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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF WATER RESOURCES, GOVERNMENT OF INDIA

PUBLIC WORKS DEPARTMENT, GOVERNMENT OF TAMIL NADU

**THE STUDY
ON
THE REHABILITATION OF MINOR IRRIGATION TANKS
FOR RURAL DEVELOPMENT
IN
TAMIL NADU**

FINAL REPORT

**VOLUME IV
APPENDICES**

JANUARY 1998

**PACIFIC CONSULTANTS INTERNATIONAL
SANYU CONSULTANTS INC.**



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THE STUDY ON THE REHABILITATION OF MINOR IRRIGATION TANKS
FOR RURAL DEVELOPMENT

FINAL REPORT

VOLUME IV : APPENDICES

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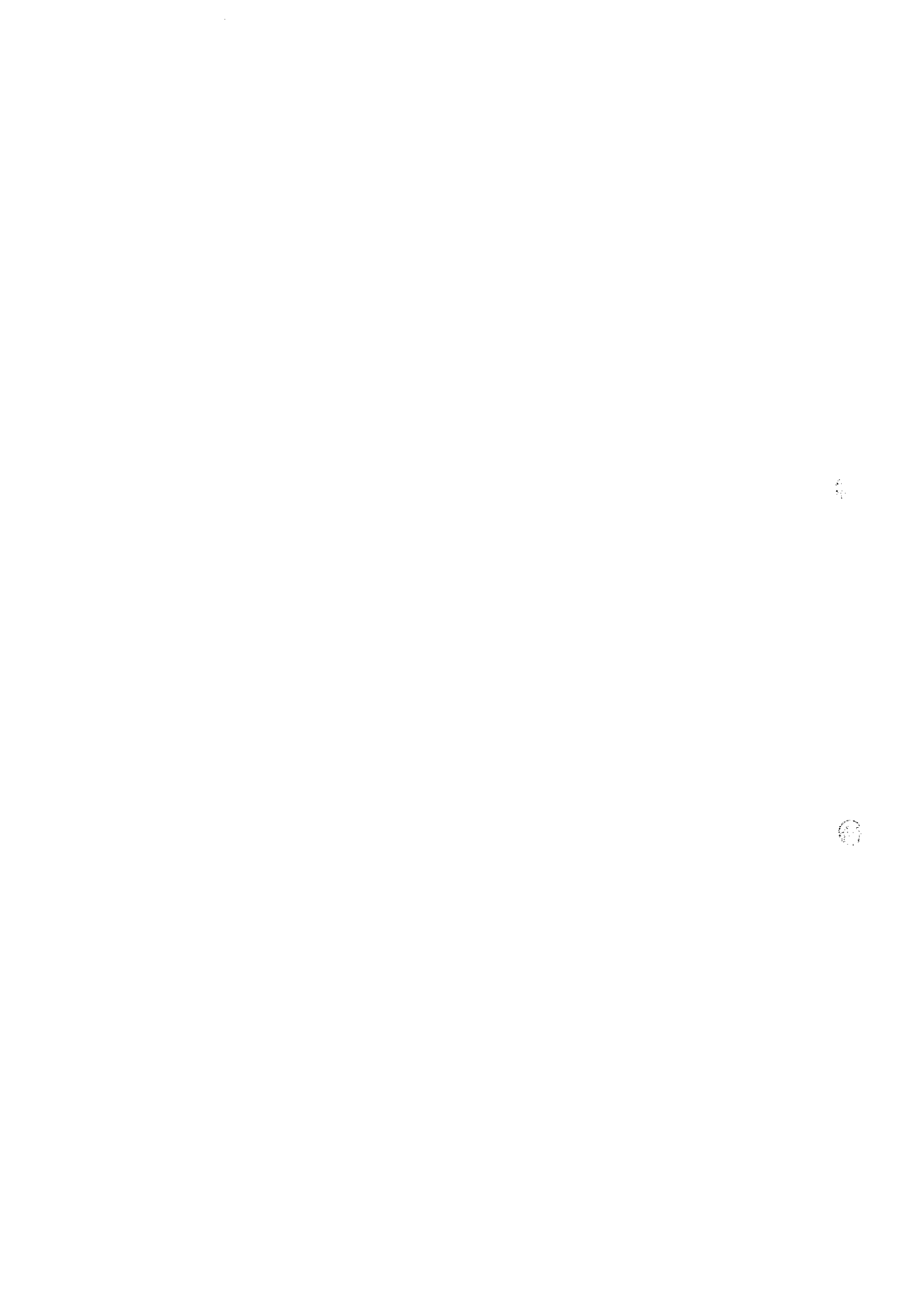
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A AGRICULTURE

A.1. Agriculture in India

A.1.1 Agricultural Policy

Since its independence in 1947, India has formulated and implemented the 8 Five Year Plans with specific objectives to attain economic prosperity and social development.

Significant increase in agricultural production was accomplished in several crops rapidly through five year plans until the 7th Plan. However, due to regional differences in agricultural infrastructure development, regional gaps in agricultural production increased, and per capita agricultural production has not increased so much. Therefore, the dissolution of regional gaps and increase in total production is emphasized in the 8th Plan (1992-1997). In this plan, the agricultural development, has targeted not only on food self sufficiency but also on export of surplus agricultural production. But high priority has been put on the improvement of agricultural productivity to satisfy the food demands of ever increasing population.

In addition to the above, it emphasized on the improvement and stabilization of agricultural production in semi-arid zone where rainfed cultivation is practiced. In rainfed agriculture zone, it is planned to improve the cultivation system for sustainable land and water resources utilization and to increase the farmers' income through diversification of agricultural production, scientific management of land, land consolidation, maintaining soil moisture. It is promoting the plan of garden plantation and agro-forestry which can extend the job opportunity for unskilled labors in rural areas. On the other hand, it also promotes agricultural diversification for the upliftment of small holding farmers who occupy most majority of farmers in India.

In irrigated agricultural zone, it is promoted to introduce watershed management under the environmental conservation together with extension of improved cultivation techniques and rationalization of water use through farmers' organizations. In addition to giving emphasize on sustainable agricultural development and improvement of farm economy, the effective use of chemical and organic fertilizers and integrated pesticide management (IPM) are introduced to reduce the volume of chemicals and to promote environmental conservation.

A.1.2 Population and Agricultural Workers

The total population in India is estimated at 846.3 millions in 1991 with the annual compound growth rate of 2.14 %, of which 74.3 % lives in rural areas. The agricultural workers in the same year is estimated at 185.3 millions including cultivators and agricultural labors, which corresponds to 64.8 % of the total workers in India. The agricultural workers still show an increasing tendency though their rate to total workers is decreasing.

A.1.3 Gross Domestic Product of Agriculture

The agricultural gross domestic product in India is estimated to be Rs. 625,890 million at 1980-81 prices in 1992-93, which share 28.0 % of the gross domestic product. The percentage share of agriculture is falling year by year in spite of the increased rate of 47 % for the 12 years from 1980-81 to 1992-93 due to the larger growth of the total gross domestic product (83 %).

A.1.4 Major Crops

(1) Major Crops

The major crops cultivated in India are rice, wheat, jowar (Cholam or Great millet, *Sorghum bicolor*), bajra (Bulrush or spiked millet, *Pennisetum Typhoides*), groundnut, cotton, gram, rapeseed and mustard, maize, soybean, Tur (red gram or pignon pea, *Cajanus cajan*) and sugarcane. Among the all cultivated crops, food grains occupied 66.5 % of the total cropped area followed by oil seeds with the share of 13.6 % and fiber crops with the share of 4.6 %. The other hand, vegetable and fruit crops shared only 2.2 % and 1.5 % of the total cropped area, respectively. The major food grain production states are Uttar Pradesh, Punjab, Madhya Pradesh, Maharashtra, West Bengal, Bihar and Andhra Pradesh, and over 70 % of the national production amount was covered by these states in 1993-94.

(2) Average Yield and Production

The national average yields of these crops in kg/ha are 1,744 in rice, 2,327 in wheat, 982 in jowar, 1,676 in maize, 573 in pulses, 1,049 in groundnut, 797 in oil seeds, 257 lint in cotton, 894 in soybean and 64, 000 in sugarcane in 1992-93.

At present, India has been producing enough amount of food grains for self sufficiency. On rice, the main production states are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Orissa, Bihar and Madhya Pradesh. The growth of production keeps in pace with population. Zone wise analysis shown below reveals that production growth rate is above that of the population (1.9 %) and productivity is still more with the exception of the northern zone.

Annual Compounded Growth Rate of Rice Yield in Percentage

Zone	1982-83	1991-95
Northern	4.00	1.73
Southern	3.80	2.62
Eastern	5.60	2.08
Western	1.80	5.36

Source: Rice, Development Opportunities, Indian Agriculture 1996.

However, the growth in all zones except the western zone has sharply declined during the Nineties as compared to Eighties. Increasingly unattractive returns and

labor shortage when needed most appear to be the major reason for the decline.

The main wheat production states are Uttar Pradesh, Punjab, Haryana and Madhya Pradesh. The production in India is increasing at a greater pace than the population. Since the introduction of high-yielding dwarf varieties in 1965, there has been a continuous increase in both production and productivity. This has been achieved without any increase in area and mainly by breeding high yielding new genotypes.

The major oilseed crops in India are groundnut, rapeseeds, mustard and soybean, which are mainly produced in the states of Madhya Pradesh, Andhra Pradesh, Rajasthan, Maharashtra, Tamil Nadu, Karnataka and Gujarat where the annual amount of rainfall is around below 1,000 mm. Oilseeds production in India increased about 28% during the half decade of Nineties. However, the amount is not to meet the demand for edible oils because of oilseed crops are grown under rainfed conditions and on low fertility soils with inadequate indigenous production such as continuous cropping in the traditional areas without crop rotation.

A.2 Agriculture in Tamil Nadu

A.2.1 General

Agriculture is the traditional and major industry in the State, employing almost 60% of its labour force, more than 65% of the State population living in rural areas, and contributing approximately 25% to the State Net Product.

Water is the main factor deciding the agricultural production in this State. The Northern regions, with an annual rainfall of approximately 1,000 mm, have enjoyed a perfect rainy season-crop and a relatively good dry season crop with irrigation measures such as from tank sources. The Southern regions, on the contrary, could not constantly obtain a sufficient annual rainfall of mostly 400 - 500 mm with erratic patterns for cropping paddy, sugarcane, vegetables etc., have been often suffered from drought casualties, causing an unstable agricultural production. Apart from the agricultural fields with water supply from system-tanks, other fields in the Southern dry regions should be relied on the groundwater source, particularly in the dry season, for carrying out the agricultural operations due to no available water from the rainfed tanks.

The net cultivated area in the State is roughly estimated at 5.85 million ha or about 45% of the State land area. The area under rice, which is the main crop is about 36% of the total cultivated area, has a tendency to increase, while area under other grain crops and beans shows a decreasing trend. Oil seed crops, such as groundnut, fiber crops and sugarcane are also widely cultivated. With the gross cropped area of around 6.95 million ha, its cropping intensity is about 1.2. This is mainly due to the irrigation water conditions. Only 2.62 million ha or 47% of the cultivated area are under irrigation. Besides, the per capita arable land in the State is only 0.105 ha.

