, Cotton Leaf Curl Virus (CLCV) infestation increased from nil in 1989 to 0.62, 5.43 and 9.97% of the area grown in 1991, 1992 and 1993 respectively. As a result of the CLCV infestations in 1992 the area sown to cotton was decreased in 1993 and 1994. Sugarcane is the one of the most important cash crop of Pakistan. The Punjab with about 521 thousand ha under cane shared approximately 60 % of national cane acreage and about 53 % of total production.

The unit yields of major crops have not reached sufficient levels. The average yields of the major crops are lower than world average yields. The reasons are shortage of irrigation water, insufficient amount of fertilizer application, late sowing, saline soil and water, shortage of capital and credit etc. as mention above section.

C.2.4 Animal Husbandry

Farmers in and around the Study area, especially marginal and small farmers engage themselves in the livestock farming which is profitable. The landless tend to have greater proportions of goats and sheep which can make the most of free grazing, while owner farmers and tenant farmers have buffaloes and cattle. The livestock population in the Study area is summarized as below.

(Unit: head)				
Districts	Cattle	Buffaloes	Goats	Sheep
Punjab	7,665,403	10,862,581	13,809,358	8,217,739
Lahore	70,106	302,437	99,369	34,452
Kasur	153,962	504,901	219,147	113,162
Gujranwala	236,277	671,135	256,062	138,054
Sheikhupura	257,747	660,859	325,650	207,597
Faisalabad	274,575	830,807	817,622	135,311
T. T. Singh	167,713	339,981	475,719	79,086
Jhang	494,110	86,027	660,245	395,998
Sarghoda	380,608	538,308	668,877	141,047
the Study Area	2,035,098	3,934,455	3,522,691	1,244,707

Source: Census of Agriculture 1990, Punjab Province Report

36 % of the buffaroes are rised in and around the Study area in the Punjab. The proportion of other species are cattle; 26.5 %, goats; 25.5 % and sheep; 15.1 % of the total population of each specie in the Punjab.

Rabi fodder sources are berseem, lucerne, weeds from wheat and other crops field, and sugarcane tops, in Kharif, maize sorghum, and again weeds are the main sources. The main periods of fodder scarcity are May/June and December/January, before Kharif and Rabi fodder crop respectively have matured sufficiently to cut.

The maintenance feed requirements of 44.4 million animal units are 51.6 million tonnes of Total Digestible Nutrients (TDN) and 4.2 million tonnes of Digestible Protein (DP). The total available TDN and DP from fodder and other resources stands at 38.0 million tonnes and 2.5 million tonnes respectively. The net shortfall even in maintenance requirements comes 26.4 % in TDN and 40.5 % in DP. It clearly indicates that the animal wealth in the e study area on the whole, remains underfed which results in poor performance.

Over grazing of the Punjab rangelands is one of the serious problem on livestock farming. Feed supply is inadequate to allow the livestock to produce and grow ordinarily. Because of the high cost, concentrates are being fed to lactating animal only.

C.2.5 Agricultural Supporting Services

(1) Agricultural Research

The Punjab province has a considerable reputation for agricultural research. There are 50 research institutes and stations with 63 substations and 89 farms totaling about 5,000 ha of land under the four Secretaries involved in agricultural research. Ayub Agricultural Research Institute (AARI), Faisalabad has over 30 institutes and sections being managed by one Director General of Research. Now half the institutes are scattered over the other parts of the Province. The location and spread of AARI is as under:

- Institutes at Faisalabad: Agronomy, Cotton, Horticulture, Oilseeds, Plant Protection, Puses, Sugarcane, Vegetables, Wheat
- Sections at Faisalabad: Agriculture Economics, Biochemistry, Biotechnology, Entomology, Food Technoligy, Integrated Pest, Plant Pathology, Plant Virology, Post Harvest, Soil Bacteriology, Soil Chemistry, Statistics
- Out reach Institutes: Arid Zone (Bhakkar), Barani Res. (Chakwal), Fodder (Sargodha), Maize and Millet (Y/wala), Regional Res. (B/pur), Rice (Kala Shah Kaku), Soil and Water Conservation (Chakwal), Soil Fertility (Lahore), Soil Salinity (Pindi Bhattian)
- Out Reach Sections: Agronomy (Khanewal, Sheikhupura, Karore, Liah, Bahawalpur), Cotton (Bahawalpur, R. Y. Khan, Vehari, Multan, Sahiwal), Horticulture (Sahiwal, Shujabad, D. G. Khan, Soan Valley, Murree), Potato (Sahiwal), Tobacco (Sahiwal), Wheat (Rawalpindi)

(2) Agricultural Extension

Agricultural Extension System operates independently in the Punjab province. This has a hierarchy from the Director General Agriculture (Extension and Agricultural Research) to Field Assistant. The province is divided into Regions, Districts, Tehsil Markiz and Union Councils. Each Union Council has one Field Assistant (FA) and two Beldars to do the job of extension under the guidance and supervision of Agricultural Officers (AO) who operate in each district under the supervision of district officers of Agricultural Department.

The main objectives of the extension services are summarized as follows:

1. Transmission of latest modern crop production technology to the farmers
2. To work as bridge between farmers and research experts and other allied agriculture functionaries

In the early 1980's the Training and Visit (T&V) system promoted by the World Bank, was introduced in few selected districts. The programme has yielded significant results through intensive motivation of the farmers with field demonstration on the benefits of improved technology. On the basis of the success achieved, this system was extended to all districts of the province from 1987-88.

Education of all members of the farm family is the principal objective. The extension audience has a wide variety of members, landless peasants, marginal, small to large farmers, etc. whose information needs range widely. In order to reach this diverse audience, equally diverse mix of teaching techniques and tools are used. The extension activities in the province is summarized as follows.

(Unit: number)

Extension Media	1991-92	1992-93	1993-94	1994-95
Demonstrations	16,527	16,540	16,670	17,000
Farme's day	3,792	4,056	4,260	4,435
Refresher Course	91	96	108	107
Seminars	36	34	40	45
Exhibition	32	36	38	40
Melas	198	204	210	220
Radio Talks	857	867	880	909
Individual Contact	4,427,000	4,432,000	4,510,000	4,511,000
Groups Contacts	435,000	435,000	520,000	520,000

Source: Department of Agriculture Punjab

There is the gap between the farmers' opinion and the extension activity. The respondents of Farm Survey indicate that the lack of agricultural extension services was also a cause of low

productivity. The 67 % of the respondents understand that the second biggest constraint they faced in farm management was the lack of agricultural extension services.

(3) Seed Supply

There is no doubt that the seed is the basic and vital input which plays an important role in the increase of agricultural production. The Punjab Seed Corporation (PSC) established in 1976 is an autonomous public corporation under the Department of Agriculture. Its primary objective at inception was to enhance the province's facilities for production, multiplication, procurement, processing, storage and marketing of certified seeds.

It is an established fact that with the use of quality/certified seed, the yield can be increased by about 20 %. This can be made possible if availability of quality seed required to be replaced every year is ensured by 20 % in case of rice, maize, 33 % in case of wheat and 100 % in case of cotton. The Punjab Seed Corporation has now started an aggressive policy to increase sale and has made arrangements to increase production by at least 50 % of the requirement of seed to be replaced annually. The sale of different crop seeds, the seed required annually and the PSC target is given below:

(Unit: 000 tons)				
Extension Media	Annual Requirement	Actual Sales	percentage (%)	Target
Wheat	176	58	33	88
Cotton	30	11	37	15
Paddy	3	1.3	43	1.5
Maise	2.8	-	-	1.4

Source: Department of Agriculture Punjab

(4) Marketing Support

Major agencies which support market and price of agricultural outputs are the Food Department of provincial government and Pakistan Agricultural Storage and Service Corporation (PASSCO).

The major purposes of PASSCO is (i) to procure agricultural output, mainly wheat, at the support price and to store, (ii) to release procured products to the deficit provinces and (iii) to control the market by indirect intervention. In addition to wheat, PASSCO deals with other agricultural outputs such as paddy, gram, onion, potato and oil seeds. The Food Department has functions (i) to procure and store wheat, (ii) to sell the procured wheat to flour millers, (iii) to issue the license to food grain dealers and millers and (iv) to check the retail prices of

essential commodities. The total amount of wheat procured by PASSCO and Food Department during 1989 to 1993 has been ranging from 20 % to 35 % of total production in the Punjab.

As to input supply, Punjab Seed Corporation (PSC) produces and markets certified seeds of major crops, and Punjab Agricultural Development and Supplies Corporation (PAD & SC) deals with imported fertilizers. For the marketing of agro-chemicals, the role of the private sector become more significant and important recently.

(5) Cooperative

Primary cooperatives are formed by individual members either at the village level or union council level. These cooperative societies are classified into 2 types, agricultural and non-agricultural cooperative. In agricultural cooperatives, there are 4 types, namely, Credit society, Marketing society, Service societies and Farming societies. Credit society and marketing society are forming a federation at district level, which is called District Co-operative Federation. The District Co-operative Federations compose Provincial Co-operative Federation at provincial level. As to the non-agricultural cooperative societies, there are urban credit cooperative, housing cooperative, women cooperative, industry cooperative and consumer cooperative. All cooperatives are under the control of Department of Cooperative of the provincial government.

There were 46,550 cooperative societies in the Punjab province during 1992/93. Of 46,550 societies, about 90% are agricultural societies and 10 % are non-agricultural societies. The major societies are the agricultural credit type, which accounts for 73 % of total societies. The number and membership in the Punjab province are as shown below.

	Number	(%)	Membership ('000')
Provincial Co-operative Bank	1	0.0	36
Central Non-credit Societies	250	0.5	68
Agricultural Co-operative Societies			
Credit	33,955	72.9	1,575
Others	7,726	16.6	228
Non-Agricultural Co-operative Societies			
Credit	1,148	2.5	166
Others	3,470	7.5	636
Total	46,550	100.0	2,709

Source: Punjab Development Statistics, 1994

In 9 districts of the study area, there are 16,421 cooperative societies. Considering the fact that number of villages is 6,204 in 9 districts, it can be said that there are more than 1 cooperative in one village. This may be attributed to the various type of social conflict and stratification inside villages.

According to the farm survey conducted during the Phase-I study, about 99% of respondents do not belong to any cooperatives. Only 1% belongs to the organizations related to rural welfare and Islamic taxation committee such as Zakat and Ushr. The participation of villagers in cooperative activities are still low irrespective to the number of registered cooperatives. The reason for this can be confined into following 4 points.

- 1) Monopolization of cooperative by influential individuals
- 2) Lack of education opportunity for cooperative leaders and members.
- 3) Lack of saving function of cooperatives and, as a result, their dependency on outsources for their budget .
- 4) Social stratification among villagers caused by religion, politics, caste system, etc.

(6) Rural Credit

The source of institutional credit are the Agricultural Development Bank of Pakistan (ADBP), Commercial Banks and Cooperative Societies. ADBP provides both development loans (loans for tubewells, tractors and other agricultural machinery) and production loans, while commercial banks and cooperative societies provide production loans for the purchase of seeds, fertilizers, pesticides and implements. The Revenue Department has also provided "Taccavi loan", which is a direct state credit, but it is not operative now. During July-March, 1994-95, Rs.13,849 million were disbursed for agricultural credit. Of this amount, 64.4% or Rs.8,924 million were provided by the ADBP followed by 20.6% of commercial banks and 15.0 % of cooperatives. The disbursed amount are as shown below.

	(Rs.million)	
	1994-95	(%)
ADBP	8,924	64.4
Cooperatives	2,076	15.0
Commercial Banks	2,849	20.6
Total	13,849	100.0

Source: Economic Survey 1994-95

On the other hand, the result of the farm survey shows that friends and relatives are the most common source of credit. Among the respondents, 42% of farmers rely on friends and relatives. Next common source is the ADBP which shares 41%. Although institutional credit is theoretically available, small and medium size farmers still rely on non-institutional credit rather than institutional one. In the case of marginal farmers, 68% are relying on non-institutional credit. The procedure for obtaining institutional credit is complicated, involves a great deal of bureaucracy and takes long time to realize, while the demand of smaller farmers for credit is rather seasonal or urgent.

In addition to the problems mentioned above, following three points are also considered as the constraints of the institutional credit.

- (i) Acute shortage of institutional credit for both project loan and production loan.
- (ii) Cooperative credit is not effectively utilized because of monopolization by influential individuals.
- (iii) Farmers have to bear relatively higher interest rate even for cooperative credit, since many institutions such as Federal Cooperative Bank, Provincial Cooperative Bank are involved in the procedure of disbursement.

C.2.6 Marketing and Prices

(1) Present Marketing Flows and Marketing Channels

The major sale destination of farm outputs at village level are village retailers, village merchants (Beopari), and governmental procurement center. Cereals and pulses are produced mainly for home consumption and surplus will be sold to merchants or markets in the villages. In case of large scale farmers, they sell their products to procurement center besides the local markets. Sugarcane is transported directly to sugar mill factory after the harvest by farmers themselves or transporter hired by the factories. Farmers refine sugar called Gur by themselves and use for home consumption or sell at village markets. In case of citrus, which is common crop in LJC area, most of farmers make contract with merchants or private agency on the pre-harvest bases for selling their products. Citrus is mostly sold to the merchants or agencies by acre-bases under the contract. Seed cotton is sold to the ginning factory by either farmers themselves or through the hands of merchants.

According to the farm survey, about 39% of respondents sell their commodities within villages, 22% are selling at local market and 18% sell to merchants. The farmers who sell their products to governmental procurement center account less than 1% among respondents. As to rice and maize, about half of production are sold within villages and almost all of production of fodder, gram/pulses, oil seeds and vegetables are also sold in the villages. 86% of orchard and 33% of cotton are sold to merchants. In case of sugarcane, about 82% are brought directly to sugar millers.

Regarding to input supply, most farmers rely on open markets at local level. 97% of farmers rely on open markets for the purchase of fertilizer. For the purchase of fertilizer, farmers go to local market nearby and purchase. In many cases, however, farmers have to face higher price than fixed rate. Moreover, farmers claim that contents of fertilizers are less than indicated

amount or mixed with gypsum in some cases. In the case of seeds, 45% of farmers are obtaining from their own products besides from open markets. Farmers do not utilize cooperatives as input supplier and only 1% of them utilize for purchasing fertilizer and seeds.

(2) Price

Average wholesale prices of major crops at three districts are summarized below for the period during January, 1995 to May, 1996. The price fluctuations for wheat and maize are relatively small throughout the period. According to the market survey, transaction costs of agricultural commodities are estimated about Rs.0.42/kg for cereals and pulses, Rs.0.48/kg for vegetables, Rs.0.85/kg for orchard and Rs.0.7/kg for seed cotton. The financial farm gate price for each commodity is estimated by deducting the transaction cost from average wholesale price.

Crop	(Rs/kg)	
	Price	
Wheat	4.3	- 5.2
Maize	5.0	- 6.9
Paddy (Basmati)	9.6	- 13.4
Paddy (IRRI-6)	6.1	- 8.4
Cotton	17.6	- 23.8
Gram	13.4	- 20.0
Mung	11.2	- 17.1
Onion	2.3	- 9.4

C.2.7 Farm Economy

According to the data collected by the farm survey, the typical farm budgets for the study areas on different farm size are prepared as follows. (Detail figures are shown in Table C.2.7-1)

	(Rs)			
	Marginal	Small	Medium	Large
LJC				
Farm Size (ha)	(1.56)	(3.49)	(6.36)	(16.45)
1. Income	51,900	73,200	119,900	325,100
Farm Income*	33,200	50,600	100,700	218,500
Off-Farm Income	18,700	22,700	19,200	106,600
2. Expenditure	54,600	79,200	88,600	201,600
3. Net Reserve	-2,700	-6,000	31,300	123,500
LCC				
Farm Size (ha)	(1.52)	(3.70)	(6.82)	(13.99)
1. Income	98,700	115,900	155,300	298,000
Farm Income*	30,700	80,500	130,000	255,800
Off-Farm Income	68,000	35,400	25,300	42,300
2. Expenditure	101,700	97,000	122,400	179,600
3. Net Reserve	-3,000	18,900	32,900	118,400
CBDC				
Farm Size (ha)	(1.48)	(3.47)	(6.36)	(16.01)
1. Income	56,000	98,200	204,200	290,300
Farm Income*	21,000	66,600	157,900	258,300
Off-Farm Income	35,000	31,700	46,300	32,000
2. Expenditure	43,700	60,400	78,900	157,500
3. Net Reserve	12,300	37,800	125,300	132,800

*: Farm income after deduction of production cost.

From the above table, the characteristics of farm budget for each farm type can be summarized below.

- (i) The dependence on non-farm income becomes higher as farm size become smaller except the case of large farmers. For the marginal and small scale farmers, farm income itself cannot cover their living expenditure. Accordingly, non-farm activity become more important as the supplemental income source.
- (ii) As the farm size become smaller, farm income become less. It is significant for marginal farmers and they do not have funds for the improvement of their living standard or farming system.
- (iii) Contribution of non-farm income is relatively high in LJC and LCC areas. The reason for this fact is the industrial zone or large scale urban area which are locating in LCC and LJC area.

The typical crop budgets for major crops are estimated as follows based on the data collected by the farm survey and data from PERI and University of Agriculture, Faisalabad.

Crop	(Rs/ha)		
	Gross Income	Production Cost	Profit Margin
Sugarcane	25,300	11,800	13,400
Cotton	26,800	9,700	17,100
Rice (Basmati)	7,000	5,500	1,500
Vegetable	49,800	13,600	36,200
Maize	9,400	7,300	2,100
Fodder	10,800	8,000	2,800
Mung bean	6,600	2,100	4,600
Wheat	11,500	7,100	4,500
Fodder (Berseem)	17,500	10,400	7,100
Oil Seeds	16,400	3,600	12,800
Citrus	42,800	7,800	34,900

Vegetable is most profitable crop and its net return per ha is about Rs.36,200. Next to the vegetable, citrus, sugarcane and cotton show high profitability. Oil seeds and Mungbeans show low production costs since farmer do not care its production so much.

C.3 Agricultural Improvement Plan

C.3.1 General

(1) Present Agricultural Constraints

The most serious problem in the study area agriculture is that unit yield of main crop remains rather low level. The yields of various agricultural crops are very low even in comparison with world average. The main agricultural constraints which is the reasons of low yields and productivity are as follows;

- The shortage of irrigation water
- farmers' lack of knowledge on the agricultural practices and poor extension services
- shortage of capital and credit
- were salinity and waterlogging

(2) Agricultural Productivity Improvement Concept

For the improvement of agriculture in the Project area, it is inevitable to improve the unit yield of the crops. The achievement of the rising agricultural productivity through the approach will be essential. With efficient use of irrigation water and the spread of recommendable farming practices, improvement of agricultural productivity will be achieved.