A.2.2 Agricultural Development Plan in the Eighth State Five Year Plan

In the 8th Five Year plan of the State, the agriculture was identified as the main sector and its targets are as follows:

- 1) With a view to improvise the economic status of the poor farmers, it is proposed to bring the fallow lands under the cultivation in about 10,000 ha every year.
- 2) Promoting less water consuming horticulture crops, through special schemes for production and distribution of quality seeds and seedlings of fruit trees, flowers and vegetables and also establishing Horticulture Estates.
- 3) To give impetus to training the farmers in modern technology, through Farmers Training Centers also imparting Orientation Courses for the school students in agriculture.
- 4) Encouraging self-employment, especially in seed production and agro-based industries.
- 5) Increasing the forest coverage of the State through, conservation forestry, community forestry and commercial forestry with special emphasis on fuel and fodder plantations under Sustainable District Forestry Programme(SDFP).
- 6) Emphasis will be laid on Coastal Aquaculture, to step up the prawn production in the blackish water area of the State, consisting of back water, tidal estuaries, mangrove, swamp and lagoons, by establishing Brackish Water Fish Farmers' Development Agencies.

Also as a vital source for agricultural production, the irrigation focused to develop under the following consideration:

- 1) Emphasis will be given to completion of all irrigation schemes that are pending and repairing tanks, ponds, *anicuts* (weir), etc., all over the State, that are a state of disrepair and maintaining them properly. New ponds, tanks and *anicuts* will be built wherever necessary.
- 2) Emphasis will also be on the technological progress and better water management to ensure sustainable growth through higher productivity.

A.2.3 Situation of the State's Agriculture

The situation of the State's agriculture in the national agriculture is characterized as below.

(1) Small size of operational holdings

The average size of operational holdings in the State is small; 0.93 ha, which correspond to 59% of the national average (1.57 ha) as shown in the following table. Further, 73.1% of the holdings are marginal holdings with the average size of 0.36 ha.

States	Marginal	Small	Semi-medium	Medium	Large	All Holdings
Andhra Pradesh	0.45	1.43	2.71	5.86	15.61	1.56
Arunachal Pradesh	0.61	1.51	2.78	5.75	17.27	3.71
Assam	0.41	1.39	2.69	5.23	78.08	1.31
Bihar	0.37	1.41	2.73	5.67	15.99	0.93
Goa	0.32	1.31	2.61	6.00	28.50	0.93
Gujarat	0.53	1.47	2.82	5.99	16.41	2.93
Haryana	0.47	1.52	2.81	5.86	15.43	2.43
Himachal Pradesh	0.41	1.36	2.72	5.66	18.11	1.20
Jammu & Kashmir	0.39	1.38	2.69	5.45	23.09	0.83
Karnataka	0.47	1.46	2.75	5.93	15.22	2.13
Kerala	0.18	1.36	2.60	5.27	55.74	0.33
Madhya Pradesh	0.45	1.45	2.78	6.04	16.46	2.63
Maharashtra	0.49	1.46	2.77	5.86	15.17	2.21
Manipur	0.55	1.37	2.56	5.01	12.16	1.23
Meghalaya	0.54	1.36	2.53	5.49	15.54	1.80
Mizoram	0.64	1.57	2.85	5.81	150.00	1.37
Nagaland	0.64	1.40	2.90	6.31	16.63	6.84
Orissa	0.49	1.38	2.63	5.45	16.61	1.34
Punjab	0.56	1.61	2.91	6.20	16.03	3.61
Rajasthan	0.48	1.44	2.85	6.23	19.13	4.11
Sikkim	0.44	1.70	2.98	6.13	18.00	2.11
Tamil Nadu	0.36	1.41	2.73	5.72	18.44	0.93
Tripura	0.40	1.53	2.69	5.14	121.57	0.97
Uttar Pradesh	0.38	1.41	2.73	5.55	15.34	0.90
West Bengal	0.45	1.53	2.78	5.37	156.99	0.90
All-India	0.40	1.44	2.76	5.90	17.33	1.57

Source: Agricultural Census Division, Ministry of Agriculture

2) High irrigation rate

The State ranks 3rd rank among the most advanced states in percentage of irrigated area to total area under principal crops, that is, the percentage is 94.6% in Punjab, 62.3% in Uttar Pradesh, and 47.9% in Tamilnadu while the national average is 35.7%.

3) High agricultural input

The consumption of fertilizer in the State is 136.64 kg/ha on average in 1994-95, which is 81% higher than the national average (75.68 kg/ha), and ranks the 2nd, next of Punjab (174.75 kg/ha).

4) High yield per unit area

As shown in the table below, the average yields of rice, bajra, groundnut, sugarcane and cotton in the State in 1992-93 are 3,116 kg/ha, 1,144 kg/ha, 1,486 kg/ha, 107 ton/ha and 289 kg/ha, respectively, which are higher than those of national average by 79%, 37%, 42%, 67% and 13%, respectively.

Comparison of Area, Yield and Production of Selected Crops
between India and Tamil Nadu in 1992-93

Crop	Area (Million ha)			Yield (kg/ha)			Production (Million ton)		
	India	Tamil Nadu	I/TN (%)	India	Tamil Nadu	I/TN (%)	India	Tamil Nadu	I/TN (%)
Rice	41.8	2.184	5.2	1,744	3,116	178.7	72.9	6.806	9.3
Wheat	24.6	0	0.0	2,327	--	--	57.2	0	0.0
Jowar(Cholam)	13.0	0.484	3.7	982	1,004	102.2	12.8	0.489	3.8
Maize	6.0	0.043	0.7	1,676	1,625	97.0	10.1	0.07	0.7
Bajra(Cumbu)	10.6	0.22	2.1	836	1,144	136.8	8.9	0.251	2.8
Other Cereals	4.8	0.275	5.7	1,000	1,462	146.2	4.8	0.402	8.4
Cereals (A)	100.8	3.206	3.2	--	--	--	166.6	8.018	4.8
Pulses (B)	22.3	0.739	3.3	574	464	80.8	12.8	0.343	2.7
(A) + (B)	123.1	3.945	3.2	--	--	--	179.4	8.361	4.7
Groundnut	8.2	1.188	14.5	1,049	1,486	141.7	8.6	1.766	20.5
Sugarcane (cane)	3.7	0.216	5.8	64,000	107,000	167.2	236.8	23.064	9.7
Cotton (lint)	7.5	0.267	3.6	257	289	112.5	1.9	0.077	4.1
on-foodgrain(C)	19.4	1.671	8.6	--	--	--	247.3	25.284	10.2
(A) + (B) + (C)	142.5	5.616	3.9	--	--	--	426.8	33.645	7.9

Source: Department of Agriculture, Madras-5. Economic Survey 1994 - 95. Ministry of Finance, Government of India

5) Agricultural production share of the State in India

The share of agricultural production of the State in the national production is 20.5% in groundnut, 9.7% in sugarcane, 9.3% in rice and 4.1% in cotton. The share of total food grains of the State in the national production is only 4.7 % as shown in the above table.

A.2.4 Land Use Pattern

Out of the total geographical area of 13.0 million ha, 16% is occupied by forest, 14% by non-agricultural use, 11% by current fallow and 44% by net area sown. 20% of the net area sown(1.1 million ha) was sown more than once, that is, the cropping intensity is 120%.

A.2.5 Land Tenure System and Land Holding Size

The predominant system of land tenure in the State is the *ryotwari* system, under which a land owner is free to alienate his right over the land by sale or gift. The State Government has imposed a ceiling of 6.07 ha on land holding. About 83 % of the holdings are small and below 2 ha. Further, 64.7 % of the holdings covering an operational areas of 21.1 % of the land area are less than 1.0 ha.

A.2.6 Agricultural Production

(1) Principal Crops

The principal crops in terms of cultivated area in the state are paddy, groundnut, pulses, cholam (*Sorghum Vulgare*), sugarcane and Cotton, which occupied 32.2 %, 16.2 %, 9.6 %, 7.1 %, 3.5 % and 3.2 % of the total cultivated area of 7,158,000 ha in 1993-94, respectively.

(2) Average Yield

The average yield of these crops in the same year is estimated as 2,927 kg/ha in paddy, 1,611 kg/ha in groundnut with shell, 400 kg/ha in pulses, 960 kg/ha in cholam, 104,386 kg/ha in cane of sugarcane and 316 kg/ha in lint of cotton.

(3) Production and Its Yearly Variation

Sugarcane has the biggest amount of production with 26.0 million tones in cane among the crops cultivated in 1993-94 sharing 60.1 % of the total crop production in the State, followed by paddy (15.6 % in rate of the share), tapioca (7.4 %), groundnut (4.3 %), cholam (1.1 %) and mango (1.0 %). The yearly variation of production amount is largest in groundnut (20.7 % in Coefficient of variation) followed by cholam (15.5 %), pulses (10.0 %), cotton (9.4 %), cumbu (9.3 %), paddy (7.1 %), ragi (6.2 %) and sugarcane (5.4 %). The large yearly variations of groundnut and cholam are caused by both the variations of cropped area and yield per unit area. In the recent 5 years, the sown areas and the productions of paddy and groundnut have a tendency to increase but those of pulses tend to be decreased. There is an even increasing demand for most of the essential commodities including pulses, oilseeds, fruits, vegetables, cotton, sugarcane etc. in the State.

(4) Use of Agricultural Inputs

The consumption of fertilizer in the State is 136.64 kg/ha on average in 1994-95, which is 81% higher than the national level (75.68 kg/ha), and ranks the 2nd, next of Punjab (174.75 kg/ha), among the States.

(5) Cropping Sequences/Cropping Systems

The main cropping sequences/cropping systems in different parts of the State are summarized as below.

1) Rainfed

Single crop (Kharif)

Groundnut, cumbu, ragi, cholam, kodo millet (*Paspalum scrobiculatum L.*), redgram and cotton are cultivated in Kharif in rainfed area. Often lab lab, redgram, dewgram, castor, cowpea etc. are grown as intercrops with millets or groundnut as main crop. Tapioca is grown in rainfed area through a year.

Double crop (Kharif / Rabi)

Groundnut, cumbu, ragi are cultivated as the 1st crop in Kharif and horsegram, gingelly, bengalgram, coriander and cotton are cultivated as the 2nd crop in Rabi. In the cases of gingelly / castor (Kharif) - horsegram (Rabi) and cotton / groundnut (Kharif) - bengalgram / sorghum (Rabi) are also found out.

2) Irrigated

Cropping sequences in the irrigated areas of the State are as follows:

- Rice - rice
- Rice - rice - rice / vegetables / ragi / cumbu
- Rice - pulses / groundnut / gingelly / maize / cotton
- Rice - tapioca
- Cotton - sorghum / millets
- Cumbu / ragi - vegetables - summer groundnut
- Ragi / sorghum - cotton
- Redgram - maize - groundnut
- Sugarcane / banana / betel vine / ornamentals (2-3 years)

A.2.8 Livestock and Poultry

Cattle is the major livestock bred and ranked first among all the livestock bred in the State as shown in table below, which shares 35.5 % of the total number of livestock of 26,366,220 heads in 1989, followed by goats, sheep, buffaloes, dogs and pigs. The number of poultry in the State in 1989 is 21,450,638 of which 98% is occupied by fowls and the rest is ducks and drakes. The milk and egg productions in the State rose to 3,483,400 tones and 2812 million pieces per year on the average of the 5 years from 1990-91 to 1994-95, respectively. The average yields of milk and per capita consumption of milk and egg are at very low level.

A.2.8 Agricultural Supporting System

(1) Agricultural Research and Technology Development

Agricultural research and technology development activities in the State are carried out by Tamil Nadu Agricultural University (TNAU). There are 37 agricultural research stations in the 7 different agro-climatic zones in the State. The list of the research stations are given in Table A.2.1. The policy making of the research is done by Research Council organized by the Vice-chancellor who is the chairman of the council and Director of Research acts as a Member-Secretary. The other members are the Registrar, all the University Officers, Directors of the State Department of Agriculture, Horticulture and Plantation Crops, Agricultural Marketing and Seed Certification, Chief Engineers (Agricultural Engineering and River Valley Project), five members from among the Heads of Department of the University nominated by the Vice Chancellor, five experts to represent different disciplines, one progressive planter and one seed producer from outside the University nominated by the Pro-Chancellor. The research focuses on need-based field-oriented and location-specific research to develop the technology for the benefit of the farming community.

(2) Technology Transfer Activities

Technology transfer activities are carried out by both of the Department of Agriculture and the TNAU in the State. There are 384 main centers and 396 sub-centers for technology extension in the State. Number of personnel concerned to the extension activities are in the State are 7,695 of which 4,126 persons are Assistant Agricultural Officers who are the front workers at the sites as shown below. The number of operational holders to be taken charge by per assistant agricultural officer are 1,939 holders on average.

The Directorate of Extension Education of the TNAU is vested with the responsibility of disseminating the latest technology emanating from the research programs to the farming community through various transfer of technology centers. Besides this, regional stations located at different agro-climatic regions of the State also undertake extension education activities.

As for the transfer of technology to farmers, the five technology transfer centers (*Krishi Vigyan Kendras*) at Coimbatore, Madurai, Trichy, Virudhachalam and Salem conduct on campus and off-campus training programs on different aspects of agriculture and allied sciences for the benefit of various segments of the farming community. They also organize first line demonstration on oil seeds and pulses with a prime objective of establishing the potential of improved technology in increasing the productivity of oilseeds and pulses.

(3) Crop Loan Scheme

In order to help marginal and small farmers in their agricultural production a short term loan scheme for cultivation purposes (Crop Loan Scheme) has been carried out by NABARD (National Bank for Agriculture and Rural Development) through Tamil Nadu State Cooperative Bank and District Central Cooperative Banks to Primary Agricultural Cooperatives for offering the crop loan to individual farmers.

This scheme is basically for short term of 6 to 12 months upon crop type, and up to 18 months for sugarcane, with the loan amount changing per crop and per region combined with a variety of loan interest rates decided by Tamil Nadu State Cooperative Bank, corresponding District Central Cooperative Bank and Primary Agricultural Cooperative upon each evaluation.

Besides, the loan amount is made in two portions: cash and agricultural inputs decided by NABARD in principle. In general the loan amount for paddy is about Rs.3,000 per acre made in about Rs 1,000 by cash and the rest by materials. The annual interest is from 12 to 18 percents depending on season and region.

A.3 Agriculture in the Study Area

A.3.1 Land Tenure and Holding

(1) Soils

Soils in the Study Area are divided into five (5) orders; Entisol (Redloam), Inceptisols (Lateritic), Vertisols (Black), Alfisols (Sandy Coastal Alluvium) and Ultisols (Red Sandy). Nitrogen content seems to be low in both Northern and Southern Study Areas as well as in whole Tamil Nadu state, and the content of Phosphorous is low in the Southern Study Area comparing with the Northern Study Area. Potassium content is judged to be enough to grow crops in both Study areas.

(2) Land Use

About 41 % of the Study Area are cultivated and more than 55 % cultivated area are irrigated.

(3) Number of Operational Holdings and Area Operated

The number of operational holders in the Study Area is 1,476,507 in 1990-91 which occupies 18.5 % of the total operational holders in the State. The area operated is 1,150,246 hectares which shares 15.4 % of the total operated area in the State.

(4) Average Size of Operational Holders

The average size of operational holdings in the Study Area is 0.78 ha in 1990-91 ranging from 0.69 ha in the Districts of Kanchipuram & Tiruvallur and Sivaganga to 0.99 ha in the District of Virudhunagar. The average size is smaller than that of the State (0.93 ha) and about 78 % of the operational holdings are below 1.0 ha.

A.3.2 Agricultural Production

(1) Principal Crops

The major crops cultivated in the Study Area are largely differed by the location of the area. In the districts of Kanchipuram & Tiruvallur and Sivaganga where the percentage of irrigated area to the total cropped area is above 60 %, the major crops cultivated are paddy, groundnut and sugarcane. In these areas paddy, groundnut and sugarcane share more than 60%, 10 to 20 % and 3 to 4 % to the total cropped area, respectively. On the other hand in the Ramanathapuram and Virudhunagar Districts where the percentage of irrigated area to the total cropped area is 32 % and 33 %, the major crops are diversified as paddy, chili, groundnut and ragi in the Ramanathapuram District, and Cotton, paddy, cumbu (*Pennisetm typhoideum*), groundnut, blackgram, Cholam, greengram, gingelly, chili, sugarcane, ragi (*Eleusine cora cana*), varagu (*Paspalum Scrobiculatum*) and redgram in the Virudhunagar District.

(2) Average Yield (Table A.3.1)

1) Paddy

The average yield of paddy rice is highest in Virudhunagar District with 3,172kg/ha in 1992-93, followed by Tiruvallur & Kanchipuram (3,079kg/ha), Sivaganga (2,651kg/ha) and Ramanathapuram (1,537kg/ha). These yields are lower than that of the State, except in Virudunagar district. The large difference in yields among the districts probably would be caused by variation in irrigation ratio.

2) Groundnut

The average yields of groundnut in the Study Area is largely differed by district, that is, the highest is 1,786 kg/ha in the combined Tiruvallur and Kanchipuram District and the lowest is 973 kg/ha in Sivaganga District in 1992-93. The differences in yield among the districts also probably be caused by the irrigation ratio because the irrigated yields are about 2.5 times of the non-irrigated yields on the average of the four (4) districts. The average groundwater yield of the Study Area is slightly higher than that of the State.

3) Sugarcane

Sugarcane is cultivated under irrigated condition. The average yields are about 107 tones/ha in cane in the 3 Districts in 1992-93 except Sivaganga District whose yield is 95 tons/ha. The average yield of the Study area is nearly the same as that of the State.

4) Ragi

The average yield of ragi in the Study Area is 1,519 kg/ha in 1992-93 ranging from 2,495 kg/ha in Virudunagar District to 929 kg/ha in Ramanathapuram Districts. The yield is largely differed by irrigation ratio, that is, the irrigated yields are 2.03 times of the non-irrigated yields on average of the 4 Districts. The average yield of the Study area is lower than that of the State by about 20% in spite of the higher irrigation ratio.

5) Cotton

The average yield of cotton in the Study Areas is 1,072 kg/ha in lint in 1992-93 with the maximum of 2,270 kg/ha in Sivaganga District and the minimum of 1,014 kg/ha in Virudhunagar District. The irrigated yield is 2 times of the non-irrigated yield on average of the 4 Districts. The average yield of the Study Area is considerably low, 63% of that of the State. It seems that the cultivation of cotton in Virudhunagar district has some technological problems.

6) Cholam, Cumbu, Gingelly

The average yields of cholam, cumbu and gingelly in the Study Area are 1,512kg, 1,369 kg and 377 kg per hectare, which correspond to 151%, 120% and 77% of those of the State respectively. These yields were also largely increased by irrigation.

(3) Gross Income (Table A.3.2)

Regarding the gross income by crops, the maximum gross income was obtained by banana with the average gross income of Rs. 158,267 in the Study Area followed by mango (Rs. 157,432), turmeric (Rs. 101,097), sugarcane (Rs. 78,175), tamarind (Rs. 41,659), tapioca (Rs.31,674), onion (Rs. 18,183), chillies (Rs. 16,727), paddy (Rs.13,673) and groundnut (Rs.8,999).

A.3.3 Farming Practices

In the Southern Study Area, where the normal annual rainfall ranges from 700 to 1,000 mm with the unsecured yearly distribution, the timely receipt of rain has a decided influence on the land use and cropping patterns. The representative technology

developed to meet with the insecure rainfall are:

- i) Use of rice seedlings purchased from outside areas.
- ii) Change over cultivation method from transplanting to direct sowing.
- iii) Change over the cultivation crop from rice to cholam/ groundnut/ cotton.
- iv) Introduction of mixed cultivation such as cholam, cumbu and cotton.

A.3.4 Cropping Pattern

Generally, paddy is cultivated under irrigated condition in Rabi season. However, in Ramanathapuram District, rainfed paddy prevails in large areas in Summer season (Jan. to June). Sugarcane is cultivated only under irrigated condition. However, the areas remains only 2 to 3% of the total planted areas due to the long growing duration extending nearly for one year. In some water surplus areas, paddy in kharif season and irrigated ragi, cotton, groundnut and chillies are also cultivated.

A.3.5 Livestock

The main livestock in the Study Areas are Cattle (1.359 million heads), sheep (1.138 million heads), goats (0.787 million heads), buffaloes (0.479 million heads) and pigs (46,000 heads). Nearly half of the heads of livestock in the Study Areas has been spread in the Tiruvallur & Kanchipuram Districts. Especially, buffaloes and cattle concentrate in these districts. 12 % of the State's poultry production is from the Study Areas, and 42.1 % of the total heads of ducks and drakes in the State is raised in the Study Area, almost concentrating in the Tiruvallur & Kanchipuram District. Milk production in the Study Area amounted to 564,200 tones on average of the years from 1990 to 95, which correspond to 16.2 % of those in the State. Egg production in the Study Areas amounts to 1,489 X10⁵ pieces per year, which is equivalent to 5.3 % of those of the State. The egg production in the recent 5 years in the Study Areas shows a constant upward trend.

A.3.6 Agricultural Supporting System

There are 37 agricultural research stations in the 7 different agro-climatic zones in the State. Four research stations out of 37 are located in the Study Area with specific activities as follows.

- (i) Paddy Experimental Station, Tirur - Crop improvement work in rice under wet dry and semi-dry conditions.
- (ii) Cotton Research Station, Srivilliputhur - Improvement of medium staple cotton for assured irrigated areas.
- (iii) Regional Research Station, Aruppukottai - Dry farming for red and black soils.
- (iv) Agricultural Research Station, Paramakudi - Verification of findings on rice improvement.

A.3.7 Aquaculture

In the Study Area, there are two (2) Fish Farmers Development Agencies (FFDA), one at Kancheepuram with jurisdiction over the Kancheepuram and the Tiruvallur districts and another at Ramanathapuram. In the Southern Study Area, intensive activities are in progress only in 179 Panchayat Union tanks under 10 Panchayat Unions in the Kamarajar district at present.