C.3.2 Landuse and Cropping Pattern

The CCA of the Project area is 241,111 ha. There will be no change in CCA after the implementation of the Project. Since the present cropping pattern has been evolved as a result of the past experience in agricultural practice reflecting the existing agro-climatic and socio-economic conditions of the area. The main crops in the area were widely grown, and the farmers have long experience in the Kharif and Rabi for a long time. In due consideration the present condition in the Project area, there will be no need to modify. The season-wise cultivated area in the Project area is shown in Table C.3.2-1. The cropping intensity in the Project area is estimated 133 %. However, the land utilization intensity is more than that because, sugarcane and tree crop (citrus) are perennial crops and standing through the year. Taking into consideration the high cropping intensity, it is not realistic to raise the cropping intensity more than that. The cropping rotation system including fallow will be introduced after the implementation of the project through the utilization of reclaimed land. Improvement of the soil fertility will be also achieved through adopting the crop rotation system.

C.3.3 Proposed Farming Practices

The proposed farming practices based on the concept of the Agricultural Improvement Plan are summarized below;

- Introduction of intensive irrigation farming through the biological effective water use,

Each crop has some critical growth stage/periods severely affected by water stress. At this stage, if the crop suffers severe moisture stress it has drastic effects on the growth and development of plants as a result the moisture stress has detrimental effect on the yields. Irrigation should be done at critical growth periods of each crop.

- Extension of the proper farming practices,

At present farming in the Study area, the dosage of fertilizers is mainly applied as basal before planting due to the poor technical know-how. The application of recommendable amount of fertilizer at right time and split application of fertilizer which rises the fertilizer utilization efficiency has much effect on the increase in crop yields, because of the low fertility of the soil in the area. The balance dose of nitrogen, phosphorus and potash is essential.

The farmyard manure application should be effective for improvement of the both soil fertility and soil physical condition.

- The important points for improvement of productivity of major crops (wheat, rice, sugarcane and cotton) are as followings;

Wheat:	planting on right time (adopting early maturing of rice and cotton and utilization fallow)
Rice:	adopting the recommendable plant density
Cotton:	improved agronomic practices of natural predators, reduce weeds and diseases against CLCV and breeding varieties resistant to CLCV
Sugarcane:	increase efficiency of water use during the critical stage
Fodder:	adopting recommendable varieties

In the Study area, more than 30 % of Irrigable land remains as fallow due to lack of irrigation water. In order to improve effective land use, crop rotation system including fallow should be introduced. Proper crop rotation is very important in the Study Area due to the following reasons ;

- a) to avoid the conflict in the cotton-wheat, rice-wheat cropping pattern,
- b) to maintain soil in good physical and chemical conditions,
- c) eradication of insects pests, diseases and weeds, and
- d) to increase productivity of the soil.

The growing of the leguminous fodder as fallow crop will be recommended in order to improve the soil fertility and increase the production of fodder.

- Improvement of salinity and waterlogging affected irrigation land and the prevention of the expansion of salinity and waterlogging

The irrigation water saved by canal lining should be used as followings in order to improve and avoid salinity and waterlogging.

- a) to expand new irrigated land,
- b) to substitute saved water for saline ground water, and
- c) to use for land reclamation purpose

The doses of farm inputs and labour requirement for various crops are given Table C.3.3-1 and 2 respectively.

C.3.4 Anticipated Yield

After the completion of the Project, it is expected that the yields of crops under the water stress condition would increase on account of increasing irrigation water supply by saving the seepage water loss. The anticipated yields after completion the Project are estimated using relationship between the yield response factor (Ky) for various crops and seepage saving rate.

The anticipated unit yields and production are given in Table C.3.4-1 and 2 respectively and summarized as follows;

Crops	Yield response factor	Present Yields (Project area) (t/ha)	Anticipated Yields (t/ha)	Anticipated Production (1,000t/ha)
Wheat	1.00	2.26	2.50	243
Rice (Basmati)	1.20	1.18	1.33	12
Cotton	0.85	1.42	1.55	20
Sugarcane	1.20	40.98	46.26	1,222
Maize	0.90	1.43	1.57	51
K. Fodder	0.90	12.84	14.08	526
R. Fodder	0.70	30.71	33.02	570
Oilseeds	0.90	1.04	1.14	16
Pulses	1.00	0.51	0.56	3
Vegetable	1.10	20.03	22.39	55
Citrus	0.95	9.69	10.68	115

Source: Privatization of SCARP Tubewells EAN Project USAID, FAO 1977

C.3.5 Agricultural Supporting System Improvement Plan

- Creation of integrated agricultural support service for the agricultural extension Agricultural Research Institute, Adaptive Research Units, Extension wings of Agriculture and other related organizations should launch a extension enhancement programme. There is no any close relationship/cooperation among them at present. A farmer's desire to improve themselves is one of the important factor. If farmers expect a higher return by adopting a new technology, there is far greater chance that they will try it. Both institutional and individual (farmers) "integrators" are needed to link research and production into an effective technology generation system, if improved technologies are to reach farmers.

In order to achieve the effective extension through the close relationship/cooperation among the related organizations, the establishment of the Agricultural Research and Agricultural Extension Council (a tentative name) should be recommended.

- Raising Agricultural Extension Efficiency

For the achievement of the effective agricultural extension within the limits of the budget, the reinforcement of the extension system by the broadcast and multimedia approach should be introduced.

- Dissemination of Information on Institutional Credit

In addition to the dissemination of agricultural technology, knowledge about procedure in utilizing institutional credit should be also disseminated. By disseminating the

knowledge on institutional credit to the farmers, farmers will know what is necessary for obtaining loan and, accordingly, it will be difficult for the officers to impose unfair demand on the farmers for disbursing credit. This can be the first step to make the utilization of institutional credit easier. Besides, accesses for institutional credit through the Farmers' Organizations should be also considered so that farmers can have the option for rural credit as much as possible.

- Education on Farmers' Organization

Considering the fact that cooperatives are not functioning well, there should be more opportunity for the farmers to know about cooperative, especially about its basic concept and operation. Ignorance about the concept, function and operation of cooperative or farmers' organization will lead to the monopolization of them or extinction of organization. Therefore, enhancement of education opportunity on the knowledge of farmers' organization (principle, operation, function, etc.) will be effective for attaining the sustainability and activation of FOs.

TABLES

Table C.1.1.1 Population, Density and Household by the Study Area

Geographical Area (km ²)	1972			1981			1996 ¹			Growth Rate (72-81)		Household		Population Density ² (P/km ²)		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Number		Size	
	('000')	('000')	('000')	('000')	('000')	('000')	('000')	('000')	('000')	('000')	(%)	(%)	('000)		(person)	
Lower Ichlum Canal	7,190	1,790	412	1,378	2,207	570	1,636	3,241	1,020	2,221	2.35%	3.67%	1.93%	357	6.2	451
Sargodha	5,856	1,554	369	1,185	1,907	503	1,404	2,770	872	1,898	2.30%	3.50%	1.90%	308	6.2	473
Jhang	1,334	236	43	193	300	67	232	471	148	323	2.67%	5.05%	2.07%	49	6.1	353
Lower Chenab Canal	16,160	6,333	1,507	4,826	7,373	2,199	5,174	10,380	4,444	5,935	1.70%	4.29%	0.78%	1,117	6.6	642
Faisalabad	5,856	3,164	916	2,248	3,562	1,246	2,316	4,595	2,153	2,442	1.33%	3.48%	0.33%	532	6.7	785
Toba Tek Singh	3,252	1,078	137	941	1,128	186	942	1,264	320	944	0.51%	3.46%	0.01%	171	6.6	389
Jhang	3,239	574	105	469	728	163	564	1,143	359	784	2.67%	5.05%	2.07%	119	6.1	353
Sheikhpura	2,241	623	93	531	794	143	651	1,247	312	935	2.73%	4.98%	2.29%	124	6.4	556
Gujranwala & Hafiz	1,572	894	256	638	1,161	460	701	2,131	1,300	831	2.95%	6.71%	1.07%	171	6.8	1,355
C.B.D. Canal	3,900	3,220	2,318	903	4,358	3,165	1,193	7,496	5,512	1,984	3.42%	3.52%	3.15%	647	6.7	1,922
Lahore	1,772	2,588	2,199	389	3,544	2,988	556	6,203	5,153	1,049	3.55%	3.47%	4.05%	514	6.9	3,500
Kasur	2,128	632	119	514	814	177	637	1,294	359	935	2.85%	4.52%	2.43%	133	6.1	608
Total-1	27,250	11,344	4,237	7,107	13,938	5,934	8,004	21,117	10,977	10,140	2.31%	3.81%	1.33%	2,120	6.6	775
Punjab Province	205,345	37,608	9,183	28,425	47,293	13,052	34,241	72,058	24,385	47,673	2.58%	3.98%	2.09%	7,390	6.4	351

¹ The population in 1996 is estimated by assuming same trend during 1972-81.

² The district wise population density shows the density for whole district.