Since the annual rainfall is limited in the Southern Study Area, most of the rainfed tanks in these areas are considered to be the short seasonal tanks, which are dried up during most period of a year. Therefore, it seems to be difficult to introduce such pisciculture that needs the water for feeding fish long period. On the contrary, the rainfed tanks in the Northern Study Area have water even during the dry season though the water levels varies widely and lowered. It is, therefore, considered possible to introduce pisciculture to the pilot tanks in the Northern Study Areas if such water is available as a result of water balance study. During the field surveys, it was found that in some villages such as the Vadakkupattu tank, etc. fishing was conducted.

A.4 Master Plan for Agricultural Development in Minor Irrigation Tank

A.4.1 Present Constraints for Agricultural Development

The present constraints of agricultural development are mentioned below:

- (1) Shortage of Stored Water in the Tank
- (2) Deterioration of Tank Irrigation Facilities
- (3) Poor Irrigation Management
- (4) Farmers' Strong Intention for Paddy Cultivation
- (5) Poor Coordination of Water Distribution among Chained Tanks
- (6) Lack of Awareness of Community Property
- (7) Poor Accessibility to Market

A.4.2 Basic Agricultural Development Strategies in the Master Plan

The basic agricultural considerations made in formulating the Master Plan are:

- 1) Establishment of Sustainable Agricultural Production System
- 2) Improvement of Rural Infrastructure for Agricultural Development
- 3) Institutional Development for the Project Implementation

A.5. Feasibility Study of Pilot Tank Areas

A.5.1 Present Conditions

(1) Land Use

Land use in the Pilot Tank Areas is shown in Table A.5.1. The crop intensity in 1995-'96 varied from 40.1 % in Sengangulam Tank Area to 180.7 % in Cherukanur Big Tank Area with the average of the whole Pilot Tank Areas of 93.9 %. In normal year, the average crop intensity of the Pilot Tank Areas was 112.3 %. The intensity is higher in the Northern Pilot Tank Areas. The cropped land is mostly allotted to paddy cultivation in the rainy season. Looking from the present situation of the agricultural water source, large improvement of the crop intensity in the Tank Areas can not be expected.

(2) Crop Production

Main crops in the Pilot Tank Areas is paddy, followed by sugarcane, casuarina, ragi, groundnut and pulses (Table A.5.2). At present, the paddy shares 93 % of the cultivated area and 92 % in net crop income in the whole Pilot Tank Areas. The average yield of paddy varies from 2.0 tons/ha in Pandikanmoi Tank Area to 4.8 tons/ha in Sengangulam Tank Area with the average of 4.1 tons/ha in rainy season and 4.6 tons/ha in dry season. It seems that paddy is the most suitable crop in the rainy season in these Pilot Tank Areas because of the suitable growing period, the submerged field condition, the income, the marketability as well as staple food. However, judging from the yield level and the limited agricultural water source, large increment of the farming profit by paddy cultivation will not be expected . In the Cherukkanur Big Tank Area, sugarcane and casuarina are cultivated in the areas of 20.0 ha and 12.0 ha with the production of 2,000 tons and 270 tons/year, respectively. The net income of these crops is higher than paddy, but sugarcane requires irrigation throughout a year and casuarina needs a long growing period for 4 to 5 years. Groundnut is grown as a 2nd crop after paddy with irrigation by tank water or well water in the Tank Areas of Echur, Polambakkam and Kurumbi. The average yield is about 1.4 tons/ha. In A.Ramalingapuram Tank Area, cotton and green gram are grown in the dry season with well irrigation in the areas of 1.2 ha and 3.5 ha, respectively. In Pandikanmoi Tank Area, chili and cotton are grown in the dry season under rainfed in the areas of 2.0 ha and 2.5 ha and in Sengangulam Tank Area, cotton and ragi are cultivated under rainfed in the areas of 10.0 ha and 40.0 ha, respectively. In Kurumbi Tank Area, black gram is also grown in the dry season with well irrigation in the area of 6.0 ha.

(3) Irrigation Water

Tank water, well water and rainfall are the source of agricultural water in the Pilot Tank Areas. As shown in Table A.5.3, the irrigable areas of the Tank water vary

from 40.0 ha in Sengangulam Tank Area to 602.0 ha in Vadakkupattu Tank Area with the average of 137.5 ha in normal year. The average of irrigable areas in the Northern Pilot Tank Areas (224.9 ha) is 4.5 times of that in the Southern Pilot Tank Areas (50.1 ha). The irrigable periods range from 2.5 months in Pandikanmoi Tank Area to 11 months in Cherukkanur Big Tank Area with the average of 5 months. The average in the Northern Pilot Tank Areas (6.4 months) is 1.7 times of the Southern Pilot Tank Areas (3.7 months). In the Tank Areas of A.Ramalingapuram, Pandikanmoi and Sengangulam where the irrigable periods are below 3 months, rice cultivation by tank water only is remarkably hard . In fact, in Pandikanmoi Tank Area, direct sowing culture of paddy combined with rainfed and irrigation has been carried out.

On the well water, the irrigable areas range from 10.0 ha in Sengangulam Tank Area to 125.4 ha in Enadur Big Tank Area with the average of 32.2 ha, except Siiruvilai and Pandukanmoi Tank Areas. In Siruvilai and Pandikanmoi Tank Areas, there is no well because of salinity problem. In the Southern Pilot Tank Areas, irrigation water including the tank and well water and the rainfall has severe limitation, especially in Pandikanmoi Tank Area. The average irrigable area per well is 1.1 ha in normal year.

(4) Fertilizer Application

The state of fertilizer application to the paddy crop in the Study Areas is shown in Table A.5.4. Nitrogen was applied 62 kg/ha on average in the 87 % of the farmers. Phosphorus was applied 35 kg/ha on average in the 74 % of the farmers. Potash was applied 22 kg/ha on average in the 40 % of the farmers. These amounts applied are considerably low than those of the government recommendation, that is, 120-150 kg/ha in N, 38-50 kg/ha in P_2O_5 , and 38-50 kg/ha in K_2O . It is, therefore, expected to increase yield by improved fertilizer application.

(5) Labor Input

Labor input to crop cultivation in the Pilot Tank Areas are shown in Table A.5.5. The total amount of labor input for paddy cultivation was around 200 man-day/ha on average, of which 28 % is allotted to harvesting, 24 % to weeding and 21 % to transplanting. The labor inputs for vegetables, sugarcane and groundnut cultivation were around 4.3 times, 2.3 times and 0.6 times of the paddy, respectively.

(6) Labor Force

The total family members per farm household in the Pilot Tank Areas is 5.2 persons of which the agricultural labor is 2.5 persons and the potential labor is 4.5 persons on average (Table A.5.6). The agricultural labor per farm household varied from 1.1 persons in Polambakkam Tank Area to 4.9 persons in Kurumbi Tank Area. The necessary staggering period required in each command areas to accomplish paddy

farm works by family labor was calculated in the Table A.5.7. According to the results, the necessary cropping staggering periods in the Pilot Tank Areas is below 12 days when the potential family labors were used. This results indicate that in the Pilot Tank Areas, pressure for labor force to paddy cultivation is not found out at present.

(7) Livestock

The present conditions of raising livestock are shown in Table A.5.8 and A.5.9. The data are considerably differed by the sources. According to the Table A.5.8, the most popular livestock in the Study Areas is chicken, followed by cattle, sheep, goat, duck and pig. The cattle was raised 3,163 heads in the 2,066 farm households. However, the activities such as selling, purchasing and consumption at home can scarcely be seen throughout the year (Table A.5.9). It seems that the raising of livestock in the Pilot Tank Areas is not so important for the farming except draft cattle.

(8) Operating Land Area

The operating land area in the Pilot Tank Areas is considerably small. As shown in Table A.5.10, the average area is 0.71 ha which correspond to 76.3 % of the State (0.93 ha) and 45.2 % of the all India. Especially, in 6 Tank Areas out of 10 tanks, the average land holding area is less than 0.5 ha.

A.5.2 Development Plan

(1) Land Use

The crop intensity of the Pilot Tank Areas is 108.4 % which increased 10 points than that of the present(98.4 %). The increment is caused by the introduction of high return crops grown by well water in the dry season.

(2) High Return Crops

The promising high return crops are shown in Table A.5.11. Turmeric showed the highest net income per unit area which is more than 6 times of paddy, followed by green chili(5.7 times of the paddy), banana(over 4 times), ladies' finger(3.3 times), egg plant(3.0 times), tomato(2.9 times), dry chili(2.9 times), sugarcane(2.7 times) and casuarina(1.7 times). On the net income per day, ladies finger showed 2nd highest net income. Drip irrigation showed higher net income than that of surface irrigation.

(3) Target of Farming

In order to improve the present low farming profit by paddy mono-culture, the target of farming of the command areas was focused on "Rice Based Profitable and

Sustainable Agriculture” with introduction of high return crops. The rice cultivation aimed at securing of the present amount or securing of self-support amount which was set up at 2,000 kg per household based on the data obtained from the farmers’ interview survey. The promising crops were chosen from the Table A.5.11 in consideration of the suitability of the crops to the areas.

(4) Cropping Plan

The cropping plan was made in consideration of the geographical irrigable area, the irrigable area and irrigable period by tank water, the irrigable area by well water, the rainfall condition, the soil condition and the self-support amount of rice. In the plan, the total paddy area of the Study Area is slightly decreased from the present area and the area of other high return crops increased 181 % than the present area.

(5) Expected Net Income

The total net income in the Pilot Tank Areas increased 73 % than the present one, which was brought about by both of the increased income of high return crops(615 % in increase rate) and the increased income of paddy (28 %).

Expected Net Income

	Area (ha)			Net Income (Rs.1,000)		
	Present(A)	Plan(B)	(B)/(A)	Present(A)	Plan(B)	(B)/(A)
Paddy	1,473	1,433	97 %	19,271	24,748	128 %
Others	111	312	281 %	1,585	11,336	715 %
Total	1,584	1,745	110 %	20,856	36,084	173 %

About 35% of these net income was brought by the high return crops cultivated by well water in the dry season. As shown in below Table, the well water in the dry season largely contributed to the increment of the net income. This results indicate importance of the orderly development of the ground water.

Net Income by Water Source

Water Source	Present(Rs.1,000)	Percentage(%)	Plan(Rs.1,000)	Percentage(%)
Tankfed	17,787	85.3	22,813	63.3
Wellfed	2,984	14.3	12,907	35.8
Rainfed	85	0.4	346	0.9
Total	20,856	100.0	36,084	100.0

(6) Labor Requirement of the Proposed Cropping Schedules

High labor requirements were estimated in September of A.Ramalingapuram Pilot Tank Area. However this labor amount can be settled by the working of the potential family labor in the area for 21 days. The total labor requirement in the Pilot Tank Areas was increased by 52 % than the present one. As the increased amount is

mainly scattered in the dry season, the planned cropping will bring stabilized labor requirement throughout a year, especially bring increment of women's labor.

Table A.2.1 List of Agricultural Research Station in the State (1/2)

Sr. No. and Station	Existing functions
NORTHERN ZONE	
1. Paddy Experiment Station, Tirur	<ul style="list-style-type: none"> • Crop Improvement work in rice under wet dry and semi-dry conditions
2. Sugarcane Experiment Sub-Station, Melalathur	<ul style="list-style-type: none"> • Studies on chemical ripeness and inter-cropping in sugarcane
3. University Research Center, Vellore	<ul style="list-style-type: none"> • Studies on the performance of banana cultivars and major agricultural crops in this region.
4. Oilseed Experiment Station, Tindivanam	<ul style="list-style-type: none"> • Oil seed improvement.
5. Multi-crop Experiment Station, Palur.	<ul style="list-style-type: none"> • Research confined to agronomic trials of all the crops grown in South Arcot district.
6. Sugarcane Research Station, Cuddalore.	<ul style="list-style-type: none"> • Sugarcane improvement.
7. Regional Research Station, Virudhachalam.	<ul style="list-style-type: none"> • Research activities on groundnut, gingelly and cashewnut.
NORTHWESTERN ZONE	
8. Regional Research Station, Paiyur.	<ul style="list-style-type: none"> • Studies on dry farming techniques.
9. Betelvine wilt scheme, Velur.	<ul style="list-style-type: none"> • Studies on the method of control of betelvine wilt diseases.
WESTERN ZONE	
10. Agricultural Collage and Research Institute, Coimbatore	<ul style="list-style-type: none"> • Wide spectrum of research covering crop improvement, crop management, soil management, pest and disease management, implements and machinery, water management etc., besides teaching in these disciplines.
11. Agricultural Research Station, Bhavanisagar.	<ul style="list-style-type: none"> • Seed production in rice, groundnut, millet and pulses.
12. Agricultural Research Station, Aliyarnagar.	<ul style="list-style-type: none"> • Evolution of short duration rice varieties, semi-spreading and bunch types of groundnut varieties.
13. Forest Research Station, Mettupalayam.	<ul style="list-style-type: none"> • Studies on farm forestry.
14. Horticultural Research Station, Periyakulam.	<ul style="list-style-type: none"> • Research to tropical fruit crops like mango, citrus, sapota and grapes.
CAUVERY DELTA ZONE	
15. Tamil Nadu Rice Research Institute, Aduthurai.	<ul style="list-style-type: none"> • Evolving new rice strains of different duration to suit different seasons of the zones with a view to increase and stabilize production.
16. Kumara Perumal Farm Science Center, Tiruchirapalli.	<ul style="list-style-type: none"> • Studies on the problems connected with soil salinity and alkalinity, and on salt affected soils in relation to morphological, physical and chemical features.
17. Soil and Water Management Institute, Kattuhottam, Thanjavur district.	<ul style="list-style-type: none"> • Studies on the water use efficiency in Deltaic region of Thanjavur.
18. Coconut Research Station, Veppankulam, Thanjavur district	<ul style="list-style-type: none"> • Studies on suitable varieties and hybrids of coconut to increase and stabilize oil production under east-coast conditions.

Table A.2.1 List of Agricultural Research Station in the State (2/2)

Sr. No. and Station	Existing functions
19. Coconut Research Station, Veppankulam, Thanjavur district	<ul style="list-style-type: none"> • Evolving new cropping system for Thanjavur district.
20. Sugarcane Experiment Sub-Station, Sirugamani	<ul style="list-style-type: none"> • Verification center to test the findings on sugarcane from other centers.
SOUTHERN ZONE	
21. Agricultural Collage and Research Institute, Madurai.	<ul style="list-style-type: none"> • Basic and applied research on rice and other important crops of southern district.
22. Agricultural Research Station, Kovilpatti.	<ul style="list-style-type: none"> • Study on dry farming techniques for black soil region and improvement in millet and cotton.
23. Cotton Research Station, Srivilliputhur.	<ul style="list-style-type: none"> • Improvement of medium staple cotton for assured irrigated areas.
24. Regional Research Station, Aruppukottai	<ul style="list-style-type: none"> • Dry farming for red and black soil.
25. National Pulses Research Center, Vamban	<ul style="list-style-type: none"> • Pulse improvement
26. Agricultural Research Station, Paramakudi.	<ul style="list-style-type: none"> • Verification of findings on rice improvement.
27. Rice Research Station, Ambasamudram.	<ul style="list-style-type: none"> • Studies on rice improvement for Thambaraparani river basin.
28. Agricultural Collage and Research Institute, Killikulam.	<ul style="list-style-type: none"> • Basic and applied research for the important crops of southern zone.
HIGH RAINFALL ZONE	
29. Rice Research Station, Tirupathisaram.	<ul style="list-style-type: none"> • Studies on the improvement of rice in high rainfall tankfed rice culture.
30. Horticultural Research Station, Pachiparai.	<ul style="list-style-type: none"> • Studies on the improvement of plantation crops.
HILLY ZONE	
31. Horticultural Research Station, Kodaikanal, Dindigul Quaid-e-Millath district.	<ul style="list-style-type: none"> • Improvement of apple and other temperate fruits and research on medicinal plants and hilly vegetables.
32. Horticultural Research Station, Thadiyankudisai, Dindigul Quaid-e-Millath District.	<ul style="list-style-type: none"> • Studies on disease control on banana and chow-chow and inter cropping in the hilly regions.
33. Horticultural Research Station, Yercaud, Salem District.	<ul style="list-style-type: none"> • Studies on coffee, mandarin-oranges and on agronomic aspects of rainfed and temperate vegetables.
34. Fruit Experiment Sub-Station, Kallar	<ul style="list-style-type: none"> • Agronomic studies on hill fruits of lower elevation.
35. Fruit Experiment Sub-Station, Burliar.	<ul style="list-style-type: none"> • Agronomic Studies on hill fruits.
36. Potato Experiment Sub-Station, Nanjanad	<ul style="list-style-type: none"> • All aspects of cultivation and improvement of potato.
37. Pomological Station, Coonoor	<ul style="list-style-type: none"> • Introduction of different kinds of fruit trees, vegetables and other economic crops that are likely to thrive in the hills of South India.

Table A.3.1 Result of the Field Inspection in the Study Area (1/4)

Athupakkam I. Tank, Gumidipundi, Chengalpattu (N/A-1)
 1) Date of Surve : 25/Jan, 1997
 2) Command Area : 199.44 ha
 3) Number of Farm Households :
 6) Cropping : Rice - Groundnut/Ragi
 7) Profitability of crops : Paddy > Groundnut > Gagi

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
199.44 (199 ha)	Paddy	Normal	Irrigation	July	Dec	180	3,750	5.00	18,750	IR50,IR20,PONNI, CO43,White Ponni
4.00 (120 ha)	Groundnut (120 ha)	Normal	Rainfed (2nd crop)	Jan	April	105	1,250	15.00	18,750	JL 24,RED,WHITE
12.00 (79 ha)	Ragi (79 ha)	Normal	Rainfed (2nd crop)	Jan	April	105	2,500	5.00	12,500	--

Kanagavalli Tank & Kadamberi Tank, Tiruvallur, Chengalpattu (N/A-3)
 1) Date of Surve : 31/Jan, 1997
 2) Command Area : 56ha (Pattarperumbudur)
 3) Tank Water : June to Nov , Full water
 4) Cropping pattern : Rice(1st crop) - Rice(2nd crop) - Groundnut(3rd crop)

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
48.00	Paddy	Normal	Irrigation (Tank water)	June	Sep	105	5,625	--	--	--
48.00	Paddy	Normal	Irrigation (Tank water)	Sep/Oct	Jan	165	5,625	--	--	--
8.00	Sugarcane	Normal	Irrigation (Tank water)	June	May	365	32,000 (in cane)	--	--	--
48.00	Groundnut	Normal	Irrigation	Feb	May	105	2,500	--	--	--

Echur Eri Tank, Chengalpattu, Chengalpattu (N/A-5)
 1) Date of Surve : 24/Jan, 1997
 2) Command Area : 58.68 ha
 3) Cropping Pattern : Paddy(Ground water) - Groundnut(Tank) - Paddy(Tank)

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
	Paddy (1st crop)	Normal	Irrigation (Ground water)	July	Oct	120	5,000	4.00	20,000	IR20,IR50
	Groundnut (2nd crop)	Normal	Irrigation (Tank water)	Dec	Feb	100	3,000	5.00	15,000	--
	Paddy (3rd crop)	Normal	Irrigation (Tank water)	March	June	120	3,750	5.00	18,750	PONNI
	Okra	Normal	"	Jan	April	120				
	Eggplant	"	"	"	"	120				
	Chillies	"	"	"	"	120				
	White carrot	"	"	"	"	120				
	Sugarcane	"	Irrigation	Jan	Dec	365				

Vadakkupattu Tank, Sriperumbudur, Chengalpattu (N/A-6)
 1) Date of Surve : 21/Jan, 1997
 2) Command Area : 417.24 ha/ 700 ha ?
 3) Number of Farm Households : 2,000 (Landless : 5%)
 4) Rain Season : Oct - Dec
 5) Constraints :
 (1) Land preparation(By draft animal) should be done within one month.
 (2) Labor shortage
 (3) Not enough fertilizer
 (4) Reducing tank water year by year

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
	Paddy (1st crop)		Irrigation	Sep	Jan	150	5,000 (Paddy)	3.50	17,500	PONNI
	Paddy (2nd crop)		Irrigation	Jan	May	150	6,250 (Paddy)	3.50	21,875	IR36,IR37
	Groundnut		--	Jan	May	120	1,125	5.00	5,625	

Table A.3.1 Result of the Field Inspection in the Study Area (2/4)

Vadakkupattu Tank, Perumbakkam Village, Chengalpattu (N/A-7)										
1) Date of Survey : 22/Jan, 1997										
2) Command Area : 197.22ha										
3) Cropping Pattern : Paddy - Groundnut										
Cultivated Area(ha)	Crop	Normal/ Drought Year	Irrigation/ Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
Sowing	Harvesting									
Farmer A	Paddy	--	Irrigation	Oct-Nov	Jan	120	2,810	5.33	14,977	PONNI
0.75							2,810	4.07	11,437	IR20,IR37
--	Groundnut	--	Rainfed	Jan	March	90	2,810	14.33	40,267	--
--	Chillies	--	Rainfed	Jan	March	90	450	32.00	14,400	--
--	Casuarina	--	Rainfed	--	--	5years	--	--	17,500/year	--

Polambakkam, Cheyyur, Chengalpattu (N/S-8)										
1) Date of Survey : 22/Jan, 1997										
2) Command Area : 91.06 ha										
Cultivated Area(ha)	Crop	Normal/ Drought Year	Irrigation/ Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
Sowing	Harvesting									
Farmer A (1.25 ha)	Paddy	Normal	Irrigation	Nov	March	125	5,000	5.50	27,500	PONNI,KO36
	Groundnut	Drought		Nov/Dec	Mar/April	120	5,000?	11.00	55,000	--
Farmer B (20 ha)	Paddy	Normal	Irrigation	May/June (Direct sowing)	Sep/Oct	135	2,500	--	--	TKM,ADI
				May/June (I.Planting)	Oct/Nov	180	4,170	--	--	IR8,IR20,JET
	Ragi	Normal	Rainfed	Nov-Feb	Feb-May	100	1,250	6.25	7,813	
	Gingelly	"	"	Feb-March	May-June	100	1,875	14.00	26,250	
	Groundnut	"	Irrigation	July-Aug	Oct-Nov	105	3,750	15.00	56,250	
		"	Rainfed	"	"	"	2,500	15.00	37,500	
	Sugarcane	"	Irrigation	Nov	Sep-Oct	330	87,500	0.65	56,875	
(in cane)										

Table A.3.1 Result of the Field Inspection in the Study Area (3/4)

Kumaralingapuram Tank, Virudhunagar, Kamarajar. (S/A-1)

1) Date of Survey : 29/Jan/1997
 2) Rain Season : 60-62 days from middle of Sep. to middle of Dec.
 3) Total amount of rainfall : 680 mm
 4) No. of farm households : 100
 5) Total irrigable area : 76.55 ha
 6) Average paddy area : 0.12 ha to 1.20 ha with average of 0.77 ha.
 7) Irrigation period : Oct. to Dec. for 3 months. Generally paddy nursery is raised with well water.
 8) Countermeasure for shortage of irrigation water :
 1/3 of the paddy area use purchased seedlings. The cost of seedlings is Rs 3,000/ha
 In case of drought year, cholam and cotton are grown in place of paddy.
 Due to severe drought, no planting of paddy was taken in the last 3 years. The family worked at match factory.
 The labor wage was Rs. 30 for male, 20 for female and 15 for child per day, and working days per month was 26 days. The annual income was estimated as Rs.15,60,000/year/family (30 + 20)/day x 26 days x 12 months).
 9) Cost of input for paddy cultivation : Rs.13,000/ha (3,000 for seedlings, 10,000 for labor of transplanting and harvesting)
 10) Raising sheep : 100 heads in the area. Feed is straw.