Source: Bureau of Statistics of Pakistan, 1995

Table C.2.2-1 Cropping Intensity in the Study Area

Canal	GCA (ha)	CCA (ha)	Seasonal Crops		Annual/Perennial Crop		Cropped Area (ha)	Cropping Intensity (%)
			Kharif (ha)	Rabi (ha)	Sugarcane (ha)	Orchard (ha)		
1 C.B.D.C	284,628	265,648	139,017	169,440	15,542	3,755	327,734	123.4%
2 LCC (East)	773,294	647,479	363,299	434,019	68,938	11,571	877,827	135.6%
LCC (West)	724,114	588,560	305,450	374,673	66,241	6,518	752,882	127.9%
LCC (Total)	1,497,408	1,236,039	668,749	808,692	135,179	18,089	1,630,709	131.9%
3 LJC	662,958	614,467	309,848	330,576	43,130	68,553	752,107	122.4%
Study Area	2,444,994	2,116,154	1,117,614	1,308,708	193,851	90,377	2,710,550	128.1%

Source: Punjab Development Statistics
PID Revenue Department

Table C.2.2-2 Cultivated Area Classified by Mode of Irrigation

Description	Cultivated Area		Cultivated Area with Irrigation Facilities										Cultivated Area without Irrigation								
	Total	Area	Canal and Tubewell					Actually Irrigated					Irrigated	not Irrigated							
			Canal Only	Tubewell Only	Canal and Tubewell	Tubewell Only	Tank/Bandat Only	Spring/Rodkahi	Karez	Others	Sailaba	Barani									
Punjab	19,402,355	24,447,985	4,836,640	10,237,414	3,879,214	63,860	305,323	0	79,882	416,598	188,866	4,440,354	79.4%	24.9%	52.8%	20.0%	20.0%	0.3%	1.6%	0.0%	0.4%
1 Lahore	276,416	282,430	152,328	45,865	77,069	404	0	750	4,469	253	1,292	97.9%	55.1%	16.6%	27.9%	0.1%	0.0%	0.0%	0.0%	0.0%	0.3%
2 Kasur	723,312	739,273	298,569	254,445	168,631	1,249	0	418	14,093	460	1,405	97.8%	41.3%	35.2%	23.3%	0.2%	0.0%	0.0%	0.0%	0.1%	0.1%
3 Gujranwala	958,560	985,186	66,074	481,759	408,856	882	0	989	6,975	15,764	3,890	97.3%	6.9%	50.3%	42.7%	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%
4 Sheikhpura	934,583	956,998	111,934	708,637	111,834	358	469	1,351	16,656	673	5,078	97.7%	12.0%	75.8%	12.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
5 Faisalabad	869,501	879,854	407,805	418,412	42,592	104	0	588	8,912	79	1,368	98.8%	46.9%	48.1%	4.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
6 Toba Tek Singh	494,666	504,256	186,344	278,640	29,503	179	0	0	9,564	4	21	98.1%	37.7%	56.3%	6.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7 Jhang	1,289,308	1,396,678	162,928	712,275	402,359	4,229	123	7,394	25,781	4,383	77,212	92.3%	12.6%	55.2%	31.2%	0.3%	0.0%	0.0%	0.0%	0.0%	0.6%
8 Sargodha	916,618	938,641	422,123	426,103	67,373	659	47	313	15,460	3,305	3,267	97.7%	46.1%	46.5%	7.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Districts related to the Study Area	6,462,964	6,683,316	1,808,105	3,326,136	1,308,217	8,064	639	11,803	101,910	24,921	93,533	96.7%	28.0%	51.5%	20.2%	0.1%	0.0%	0.0%	0.0%	0.2%	0.2%

Source: Census of Agriculture, 1990, p191

Table C.2.2-3 (1/2) Cultivated Area Classified by Crops in Kharif and Rabi Kharif

Canal	(Unit: ha)										
	Sugar cane	Rice	Cotton	Maiz	Fodder and hari		Bajra	Garden	Other Crops	Oil-seed	Total
Lahore Zone											
C.B.D.C	15,542	26,818	10,174	30,155	52,342	2,883	3,735	16,170	475	158,294	
GCA	9.8%	16.9%	6.4%	19.0%	33.1%	1.8%	2.4%	10.2%	0.3%		
CCA	5.9%	10.1%	3.8%	11.4%	19.7%	1.1%	1.4%	6.1%	0.2%	59.6%	
Faisalabad Zone											
LCC (East)	68,938	55,737	74,978	91,144	93,946	9,214	11,571	36,535	1,745	443,808	
GCA	15.5%	12.6%	16.9%	20.5%	21.2%	2.1%	2.6%	8.2%	0.4%		
CCA	10.6%	8.6%	11.6%	14.1%	14.5%	1.4%	1.8%	5.6%	0.3%	68.5%	
LCC (West)											
GCA	66,241	55,696	44,314	82,497	74,633	15,763	6,518	28,632	3,915	378,209	
CCA	17.5%	14.7%	11.7%	21.8%	19.7%	4.2%	1.7%	7.6%	1.0%		
	11.3%	9.5%	7.5%	14.0%	12.7%	2.7%	1.1%	4.9%	0.7%		
LCC											
GCA	135,179	111,433	119,292	173,641	168,579	24,977	18,089	65,167	5,660	822,017	
CCA	16.4%	13.6%	14.5%	21.1%	20.5%	3.0%	2.2%	7.9%	0.7%		
	10.9%	9.0%	9.7%	14.0%	13.6%	2.0%	1.5%	5.3%	0.5%	66.5%	
Sargodha Zone											
LJC	43,130	36,800	31,468	43,231	152,158	25,554	68,553	19,152	1,485	421,531	
GCA	10.2%	8.7%	7.5%	10.3%	36.1%	6.1%	16.3%	4.5%	0.4%		
CCA	7.0%	6.0%	5.1%	7.0%	24.8%	4.2%	11.2%	3.1%	0.2%	68.6%	
Study Area											
GCA	193,851	175,051	160,934	247,027	373,079	53,414	90,377	100,489	7,620	1,401,842	
CCA	13.8%	12.5%	11.5%	17.6%	26.6%	3.8%	6.4%	7.2%	0.5%		
	9.2%	8.3%	7.6%	11.7%	17.6%	2.5%	4.3%	4.7%	0.4%	66.2%	

Source: PID

Table C.2.2-3 (2/2) Cultivated Area Classified by Crops in Kharif and Rabi

Canal	Rabi							Total	
	Wheat	Barley	Mixed Grain	Oil Seed	Grams	Fodder	Garden		Other Crops
Lahore Zone									
C.B.D.C	118,804	5,068	2,083	8,644	963	28,164	3,735	5,714	173,175
GCA	68.6%	2.9%	1.2%	5.0%	0.6%	16.3%	2.2%	3.3%	
CCA	44.7%	1.9%	0.8%	3.3%	0.4%	10.6%	1.4%	2.2%	65.2%
Faisalabad Zone									
LCC (East)	312,992	612	2,218	23,048	1,314	75,213	11,571	18,622	445,590
GCA	70.2%	0.1%	0.5%	5.2%	0.3%	16.9%	2.6%	4.2%	
CCA	48.3%	0.1%	0.3%	3.6%	0.2%	11.6%	1.8%	2.9%	68.8%
LCC (West)									
GCA	251,308	11,842	5,701	19,621	1,019	63,358	6,518	21,833	381,200
CCA	65.9%	3.1%	1.5%	5.1%	0.3%	16.6%	1.7%	5.7%	
	42.7%	2.0%	1.0%	3.3%	0.2%	10.8%	1.1%	3.7%	64.8%
LCC									
GCA	564,300	12,454	7,919	42,669	2,333	138,571	18,089	40,455	826,790
CCA	68.3%	1.5%	1.0%	5.2%	0.3%	16.8%	2.2%	4.9%	
	45.7%	1.0%	0.6%	3.5%	0.2%	11.2%	1.5%	3.3%	66.9%
Sargodha Zone									
LJC	662,958	7,710	53	4,084	1,565	78,018	68,553	5,644	399,129
GCA	58.5%	1.9%	0.0%	1.0%	0.4%	19.5%	17.2%	1.4%	
CCA	38.0%	1.3%	0.0%	0.7%	0.3%	12.7%	11.2%	0.9%	65.0%
Study Area									
GCA	2,444,994	25,232	10,055	55,397	4,861	244,753	90,377	51,813	1,399,094
CCA	65.5%	1.8%	0.7%	4.0%	0.3%	17.5%	6.5%	3.7%	
	43.3%	1.2%	0.5%	2.6%	0.2%	11.6%	4.3%	2.4%	66.1%