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period Sowing	Harvesting	Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
Command area	Paddy	Normal	Irrigation	Sep-Oct	Jan-Feb	120-140	6,300	4.57	28,791	IR20,CO43, ADT39
Fanner A (1.0 ha)	Paddy	Normal	Irrigation	Sep.	Dec.	120	5,000	5.00	25,000	IR-20
	Cholam	Drought	Rainfed	Oct	Jan	90	750	3.00	2,250	
	Cotton			Sep	Jan-Apr.	210	750	12.00	9,000	
Fanner B (3.0 ha)	Cholam	Drought	Rainfed	Aug-Sep	Dec.	120	1,050	4.29	4,505	
	Cumbu (Mixed cultivation)			Oct-Nov	Dec-Jan	90	350	5.71	1,999	
	Cotton			Aug-Sep	Jan-Apr	240	1,000	10.00	10,000	
	Ginjelly		Rainfed	Aug-Sep	Nov	90				
	Sunflower			Oct-Nov	Jan	90				
	Redgram			Jun-July	Feb-Mar	240				
	Greengram			Sep-Oct	Dec	90				
Command area	Blackgram			Sep-Oct	Dec	90				
	Sugarcane		Irrigati	Dec-Jan	Nov-Dec	330				
	"			Jan-Feb	Dec-Jan	330				
	"			Mar-Apr	Feb-Mar	330				
	"			July-Aug	June-Jul	330				
	Chilli		Well irri.	Sep	Feb-May	240				
	Tamarind		Rainfed							
	Neem tree									

Harvesting : 12-15 years after planting. Grafted : 5 years after planting
 Harvesting : 12 years after planting. Rs.4,000/tree x 120 plants/ha
 = Rs.480,000/ha/12 years = Rs40,000/ha/year

Ermbi Tank, Karaikudi, Pasumpon M.T. (S/A-4)

1) Date of Surve : 31/Jan, 1997
 2) Command Area : 52.61 ha
 3) Number of Farm Households : 120
 4) Paddy Cultivation : Complete double cropping
 5) Livestock breeding : Caw : 200, Cattle (draft) : 250, Goats : 0 (Damage crops), Sheep : 100

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period Sowing	Harvesting	Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
38.00	Paddy	Normal	Tank & Well	June-July (N.Period:60)	Jan.	180	4,950	4.70	23,265	PONN1
38.00	Paddy	Normal	Irrigation	Apr	July	165	5,775	4.70	27,143	KALLISERI
4.00	Sugarcane	Normal	Irrigation	Jan-Feb	Jan-Feb	365			34,980	ADT36,39
12.00	Groundnut	Normal	Irrigation (Tank)	Jan	April	120	2,100	11.90	24,990	

Kurunthanakottai Tank, Devaikkottai, Pasumpon M.T. (S/A-5)

1) Date of Surve : 31/Jan, 1997
 2) Command Area : 61.64 ha
 3) Number of Farm Households : 200
 4) Paddy Cultivation :
 In the normal years, nursery is established in Sep. as dry nursery, but if not available enough water, direct sowing is introduced.
 5) Livestock breeding : Caw : 100, Cattle (draft) : 20, Goats : 0, Sheep : 0.

Cultivated Area(ha)	Crop	Normal/Drought Year	Irrigation/Rainfed	Growing Period Sowing	Harvesting	Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
Fanner A (1.6 ha)	Paddy	Normal	Irrigation	Early-Sep (Dry nursery)	End-Jan to Early-Feb	140	7,425	3.71	27,547	IR36,ACM10
	Paddy	Drought	Irrigation	irect Sowing	--	--	3,300	3.71	12,243	*
Fanner A (2.4 ha)	Gingelly	Normal	Rainfed	Early/Aug	Early/Nov	90	1,500	30.00	45,000	
	Ragi	Drought	Rainfed	Early/Aug	Early/Dec	120	1,275	6.00	7,650	
	Grams (later crop with Gingelly/Ragi)		Rainfed	--	--	--	300	16.67	5,001	

Table A.3.1 Result of the Field Inspection in the Study Area (4/4)

Annayasal Tank, Manamadural, Pasumpon M.T. (S/A-6)
 1) Date of Survey : 30/Jan /1997
 2) Rain Season : Middle of Sep to End of Nov. for 2.5 months
 3) Command Area : 200 ha
 4) Paddy Cultivation :
 Nursery is established at early Sep. with rainfall, but even in the normal years, seedlings for 100 ha purchase from 3-4 km far place. In drought year, around a half of the planted area (100ha) suffer drought damage with the average yield is 1,625 kg/ha
 5) Second Cropping : If rain is available, cotton is cultivated in the paddy field after the harvesting of paddy.
 Chillies is also cultivated in a small area after paddy.

Cultivated Area(ha)	Crop	Normal/ Drought Year	Irrigation/ Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
				Sowing	Harvesting					
200.00	Paddy	Normal	Irrigation	Early/Sep	Middle/Jan	115	4,875	5.38	26,228	IR36,ACM10,ADT36
100.00	Cotton	Drought If rain available	Rainfed	Middle/Jan	Apr-June	165	1,625 2,500 with seeds	10.00	8,743 25,000	
2nd Crop after Paddy	Chillies	If rain available	Rainfed (very small area)	Early/Jan	Apr-June	180	1,250	30.00	37,500	

Seyalur Tank, Paramakudi, Ramanathapuram (S/A-7)
 1) Date of Survey : 30/Jan/1997
 2) Command Area : 125 ha.
 3) Number of Farm Households in the Command Area : 181
 4) Paddy Cultivation :
 Nursery is established at middle of Sep with rainfall, but even in the normal years, seedlings for 40 ha purchase from outside. The cost of seedlings is 210 Rs/ha (70 kg/ha).
 5) Chillies is cultivated under irrigation condition during the period from middle of Sep to end of April.
 6) Second Cropping : Ragi, Cotton and Gingelly are cultivated under irrigation conditions as a second crops after the harvesting of paddy.
 7) Benefitable Crops : Farmer's opinions for the benefitable crops are in the following order : Paddy>Chillies>Ragi>Cotton
 8) Livestock breeding: Cattle (draft) : 400, Caw : 1,000, Sheep : 2,000, Goats : 2,000

Cultivated Area(ha)	Crop	Normal/ Drought Year	Irrigation/ Rainfed	Growing Period		Total (days)	Average yield(kg/ha)	Unit Price Sold(Rs/kg)	Gross Income (Rs/ha)	Variety Used
				Sowing	Harvesting					
125.00	Paddy	Normal	Irrigation	Sep	Jan	120	6,000	3.33	19,980	IR-20,IR50,ADT36
	Chillies	-	Irrigation (Tank)	Every year, seedlings for 40 ha purchase from outside. Middle /Sep	Mar-Apr	225	3,750	30.00	112,500	
	Ragi	-	Irrigation	Jan	Mar-Apr	90	250	4.00	1,000	
	Cotton	-	Irrigation (Tank)	Jan	May	150	313	20.00	6,260	
	Gingelly	-	Irrigation	Middle /Feb	Middle /March	90	1,500	20.00	30,000	
	Tamalind	-	Rainfed	75 kg/tree(yield) x Rs. 20/kg (Price) = Rs. 1,500/tree						

Table 4.3.1 Particulars of Varieties in the Study Area (1/3)

Name of Variety	Duration (days)	Average Yield		Unit Price (Rs/kg)	Gross Income (Rs)				Northern Area		Southern Area			
		Irrigated (kg/ha)	Rainfed (kg/ha)		Irrigated (Rs/ha)	Rainfed (Rs/ha)	Irrigated (Rs/ha/day)	Rainfed (Rs/ha/day)	Cropping Season(Month)					
Rice									8-10 (7-8)	12-1	4-5	8-10 (7-8)	12-1	4-6
ASD 17	101	5,422		5.92	32,098		318							
TKM 9	103	5,019		5.92	29,712		290		○		●	○		●
ADT 37	105	6,200		5.92	36,704		350			●	●		●	●
ASD 18	108	5,900		5.92	34,928		325			●	●		●	●
ADT 41	110	4,758		5.92	28,167		256				●		●	●
ADT 36	110	4,000		5.92	23,680		215			●	●	○	●	●
ASD 16	113	5,600		5.92	33,152		295			●	●		●	●
TPS 1	113	4,800		5.92	28,416		253							
PMK 1	113	3,200		5.92	18,944		168		○			○		
CO 37	115	5,000		5.92	29,600		257			●			●	
IET 1444	115	4,500		5.92	26,640		232							
PY 2	115	4,500		5.92	26,640		232							
IR 64	118	6,146		5.92	36,384		310			●	●		●	●
IR 36	120	5,000		5.92	29,600		247				●			●
MDU 4	123	5,900		5.92	34,928		285					●		
ADF 39	123	5,000		5.92	29,600		242		●	●		●		
MDU 3	123	4,970		5.92	29,422		240					●		
TPS 2	128	4,615		5.92	27,321		214							
IR 50	130	6,000		5.92	35,520		273		○		●			●
ADT 38	133	6,200		5.92	36,704		277					●		
IR 20	133	5,000		5.92	29,600		223		●○	●		●		
Bhavani	133	5,000		5.92	29,600		223					●		
MDU 2	133	4,700		5.92	27,824		210					●		
TKM 10	135	2,563		5.92	15,173		112		○					
CO 45	138	5,800		5.92	34,336		250		●			●		
TPS 3	138	5,253		5.92	31,098		226		●	●		●		
CO 43	138	5,200		5.92	30,784		224			●		●		
White Ponni	138	4,500		5.92	26,640		194		●			●		
AU 2	143	5,200		5.92	30,784		216		●			●		
PY 4	148	5,330		5.92	31,554		214		●			●		
ADT 40	148	4,690		5.92	27,765		188		●			●		
PAIYUR	150	5,000		5.92	29,600		197							
PONMANI	158	5,360		5.92	31,376		199							
									Suitable Area					
Sorgham									Northern Area		Southern Area			
CO 20	58													
K 8	85		2,440	3.60		8,784		103					●	
K TALL	90	4,250	3,750	3.60	15,300	13,500	170	150		●			●	
K 4	90		3,000	3.60		10,800		120					●	
K 5	93	3,500	2,750	3.60	12,600	9,900	136	107		●			●	
CSH 5	100	4,500	4,000	3.60	16,200	14,400	162	144		●			●	
CO 21	103	4,250	2,750	3.60	15,300	9,900	149	97		●			●	
CO 26	108	6,000	4,500	3.60	21,600	16,200	201	151		●			●	
COH 3	108	6,000	3,000	3.60	21,600	10,800	201	100		●			●	
K 7	108		690	3.60		2,484		23						
COH 4	108	6,500		3.60	23,400		218							
K 10	113		1,600	3.60		5,760		51					●	
CO 25	118	6,000	3,680	3.60	21,600	13,248	184	113		●			●	
K 9	120		2,000	3.60		7,200		60						
CO 19	145		900	3.60		3,240		22						
PAIYUR 1	148		1,000	3.60		3,600		24						
									Southern Area					
Cumbu										1-2	3-4	6-7		
K 3	85	1,100	800	3.36	3,696	2,688	43	32		●				○
WCC 75	95	3,000	2,000	3.36	10,080	6,720	106	71		●		●		○
CO 7	95	3,250	2,700	3.36	10,920	9,072	115	95		●		●		○
X 6	95	3,236	2,394	3.36	10,873	8,044	114	85		●		●		○
K4HB														○