Source: PID

Table C.2.3-1 Major Crop Production and Yields

Description	unit	1991-92			1992-93			1993-94			1994-95			1995-96		
		Total	Irrigable	Un-irrigable	Total	Irrigable	Un-irrigable	Total	Irrigable	Un-irrigable	Total	Irrigable	Un-irrigable	Total	Irrigable	Un-irrigable
Wheat																
Punjab Province	area 1,000ha	5,669	4,913	756	5,961	5,170	791	5,771	5,088	703	5,902	5,166	737	5,917	5,190	727
	prod. 1,000ton	11,492	10,543	949	11,742	10,834	908	11,218	10,615	603	12,713	11,819	894	12,720	11,853	887
	yield ton/ha	2.03	2.15	1.26	1.97	2.10	1.15	1.94	2.09	0.86	2.15	2.29	1.21	2.15	2.28	1.22
Study Area	area 1,000ha	1,701	1,689	12	1,606	1,593	13	1,585	1,575	9	1,609	1,596	13	2,118	1,953	165
	prod. 1,000ton	37,630	3,716	13	3,317	3,304	13	3,461	3,451	10	3,750	3,714	16	3,776	3,760	16
	yield ton/ha	2.19	2.20	1.11	2.07	2.07	0.99	2.18	2.19	1.11	2.32	2.33	1.19	1.78	1.93	0.10
Paddy																
Punjab Province	area 1,000ha	1,231	1,033	199	1,222	1,007	215	1,301	1,074	227	1,339	1,108	231	1,328	1,109	219
	prod. 1,000ton	1,342	1,034	308	1,404	1,076	328	1,588	1,216	372	1,684	1,296	388	1,803	1,415	388
	yield ton/ha	1.09	1.00	1.55	1.15	1.07	1.53	1.22	1.13	1.64	1.26	1.17	1.68	1.36	1.28	1.78
Study Area	area 1,000ha	680	610	70	590	522	68	613	545	68	629	558	72	631	553	79
	prod. 1,000ton	733	603	130	669	553	116	751	620	131	776	639	137	838	674	163
	yield ton/ha	1.08	0.99	1.86	1.13	1.06	1.70	1.22	1.14	1.92	1.23	1.15	1.91	1.33	1.22	2.08
Cotton																
Punjab Province	area 1,000ha	2,287	2,222	65	2,438	2,379	59	2,249	2,193	56	2,244	2,182	62	2,463	2,407	56
	prod. 1,000bales	11,417	11,331	86	8,237	8,172	65	6,523	6,463	60	7,410	7,326	84	8,720	8,656	64
	yield bales/ha	4.99	5.10	1.32	3.38	3.44	1.10	2.90	2.95	1.08	3.30	3.36	1.35	3.54	3.60	1.13
Study Area	area 1,000ha	680	610	70	590	522	68	613	545	68	629	558	72	631	553	79
	prod. 1,000bales	733	603	130	669	553	116	751	620	131	776	639	137	838	674	163
	yield bales/ha	1.08	0.99	1.86	1.13	1.06	1.71	1.22	1.14	1.92	1.23	1.15	1.91	1.33	1.22	2.08
Sugarcane																
Punjab Province	area 1,000ha	536	533	4	536	532	4	596	593	4	657	653	3	610	606	3
	prod. 1,000ton	20,027	20,000	27	20,045	19,974	71	24,511	24,421	90	28,268	28,164	104	27,010	26,902	108
	yield ton/ha	37.35	37.53	7.42	37.30	37.52	19.05	41.11	41.22	24.35	45.05	45.11	30.68	44.29	44.36	31.76
Study Area	area 1,000ha	368	367	1	289	289	0	325	325	0	367	367	1	341	340	1
	prod. 1,000ton	11,503	11,497	6	11,332	11,329	3	14,005	14,002	3	16,210	16,200	10	15,449	15,439	10
	yield ton/ha	31.23	31.29	6.56	39.20	39.20	27.00	43.05	43.04	3	44.16	44.19	19.80	45.35	45.37	25.50
Maize																
Punjab Province	area 1,000ha	311	249	63	323	256	67	337	268	69	345	274	71	334	266	68
	prod. 1,000ton	415	361	54	402	349	53	437	384	54	461	399	62	451	392	58
	yield ton/ha	1.33	1.45	0.86	1.24	1.36	0.78	1.30	1.43	0.78	1.33	1.46	0.87	1.35	1.47	0.86
Study Area	area 1,000ha	151	151	0	155	154	0	157	157	0	155	155	0	150	150	0
	prod. 1,000ton	223	223	0	209	209	0	225	224	0	225	224	0	218	218	0
	yield ton/ha	1.48	1.48	0.33	1.36	1.36	0.33	1.43	1.43	0.33	1.45	1.45	0.67	1.46	1.46	0.60

Source: Directorate of Agriculture Crop Reporting Service, Punjab

Table C.2.7-1 Farm Budget by Farm Size in Punjab (1996)
(Result of Farm Survey Conducted by JICA Study Team)

	(Rs.)				
Operating Farm Size	Marginal	Small	Medium	Large	Overall
(Lower Jhelum)					
<u>1. Income</u>	<u>51,882</u>	<u>73,245</u>	<u>119,935</u>	<u>325,122</u>	<u>122,761</u>
Farm Income	33,209	50,586	100,730	218,511	87,429
- Crops	22,362	39,940	83,087	191,960	72,290
- Livestock etc.	10,847	10,646	17,643	26,551	15,139
Off-Farm Income	18,673	22,659	19,205	106,611	35,332
<u>2. Expenditure</u>	<u>54,610</u>	<u>79,238</u>	<u>88,599</u>	<u>201,611</u>	<u>96,524</u>
- Food	41,698	54,365	57,668	106,442	61,013
- Education	1,407	2,577	2,633	17,596	4,894
- Health	3,209	6,763	5,100	9,053	5,872
- Others	8,296	15,533	23,198	68,520	24,745
<u>3. Net Reserve</u>	<u>-2,728</u>	<u>-5,993</u>	<u>31,336</u>	<u>123,511</u>	<u>26,237</u>
(Lower Chenab)					
<u>1. Income</u>	<u>98,714</u>	<u>115,890</u>	<u>155,277</u>	<u>298,047</u>	<u>73,601</u>
Farm Income	30,712	80,516	130,011	255,760	47,037
- Crops	24,677	65,241	100,008	222,756	37,231
- Livestock etc.	6,035	15,275	30,004	33,004	9,807
Off-Farm Income	68,002	35,375	25,266	42,287	26,564
<u>2. Expenditure</u>	<u>101,719</u>	<u>96,960</u>	<u>122,373</u>	<u>179,634</u>	<u>58,157</u>
- Food	64,522	65,723	85,439	120,584	38,327
- Education	3,543	4,596	4,684	9,362	2,469
- Health	5,138	6,811	6,355	8,037	2,498
- Others	28,517	19,831	25,896	41,651	14,864
<u>3. Net Reserve</u>	<u>-3,005</u>	<u>18,930</u>	<u>32,904</u>	<u>118,413</u>	<u>15,444</u>
(Central Bari Doab)					
<u>1. Income</u>	<u>55,986</u>	<u>98,222</u>	<u>204,195</u>	<u>290,326</u>	<u>114,582</u>
Farm Income	21,025	66,568	157,928	258,326	75,885
- Crops	16,618	56,865	140,931	241,817	60,955
- Livestock etc.	4,407	9,703	16,997	16,509	14,930
Off-Farm Income	34,961	31,654	46,267	32,000	38,697
<u>2. Expenditure</u>	<u>43,714</u>	<u>60,443</u>	<u>78,889</u>	<u>157,480</u>	<u>102,910</u>
- Food	29,977	42,651	59,365	106,513	68,086
- Education	1,769	2,669	4,107	10,600	4,682
- Health	2,396	2,609	3,827	5,800	6,144
- Others	9,572	12,514	11,590	34,567	23,998
<u>3. Net Reserve</u>	<u>12,272</u>	<u>37,779</u>	<u>125,306</u>	<u>132,846</u>	<u>11,672</u>

Table C.3.2-1 Cropping Pattern and Cropping Intensity

Item	Lower Jhelum Canal				Lower Chenab Canal				Central Bari Doab Canal					
	Overall	Pindil	Hujian	Overall	Swatwala	Nasrati	Gorta	Mund	Jamwala/Kamra	Pirmahal	Kilianwala	Overall	Thamman	China
	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha	ha
CCA	78,246	2,285	25,276	50,745	120,554	6,627	34,677	7,340	19,161	6,513	18,242	42,267	25,877	16,390
Kharif Season Crops														
Sugarcane	6,898	8.8	1,478	5.9	19,083	15.8	7,181	20.7	2,223	11.6	2,466	13.3	3,775	8.9
Cotton	3,795	4.8	51	2.2	9,804	8.1	1,410	5.2	2,365	12.3	2,068	11.3	1,055	2.5
Rice (Basmati)	2,305	2.9	780	3.1	5,410	4.5	381	1.1	490	2.6	3,856	21.1	3,416	8.8
Vegetable	776	1.0	15	0.7	1,271	1.1	199	0.6	612	3.2	157	0.9	740	1.7
Mushe	9,026	11.5	288	12.6	24,061	19.9	7,881	22.7	2,902	15.1	1,410	7.7	7,088	17.7
Fodder	16,533	21.1	714	31.3	17,787	14.8	5,866	16.7	1,343	7.8	2,426	13.3	8,248	19.5
Others	2,093	2.7	32	1.4	3,356	2.8	1,522	4.4	389	1.9	140	0.9	445	1.6
Subtotal	61,627	82.9	1,262	54.3	80,222	62.0	24,729	71.5	11,235	61.8	12,562	68.8	22,605	53.5
Rabi Season Crops														
Wheat	34,937	44.6	1,270	55.6	58,765	48.7	17,272	49.8	3,614	47.9	9,847	54.0	12,214	47.2
Fodder (Berseem)	9,621	12.3	69	3.0	6,596	5.5	1,075	4.8	425	5.6	906	5.0	3,913	15.2
Others	2,788	3.6	93	4.1	10,440	8.7	3,719	10.7	1,687	8.8	1,528	8.4	2,080	4.9
Subtotal	47,346	60.5	1,432	62.7	75,801	62.9	22,066	65.3	5,026	66.2	12,282	67.3	17,053	65.2
Perennial Crops														
China	13,206	16.9	565	24.7	4,823	9.5	849	2.4	484	6.4	682	3.7	492	1.9
Subtotal	13,206	16.9	565	24.7	4,823	9.5	849	2.4	484	6.4	682	3.7	492	1.9
Total	101,978	130	3,228	132	161,178	134	48,228	139	24,507	128	24,505	130	29,551	114
Cropping Intensity														
Kharif	52.9%		51.4%		67.0%		71.5%		61.4%		68.8%		66.4%	
Rabi	40.5%		54.0%		62.9%		65.4%		61.0%		67.3%		65.9%	
Perennial	16.9%		31.0%		3.9%		2.4%		5.6%		3.7%		1.9%	
Overall	130.3%		136.4%		133.7%		139.3%		127.0%		139.8%		134.2%	
Irrigation Intensity	155.9%		173.2%		153.4%		162.4%		145.1%		157.1%		121.9%	
Source: PID, Canal Offices														

Table C.3.3-1 Farm Inputs

		(Unit: per ha)					
Items	Unit	Paddy	Cotton	Maize	K. Fodder	Watermelon	Pulses
Seed Material	(kg)	10	15	37	99	4	17
Fertilizer							
N	(kg)	54	109	94	49	130	
P	(kg)	32	57	47		59	
K	(kg)					74	
Compost	(ton)	1	4	20	12	17	
Agrochemicals							
Insecticide	(lit.)		10			2	
Fungicides	(lit.)						
Pesticide	(lit.)	2				2	
Machinery							
Plowing	(No)	2	12	7	2	2	2
Plow, plank	(No)	17	5	7	7	10	2
Drill for seed	(No)		2	2	2		2
Harvesting	(No)						

Items	Unit	Wheat	Oilseeds	R. Fodder	Sugarcane	
					Fresh	Ratoon
Seed Material	(kg)	99	5	20	25marla	
Fertilizer						
N	(kg)	104	20	86	128	114
P	(kg)	54	12		40	
K	(kg)					
Compost	(ton)	3		12	17	
Agrochemicals						
Insecticide	(lit.)					
Fungicides	(lit.)					
Pesticide	(lit.)				2	2
Machinery						
Plowing	(No)	7	2	2	17	
Plow, plank	(No)	5	7	7	17	
Drill for seed	(No)	2	1	2		
Harvesting	(No)	1				

Items	Unit	Citrus			
		First	2-5	6-10	11-20
Seed Material	(No)	222			
Fertilizer					
N	(kg)		53	207	307
P	(kg)			90	160
K	(kg)			111	167
Compost	(ton)	30	20	36	53
Agrochemicals					
Insecticide	(lit./ha)				
Fungicides	(lit./ha)				
Pesticide	(lit./ha)	2	2	7	7
Machinery					
Plowing	(No)	2			
Plow, plank	(No)	5			
Drill for seed	(No)				
Harvesting	(No)				

Source: Farm Management Handbook 1993, Farm Survey for the Study 1996

Table C.3.3-3 Labour Requirement

Items	Unit	(Unit per ha)											
		Paddy		Cotton		Maize		K. Fodder (Maize)		Watermelon		Pulses (Maize)	
		Present	Project	Present	Project	Present	Project	Present	Project	Present	Project	Present	Project
Labour													
Clearing Channels	(hr)	9.9	9.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	1.2	1.2
Ploughing	(hr)			6.2	6.2	3.7	3.7	1.2	1.2	3.7	3.7		
Pl and Plank	(hr)	1.2	1.2	1.2	1.2	3.7	3.7	3.7	3.7	4.9	4.9	1.2	1.2
Puddling	(hr)	24.7	24.7										
Pud and Plank	(hr)	22.2	22.2										
Leveling	(hr)			4.9	4.9			14.8	14.8				
Raising Nursery	(hr)	9.9	9.9										
Transplanting	(hr)	148.3	148.3										
Broadcast Seed	(hr)			3.7	3.7	4.9	4.9	173.9	173.9	237.2	237.2	4.9	4.9
Fertilizer Appl	(hr)	1.2	1.2			1.2	1.2	3.7	3.7	3.7	3.7		
Chemical Appl	(hr)	1.2	1.2	19.8	19.8					9.9	9.9		
Manure appl	(hr)	2.5	2.5	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8		
Canal Irrigation	(hr)	29.7	29.7	9.9	9.9	29.7	29.7	14.8	14.8	9.9	9.9		
Tubewell Irrigation	(hr)	39.5	39.5	39.5	39.5	11.1	11.1	4.9	4.9	9.9	9.9		
Hand Weeding	(hr)	39.5	39.5			118.6	118.6					39.5	39.5
Hoeing	(hr)			59.3	59.3								
Hoe and Thing	(hr)			14.8	14.8								
Interplough	(hr)									197.7	197.7		
Sowing	(hr)												
Thinning	(hr)					39.5	41.5						
Harvesting	(hr)	158.1	166.1	237.2	249.1	79.1	83.0	217.5	228.3	197.7	207.6	79.1	83.0
Debussing	(hr)					39.5	41.5						
Shelling	(hr)					9.9	10.4						
Threshing	(hr)											9.9	10.4
Cleaning	(hr)												
Stacking Straw	(hr)	7.4	7.8									4	4.2
Winnowing	(hr)												
Miscellaneous	(hr)	21.0	21.0	16.1	16.1	6.2	6.2	9.5	9.5	19.8	19.8	6.2	6.2
Total man-day		516.5	524.7	437.4	439.2	371.9	380.3	472.8	483.7	739.1	729.0	146.1	150.7
		62	66	52	56	46	48	32	30	90	91	18	12

Items	Unit	Wheat		Olive		R. Fodder (Sorghum)		Sugarcane (Fresh)		Sugarcane (Ratoon)	
		Present	Project	Present	Project	Present	Project	Present	Project	Present	Project
Labour											
Clearing Channels	(hr)	4.9	4.9	4.9	4.9	4.9	4.9	9.9	9.9	9.9	9.9
Deep Ploughing	(hr)	0.2	0.2								
Ploughing	(hr)	3.7	3.7	2.5	2.5	1.2	1.2				
Pl and Plank	(hr)	2.5	2.5	3.7	3.7	3.7	3.7	8.6	8.6		
Puddling	(hr)					1.2	1.2	1.2	1.2		
Pud and Plank	(hr)							14.8	14.8		
Leveling	(hr)										
Raising Nursery	(hr)										
Transplanting	(hr)										
Broadcast Seed	(hr)	4.9	4.9	2.5	2.5	4.9	4.9	173.9	173.9		
Sowing	(hr)	2.5	2.5	2.5	2.5	2.5	2.5	8.6	8.6	4.9	4.9
Fertilizer Appl	(hr)		0			19.8	19.8	4.9	4.9		
Chemical Appl	(hr)					19.8	19.8	29.7	29.7		
Manure appl	(hr)	9.9	9.9	4.9	4.9	74.1	74.1	59.3	59.3	44.5	44.5
Canal Irrigation	(hr)	14.8	14.8	4.9	4.9	4.9	4.9	29.7	29.7	24.7	24.7
Tubewell Irrigation	(hr)										
Hand Weeding	(hr)							79.1	79.1		
Hoeing	(hr)										
Hoe and Thing	(hr)							29.7	29.7	29.7	29.7
Interplough	(hr)										
Sowing	(hr)										
Thinning	(hr)										
Harvesting	(hr)	79.1	83.0	79.1	83.0	59.3	62.7	474.4	498.2	355.8	371.6
Debussing	(hr)										
Shelling	(hr)										
Threshing	(hr)	14.8	15.6	19.8	20.8						
Cleaning	(hr)	19.8	20.8	39.5	41.5						
Stacking Straw	(hr)										
Winnowing	(hr)							39.5	41.5	39.5	41.5
Transport	(hr)										
Miscellaneous	(hr)	22.2	22.2	8.6	8.6	23.5	23.5	63.3	63.3	39.5	39.5
Total man-day		179.4	185.1	173.0	179.3	353.7	363.3	1,000.7	1,056.4	548.8	568.4
		22	23	22	22	23	22	122	122	62	71

Items	Unit	Cotton (1-5)		Cotton (6-10)		Cotton (11-20)	
		Present	Project	Present	Project	Present	Project
Labour							
Clearing Channels	(hr)	4.9	4.9	4.9	4.9	4.9	4.9
Deep Ploughing	(hr)						
Ploughing	(hr)	3.7	3.7				
Pl and Plank	(hr)	1.2	1.2				
Puddling	(hr)						
Pud and Plank	(hr)						
Leveling	(hr)	4.9	4.9				
Raising Nursery	(hr)	47.4	47.4				
Transplanting	(hr)						
Broadcast Seed	(hr)						
Sowing	(hr)	171.0	173.0				
Fertilizer Appl	(hr)	9.9	9.9	14.8	14.8	19.8	19.8
Chemical Appl	(hr)	9.9	9.9	29.7	29.7	29.7	29.7
Manure appl	(hr)	39.5	39.5	29.7	29.7	44.5	44.5
Canal Irrigation	(hr)	59.3	59.3	59.3	59.3	59.3	59.3
Tubewell Irrigation	(hr)	29.7	29.7	29.7	29.7	29.7	29.7
Hand Weeding	(hr)	24.7	24.7	24.7	24.7	24.7	24.7
Hoeing	(hr)						
Hoe and Thing	(hr)						
Interplough	(hr)						
Sowing	(hr)						
Thinning	(hr)						
Harvesting	(hr)			197.7	207.6	385.4	415.1
Debussing	(hr)						
Shelling	(hr)						
Threshing	(hr)						
Cleaning	(hr)						
Stacking Straw	(hr)						
Winnowing	(hr)						
Transport	(hr)			39.5	41.5	74.1	77.8
Care	(hr)	49.4	49.4				
Miscellaneous	(hr)	24.7	24.7	24.7	24.7	49.4	49.4
Total man-day		485.6	485.6	454.7	466.5	731.4	754.9
		61	61	52	58	91	91

Source: Farm Management Handbook 1983, Time Standards for Farm Operations 1984, Rural Labour Market with Special Reference to Hired Labour in Pakistan Punjab 1983, Farm Survey for the Study 1996

Table C.3.4-1 Yield Gap of Various Crops and Anticipated Yield

Crops	Potential Yield under Experiment Conditions	Average Yield of Progressive Farmers	National Average Yield 89-92	Punjab Average Yield	Study Area Average Yield	Project Area Average Yield	World Average Yield	Target Projection of NCA		Anticipated Yield of the Project
								1992/93	1999/00	
Wheat	6.43		2.05	2.18	2.13	2.26	2.46	2.42	2.95	2.50
Paddy	6.85		2.19				3.50	2.40	2.77	
Basmati	5.00		1.07	1.13	1.11	1.18		1.44	2.00	1.33
Maize	6.94		1.40 *1	1.44	1.43	1.43	3.66	1.83	2.09	1.57
Sugarcane	183.00		41.89 *1	40.95	40.55	40.98	61.58	42.00	50.00	46.26
Cotton	1.40		1.37	1.06	1.06	1.42	1.62	1.84	2.14	1.55
Oilseeds (Rape and Mustard)	2.74		0.75 *1	1.06	1.04	1.04	1.33	0.78 *1	1.02 *1	1.14
Mung	2.20		0.41 *1	0.44	0.51	0.51	0.80			0.56
R. Fodder (Berseem)	121.52			29.85	30.19	30.71				33.02
K. Fodder (Maize/Sorghum)	63.23			12.96	12.68	12.84				14.08
Watermelon				19.85	20.74		15.24			22.39
Citrus	30.00			9.21		9.69				10.68