Notes: ●: Irrigated, ○: Dry or Semi-arid (rainfed)

Source: Crop Production Guide, 1994. Tamil Nadu Agricultural University, Coimbatore.

Table 4.3.1 Particulars of Varieties in the Study Area (2/3)

Name of Variety	Duration (days)	Average Yield (kg/ha)		Unit Price (Rs/kg)	Gross Income (Rs)				Season (Month)				Remarks		
		Irrigated	Rainfed		Irrigated (Rs/ha)	Rainfed (Rs/ha)	Irrigated (Rs/ha/day)	Rainfed (Rs/ha/day)	● Northern, ○ Southern						
Ragi											12-1	4-5	6-7	9-10	
CO 11	93	4,750	3,250	3.68	17,480	11,960	189	129	●○	●○	○	●○	12-5: Irrigate		
K 7	98		3,130	3.68		11,518		118	○	●○	○	○	6-10: Rainfed		
CO 13	98	3,600	2,300	3.68	13,248	8,464	136	87	●						
CO 7	100	4,500	2,750	3.68	16,560	10,120	166	101	●		●				
TRY 1	102	4,011		3.68	14,760		145								
K 5	105	1,800	1,100	3.68	6,624	4,048	63	39	○	○		○			
INDAF 5	108	4,000	2,500	3.68	14,720	9,200	137	86							
CO 12	115	4,750	3,250	3.68	17,480	11,960	152	104			○				
Paiyur 1	118		3,125	3.68		11,500		98			○				
Redgram											6-8	9-11	2-3		
Vamban 1	70	1,200	840	10.35	12,420	8,704	177	124	○				●○		
CO 5	73	1,440	760	10.35	14,904	7,876	206	109	●○		●○		●○		
CO 3	93	1,400	1,180	10.35	14,490	12,223	157	132					●○		
CO 4	93	1,750	980	10.35	18,113	10,153	196	110	●○				●○		
BSR 1	105		73,000*												
CO 6	125		893	10.35		9,253		74	●○				●○		
AS 1	180		1,250	10.35		12,948		72	●				●○		
Blackgram											6-8	9-11	2-3	Remarks	
ADT 5	62		1323*	10.71		14,169		229				●	*: Rice fallows		
ADT 4	63		600*	10.71		6,426		103							
KM 2	63		690	10.71		7,390		118	●○	●○	●○				
VBN 1	63	850	700	10.71	9,104	7,497	146	120	●	●○					
TMV 1	68	1,320		10.71	14,137		209				●				
T 9	68	1,000		10.71	10,710		159				○				
CO 4	70	1,040	640	10.71	11,138	6,854	159	98	●						
ADT 2	73		970*	10.71		10,389		143							
ADT 3	73		720*	10.71		7,711		106							
CO 5	73	1,270	740	10.71	13,602	7,925	188	109	○	●○	○				
Greengram											6-7	9-10	2-3	Remarks	
VBNT	65		770	11.22		8,639		133	●○	●			*: Rice fallows		
ADT 3	66	500*	500	11.22	5,610	5,610	85	85							
KM 2	68		767	11.22		8,606		127	●○	●○	●○				
ADT 2	73		850	11.22		9,537		132							
CO 5	73		900	11.22		10,098		139	●○	●○					
CO 4	85	1,550	910	11.22	17,391	10,210	205	120	●○	●○	●○				
Paiyur 1	88		742	11.22		8,325		95	●○	○	○				
Cowpea											6-8	9-11			
KMT	63	905													
CO 6	68		671							●○			●○		
CO 3	80	830								●			●○		
CO 4	85	961								●○					
CO 2	90	1,375								○			○		
Paiyur 1	90		900												
Horsegram											7-8	9-11	11		
CO 1	110		560.00	5.25		2,940		27					●○		
Paiyur 1	110		650.00	5.25		3,413		31					●○		
Bengalgram											7-8	9-11	11		
CO 2	90		980.00	10.71		10,496		117					○		
CO 3	85		1,000.00	10.71		10,710		126					○		
Lab lab (Avarai)											(7-8)	(9-11)	(4)		
CO 3	240	10,300*							●○						
CO 4	240	13,500*							●○						
CO 5	240	6,000*							●○						
CO 6	120	4,500*							●○		●○		●○		
CO 7	120	4,000*							●○		●○		●○		
CO 8	120	4,750							●○		●○		●○		
CO 9	120	7,500							●○		●○		●○		
CO 10	120	7,200							●○		●○		●○		
CO 11	98	9,900							●○		●○		●○		
CO 12	105	9,700							●○		●○		●○		
Lab lab (Mochai)											(6-7)	(11-12)			
CO 1	140		1,600.00							●○					
CO 2	105	1,400	900.00										●○		

Source: Crop Production Guide, 1994. Tamil Nadu Agricultural University, Coimbatore.

Table 4.3.1 Particulars of Varieties in the Study Area (3/3)

Name of Variety	Duration (days)	Average Yield		Unit Price (Rs/kg)	Gross Income (Rs)				Season(Month)							
		Irrigated (kg/ha)	Rainfed (kg/ha)		Irrigated (Rs/ha)	Rainfed (Rs/ha)	Irrigated (Rs/ha/day)	Rainfed (Rs/ha/day)	● Northern, ○ Southern							
Groundnut (pods)									(6-7)	(7-8)	(10)	(4-7, 12-1)				
TMV 2	103		1,250.00	8.96		11,200			109	●	○	●	●	○		
TMV 7	103		1,400.00	8.96		12,544			122	●	○	●	●	○		
TMV 10	125		1,650.00	8.96		14,784			118	●	○	●	●	○		
CO 1	103		1,675.00	8.96		15,008			146		○		●	○		
CO 2	103		1,650.00	8.96		14,784			144		○	●	●	○		
Ji. 24	100		1,650.00	8.96		14,784			148		○	●	●	○		
AI R 1	118		1,840.00	8.96		16,485			140				●	○		
VRI 1	103	1,875	1,590.00	8.96	16,800	14,246	164	139		○	●	●	○			
VRI 2	103	2,060	1,791.00	8.96	18,458	16,047	180	157		○	●	●	○			
VRI 3	90	1,882	1,668.00	8.96	16,863	14,945	187	166		●	○	●	●	○		
Gingelly									(4-7)	(6-7)	(10-11)					
CO 1	88	780	550.00	13.27	10,351	7,299	118	83			●	○	●	○		
TMV 3	83	688	345.00	13.27	9,130	4,578	111	55			●	○	●	○		
TMV 4	88	825		13.27	10,948		125						●	○		
TMV 5	83		550.00	13.27		7,299		88			●	○	●	○		
TMV 6	88	788		13.27	10,457		120									
Paiyur 1	90	644		13.27	8,546		95									
SVPR 1	78	807	607.00	13.27	10,709	8,055	138	104		○				●	○	
Cotton									Rainfed(9-10)	Irrigated(2-3)						
MCU 5	180	1,850		11.00	20,350		113							○		
MCU 7	150	1,330		11.00	14,630		98									
MCU 9	180	2,100		11.00	23,100		128							○		
MCU 10	150		750.00	11.00		8,250		55		○						
MCU 11		2,200		11.00	24,200											
IRA 5166	150		725.00	11.00		7,975		53		○						
K 9	150		570.00	11.00		6,270		42		○						
K 10	150		726.00	11.00		7,986		53		○						
K 11	180		1,100.00	11.00		12,100		67		○						
Savin	210	1,020		11.00	11,220		53									
Jayalaxmi	210	2,880		11.00	31,680		151							○		
TCHB 213	210	2,215		11.00	24,365		116							○		
SVPR 1	165	1,550		11.00	17,050		103							○		
Paiyur 1	148		1,173.00	11.00		12,903		87		○						
Savitha	210	1,800		11.00	19,800		94									
HB 224	210	2,000		11.00	22,000		105									
ADT 1	125	1,263		11.00	13,893		111									

Source: Crop Production Guide, 1994. Tamil Nadu Agricultural University, Coimbatore.