Source: Report of the National Commission on Agriculture (1988)

Agricultural Research Phase-II Project (1995)

FAO Production Year Book

Ayub Agricultural Research Institute (AARI) Research Brochure

Directorate of Agriculture Crop Reporting Service, Punjab

Fodder Research Institute, Sargodha

Crop Area Production

Agricultural Statistics of Pakistan

Study Area: Lahore District, Kasur District, Sheikhupura District, Gujranwala District, Faisalabad District, Toba Tek Singh

District, Jhang District, Sargodha District

Project Area: Kasur District, Faisalabad District, Toba Tek Singh District, Sargodha District

*1 Both irrigated and non-irrigated

Table C.3.4-2 Anticipated Production

Item	Lower Cheong Canal												Central Bin-Dong Canal												Total Prod. (t/ha)									
	Kranai			Nayana			Gaya			Musi			Janawala/Mania			Pimabai			Kittanwala			Overall				Thammin			Chum					
	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)		Prod. (t/ha)	Yield (t/ha)	Prct. (%)	Prod. (t/ha)	Yield (t/ha)	Prct. (%)			
CCA (ha)	78,296	2,285	27,236	6,627	34,877	7,540	19,161	6,413	18,242	27,798	4,267	25,577	16,290	241,111																				
Food Season Crop																																		
Sugarcane	310,841	3,807	44,24	57,021	46,07	338,881	47,20	62,423	45,99	102,990	46,62	62,263	46,15	163,579	64,532	43,90	1,217	1,49	99,047	44,94	1,356,632													
Cotton	5,700	75	1,21	113	1,54	2,345	1,57	790	1,54	3,668	1,56	1,169	1,55	1,554	1,217	1,49	4,229	1,26	337	1,52	22,496													
Rice (Basmati)	3,091	66	1,28	170	1,33	514	1,36	120	1,32	654	1,34	5,132	1,41	4,615	502	1,31	4,334	1,24	366	1,29	14,811													
Vegetable	16,931	317	21,64	797	22,31	4,519	22,41	1,237	22,28	13,726	22,55	2,880	22,35	15,609	1,813	22,08	15,609		11,272	21,81	61,072													
Maize	13,857	430	1,52	2,403	1,56	12,530	1,59	2,438	1,56	4,556	1,58	2,119	1,57	7,390	10,344	1,55	3,877	1,51	3,553	1,53	56,845													
Fodder	229,123	9,377	13,69	20,411	14,04	43,007	14,30	16,628	14,02	39,428	14,16	18,628	14,02	110,653	34,142	14,71	90	0,59	64,976	13,77	590,089													
Others	1,160	17	0,55	16	0,56	874	0,57	181	0,56	208	0,57	208	0,56	55	244	0,56	27	0,54	28	0,55	3,118													
Non-Food Season Crop																																		
Wheat	85,541	3,012	2,43	6,230	2,49	43,967	2,55	9,900	2,49	22,504	2,52	8,865	2,50	49,492	24,631	2,63	28,719	2,47	20,957	2,44	292,144													
Peanut (Broom)	313,659	2,185	32,28	12,321	32,93	55,961	33,43	13,974	32,90	33,569	33,17	4,699	32,97	177,053	29,930	34,20	66,602	32,71	52,795	32,44	707,794													
Others	3,314	101	1,11	536	1,14	4,307	1,16	1,120	1,14	1,926	1,15	686	1,14	2,256	1,742	1,19	1,608	1,13	1,280	1,12	17,285													
Non-Food Crops																																		
Cocoa	139,151	5,725	10,34	4,206	10,64	9,199	10,85	5,143	10,63	11,419	10,74	1,550	10,66	9,069	7,270	11,18	10,701	10,55	4,119	10,43	197,708													
Saving Rate (%)																																		
		7,32		10,35		12,64		10,19		11,46		10,52		9,30	16,22		16,22		8,06		5,95													

Remark: Yields show anticipated yield of SGW area of each cultivated area.

FIGURES

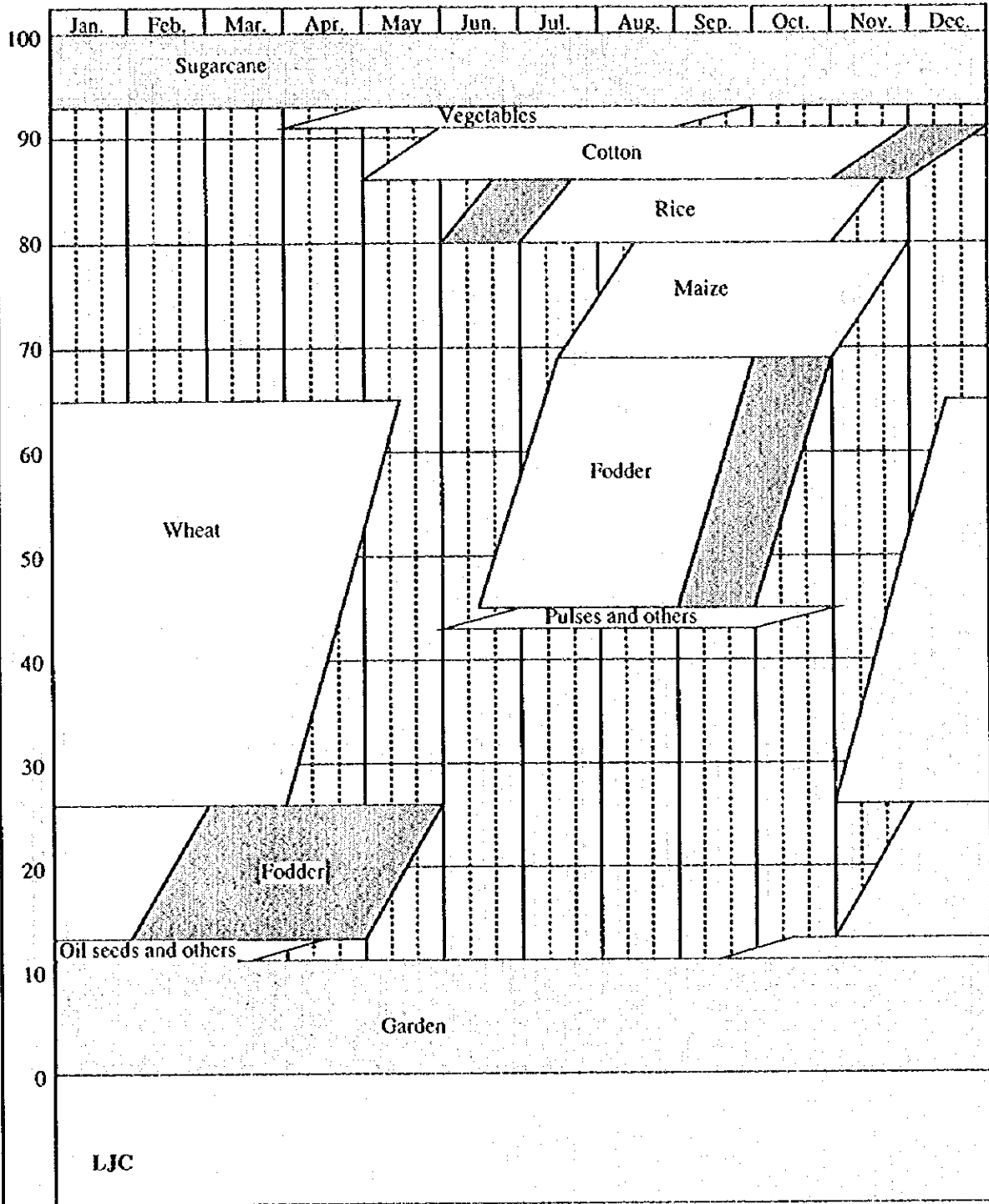


Fig. C.2.2-1 (1/3) Present Cropping Pattern

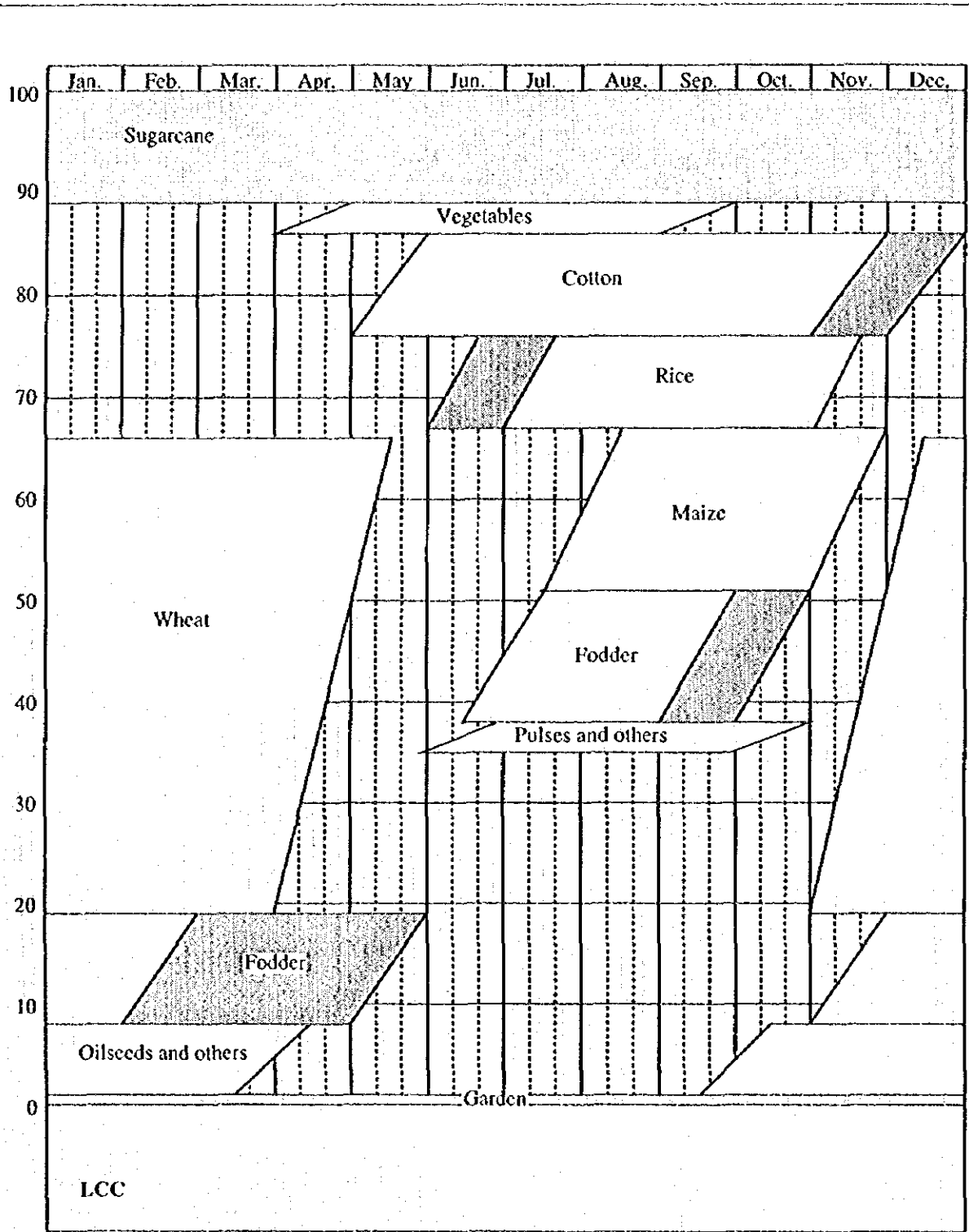


Fig. C.2.2-1 (2/3) Present Cropping Pattern

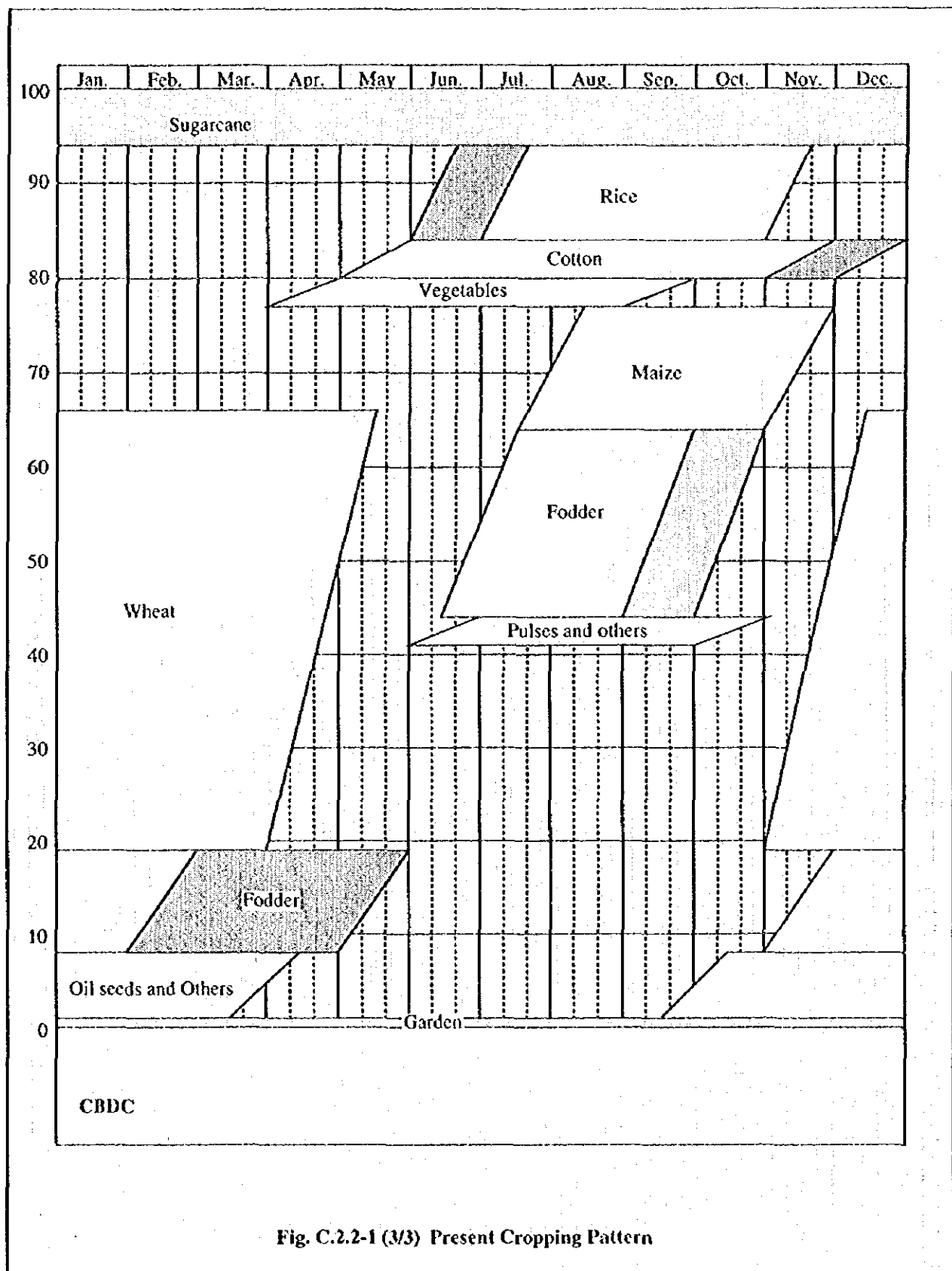


Fig. C.2.2-1 (3/3) Present Cropping Pattern

ATTACHMENTS

**Technical Specifications
for
Farm Survey**

1. Objectives

The main objectives of the farm survey are to survey the agro-economic conditions in the study area according to this technical specifications and to provide data and analyses required for formulation of the project, the Lining of Distributaries and Minors in Punjab.

2. Works

The Works comprise (i) preparatory work, (ii) questionnaire survey in selected villages, and (iii) data analysis and iv) reporting. The Works shall be carried out by full-use of technical knowledge of the Contractor under the supervision and frequent monitoring of JICA Study Team. The discussed and approved questionnaire has been attached.

3. Survey Area

The survey area covers all command areas of the Lower Chenab Canal System, Lower Jhelum Canal System and C.B.D. Canal System in Punjab province, which is approximately 23,500km². The villages, in which the questionnaire survey is carried out, shall be located in both the saline and non-saline zones, and shall be indicated by JICA Study Team.

4. Preparatory Work

The Contractor shall be responsible for employment of enumerators, arrangement of accommodation and transportation required for the survey work.

5. Questionnaire Survey

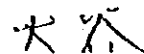
(1) Questionnaire

The questionnaire approved by the JICA Study Team has been attached to this contract as the TOR for the Contractor. The questionnaire contains approximately 100 questions under the following eight (8) headings.

(1) Household Characteristics



CA - 1



- (2) Family life and food consumption
- (3) Land ownership
- (4) Irrigation and water management
- (5) Crop production
- (6) Agricultural Support Services
- (7) Animal husbandry
- (8) General attitude

(2) Sampling

The questionnaire survey shall be done basically by random sampling in selected villages. The number of samples taken in each village shall be not less than thirty (30) so that the respondents will be proportionally distributed in terms of the land holding size and cropping pattern.

(3) Number of Samples

The total number of samples shall be not less than one thousand (1,000). The total number of survey villages shall be thirty four (34), of which twenty three (23) villages shall be located in the saline zone and the remaining eleven (11) villages shall be located in the non-saline zone.

6. Inspection of JICA Study Team

JICA Study Team shall make a series of site inspections to monitor the progress and reliability of the questionnaire survey. The Contractor shall render full cooperation to JICA Study Team's inspection.

7. Data Analysis

The Contractor shall carry out analysis and study based on survey data focusing on:

- i) present agricultural and agro-economic conditions in the Study Area.
- ii) farmers' intention on organizing themselves into WUF.
- iii) proposed procedure and methodology for forming WUF.

8. Outputs to be Submitted

The Contractor shall submit the followings:

- 1) Translated questionnaire in the local language if need be.
- 2) Original questionnaire sheets which have been filled up.



- 3) Database in which the raw data are saved
- 4) Report (four copies) containing:
 - i) Procedure and performance of the Work and location map of survey villages
 - ii) Analysis of survey data
 - iii) Description of the present agriculture and agro-economic conditions of the Study area.
 - iv) Analysis and study on formulation of farmers organization

9. Cost estimation

The estimated costs shall be deemed to cover all the costs necessary for completion of the Works.

10. Work period

All the works shall be completed during two (2) months in April through June, 1996.