Table A.5.1 Land Use in Pilot Tank Areas, 1995-96

Description	Northern Study Area												
	Echur Tank (58.6 ha)		Cherokkanur Big Tank (91.3 ha)		Polambakkam Tank (94.6 ha)		Endur Big Tank (574.7 ha)		Vadakkupattu Tank (471.3 ha)				
	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	
Crops(Sowing time)													
-Paddy(Jul-Nov)	-	-	83.0(83.0)	90.9(90.9)	-	-	357.6(322.0)	-	374.8(370.0)	-	-	89.8(78.5)	-
-Paddy(Jul-Jan)	-	-	-	-	13.1(12.3)	13.8(13.0)	-	-	-	-	-	-	-
-Paddy(Jul-Dec)	47.1(47.0)	80.4(80.2)	-	-	81.3(79.7)	85.7(84.0)	-	-	-	-	-	-	-
-Paddy(Oct-Feb)	-	-	-	-	-	-	-	-	-	-	-	-	-
-Paddy(Dec-Apr)	-	-	50.0(50.0)	54.8(54.8)	-	-	-	-	-	-	228.0(225.0)	54.6(47.7)	-
-Paddy(Jan-Apr)	11.3(10.0)	19.3(17.1)	-	-	-	-	10.0	1.7	-	-	-	-	-
-Groundnuts(Nov-Jan)	-	-	-	-	-	-	-	-	-	-	-	-	-
-Groundnuts(Jan-Mar)	(2.0)	(3.4)	-	-	(2.0)	(2.1)	-	-	-	-	-	-	-
-Groundnuts(Jan-Apr)	-	-	20.0(20.0)	21.9(21.9)	-	-	-	-	-	-	-	-	-
-Sugarcane(Year-round)	-	-	12.0(12.0)	13.1(13.1)	-	-	-	-	-	-	-	-	-
-Casuarina equisetifolia	-	-	165.0(165.0)	180.7(180.7)	94.4(94.0)	99.5(99.1)	367.6(322.0)	63.9(56.0)	602.8(595.0)	144.5(126.2)	-	-	-
Total Cropped Area	58.4(59.0)	99.7(100.7)											
Description	Southern Study Areas												
	Sivualai Tank (49.3 ha)		A.Ramalingapuram tank (76.5 ha)		Pandikannoi Tank (41.9 ha)		Sengargulam Tank (99.2 ha)		Kurumbi Tank (52.7 ha)				
	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	Cropped area (ha)	Percent to Ayacut area (%)	
Crops(Sowing time)													
-Paddy(June-Sep)	-	-	-	-	-	-	-	-	-	-	-	-	-
-Paddy(Jun-Dec)	-	-	-	-	-	-	-	-	-	-	16.0	(30.4)	-
-Paddy(Aug-Jan)	49.3(49.3)	100(100)	-	-	-	-	-	-	-	-	24.1	45.7	-
-Paddy(Sep-Jan/Feb)	-	-	52.0(66.0)	68.0(86.3)	40.6(40.6)	96.9(96.9)	-	-	-	-	-	-	-
-Paddy(Oct-Jan/Feb)	-	-	-	-	-	-	20.2(50.0)	20.4(50.4)	-	-	52.0	(98.7)	-
-Groundnuts(Feb-May)	-	-	-	-	-	-	-	-	-	-	10.0	(19.0)	-
-Pulses(Feb-Apr/May)	-	-	(3.5)	(4.6)	-	-	-	-	-	-	(6.0)	(11.4)	-
-Chili(Sep-Feb)	-	-	-	-	-	-	8.6	8.7	-	-	-	-	-
-Chili(Dec-May)	-	-	-	-	(2.0)	(4.8)	-	-	-	-	-	-	-
-Cotton(Aug-Dec)	-	-	-	-	(2.5)	(5.9)	6.0	6.0	-	-	-	-	-
-Cotton(Jan-May)	-	-	-	-	-	-	(10.0)	(10.1)	-	-	-	-	-
-Cotton(Feb-Jun)	-	-	-	-	-	-	-	-	-	-	-	-	-
-Rajj(May-Aug)	-	-	(1.2)	(1.6)	-	-	4.0(40.0)	4.0(40.3)	-	-	-	-	-
-Millett(Sep-Nov)	-	-	-	-	-	-	1.0	1.0	-	-	-	-	-
Total Cropped Area	49.3(49.3)	100(100)	52.0(70.7)	68.0(92.4)	40.6(45.1)	96.9(107.6)	39.8(49.0)	40.1(150.2)	24.1 (84.0)	45.7(159.4)			

() : Normal year

Source: AD, PWD, Taluk revenue office and farmers in the areas

Table A.5.2 Crop Production in Pilot Tank Areas

Code No.	Pilot Tank	Crop and Growing Month	1995-96			Normal Year			Variety Used
			Area (ha)	Yield (kg/ha)	Production (t)	Area (ha)	Yield (kg/ha)	Production (t)	
N-1	Echur	Paddy(Sep-Dec)	47.1	4,650	219.0	47.0	4,650	218.6	IR50
		Paddy(Jan-April)	11.3	4,650	52.5	10.0	4,650	46.5	IR20
		Groundnut(Jan-Mar)				2.0	1,500	3.0	JL24
		Ragi(Jan-Mar)							CO11
		Total	58.4	4,650	271.6	59	4,543	268.1	
N-2	Cherukkanur Big	Paddy(July-Nov)	83.0	3,504	290.8	83.0	4,000	332.0	IR36,ADT39
		Paddy(Dec-Apr)	50.0	2,480	124.0	50.0	4,000	200.0	ADT37
		Sugarcane(Dec-Dec)	20.0	00,000	2,000.0	20.0	00,000	2,000.0	
		Casuarina(4-5years)	12.0	113	1,350.0	12.0	113	1,350.0	
		Total	115.9	31,804	3,686.0	115.9	33,494	3,882.0	
N-3	Polambakkam	Paddy(July-Dec)	13.1	3,750	49.1	12.3	3,800	46.7	W.Ponni,ADT39
		Paddy(Oct-Feb)	81.3	3,750	304.9	79.7	3,800	302.9	IR36,IR50
		Groundnut(Jan-Apr)				2.0	1,250	2.5	
		Sugarcane(Dec-Dec)							
		Total	94.4	3,750	354.0	94.0	3,746	352.1	
N-4	Enadur Big	Paddy(July-Jan)	357.6	3,560	1,273.1	220.0	4,000	12,880.0	ADT39,W.Ponni
		Groundnut(Nov-Jan)	10.0	800	8.0				
		Total	367.6	3,485	1,281.1	220.0	4,000	12,880.0	
N-5	Vadakkupattu	Paddy(July-Nov/Dec)	374.8	3,485	1,306.3	370.0	4,500	1,665.0	ADT37,39,W.Ponni
		Paddy(Dec/Jan-Apr)	228.0	3,784	862.8	225.0	4,700	1,057.5	ADT36,37,39
		Total	602.8	3,598	2,168.9	595.0	4,576	2,722.5	
S-1	Siruvalai	Paddy(Aug-Jan)	49.3	3,399	167.6	49.3	3,900	192.3	CO43,ADT38
		Total	49.3	3,399	167.6	49.3	3,900	192.3	
S-2	A Ramalingapuram	Paddy(Sep-Jan)	52.0	3,020	157.0	80.0	3,500	280.0	IR20,CO43
		Pulses(Feb-May)				3.5	450	1.6	Green gram
		Cotton(Feb-June)				1.2	980	1.2	
		Total	52.0	3,020	157.0	84.7	3,338	282.8	
S-3	Pandikanmoi	Paddy(Sep/Oct-Dec/Jan)	40.6	1,400	56.8	40.6	2,000	81.2	ADT36,IR36
		Chili(Dec/Jan-Apr/May)				2.0	635	1.3	Ramhay,Gundu
		Cotton(Jan/Feb-Apr/May)				2.5	560	1.4	MCU7,LRA5166
		Total	40.6	1,400	56.8	45.1	1,850	83.9	
S-4	Sengulam	Paddy(Oct-Jan)	20.2	4,459	90.1	50.0	4,750	237.5	ADT36,CO43
		Chili(Sep-Feb)	8.6	300	2.6				WCO75
		Cumbu(Sep-Nov)	1.0	200	0.2				MCU10,LRA5166
		Cotton(Aug-Dec)	6.0	3,100	18.6				
		Cotton in capas(Jan-May)				10.0	1,000	10.0	LRA5166
		Ragi(May-Aug)	4.0	200	0.8	40.0	2,000	80.0	CO7
S-5	Kurumbi	Paddy(Jun-Dec)	24.1	4,313	104.0				ADT36,39
		Paddy(Jun-Sep)				16.0	4,200	67.2	ADT36,39
		Paddy(Oct-Feb)				52.0	4,500	234.0	ADT36,39
		Groundnut(Feb-May)				10.0	1,400	14.0	TMV7
		Pulses(Feb-Apr)				6.0	500	3.0	Black gram
		Total	24.1	4,313	104.0	84.0	3,788	318.2	
Total	Total	Paddy(Rainy Season)	1,518	3,508	5,325	4,470	4,072	18,202	
		Paddy(Dry Season)	289	3,593	1,039	285	4,575	1,304	
		Sugarcane(Dec-Dec)	20	00,000	2,000	20	00,000	2,000	
		Other Crops	42	33,177	1,380	91	16,096	1,468	

Source: Taluk Revenue office, AD office, PWD office, Farmers interview survey carried out by JICA

Table A.5.3 Irrigation Status in Pilot Areas

Description		Northern Study Area									
		Echur Tank (58.6 ha)		Cherukkanur Big Tank(91.3 ha)		Polambakkam Tank (94.6 ha)		Enadur Big Tank (574.7 ha)		Vadakkupattu Tank (471.3 ha)	
Geographical Irrigable Area		47.0 ha		83.0 ha		94.4 ha		360.0 ha		370 ha	
		Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)
Tank Water	Normal Year	Oct-Jan	58.6	Jun-Apr	129.0	Oct-Jan	79.7	Sep-Jan	255.3	Sep-Apr	602.0
	Drought Year	Jan-March	12.8	Aug-Jan	70.0	-	-	-	126.0	Oct-Jan	75.0
		No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)
Well Water	Normal Year	61	12.6	39	24.0	45	18.6	38	125.0	18	18.0
	Drought Year	6	3.5	39	12.5	-	-	25	111	-	-
Source of Data		AD,PWD		Revenue office, PWD		Revenue Office,PWD		AD,PWD		AD,PWD	
Description		Southern Study Area									
		Siruvalai Tank (49.3 ha)		A Ramalingapuram Tank(76.5 ha)		Pandikanmoi Tank (41.9 ha)		Sengangulam Tank (99.2 ha)		Kurumbi Tank (52.7 ha)	
Geographical Irrigable Area		49.2 ha		66.0 ha		40.6 ha		40.0 ha		52.0 ha	
		Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)	Available Period	Irrigable Area(ha)
Tank Water	Normal Year	25/Aug- 25/Dec	53.9	5/Oct- 20/Dec	66.0	25/Oct- 5/Jan	40.6	15/Sep- 15/Dec	40.0	Sep-Feb	50.0
	Drought Year	-	-	10/Oct- 5/Dec	52.0	20/Oct- 10/Dec	16.0	-	-	Nov-Feb	-
		No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)	No. of Available Wells	Irrigable Area(ha)
Well Water	Normal Year	0	0.0	18	14	0	0.0	8	10.0	16	35.0
	Drought Year	0	0.0	18	5	0	0.0	8	6	16	24.0
Data Source		DA		Revenue office		AD		AD		AD	

Table A.5.4 Fertilizer Application in Pilot Tank Areas, 1995-96

Code No.	Tank Area		Basal		Top-1		Top-2		Total	
			Number of Farmers Applied (%)	Amount of Fertilizer Applied (Kg/ha)	Number of Farmers Applied (%)	Amount of Fertilizer Applied (Kg/ha)	Number of Farmers Applied (%)	Amount of Fertilizer Applied (Kg/ha)	Number of Farmers Applied (%)	Amount of Fertilizer Applied (Kg/ha)
N-1	Echur	N	100	19.9	89	29.4	56	12.8	100	62.1
		P	100	31.9	11	3.2	0	0.0	100	35.1
		K	22	1.9	0	0.0	11	3.2	22	5.1
N-2	Cherukkanur Big	N	100	49.0	78	24.3	0	0.0	100	73.3
		P	100	37.1	0	0.0	0	0.0	100	37.1
		K	0	0.0	0	0.0	0	0.0	0	0.0
N-3	Polambakkam	N	100	29.8	100	25.0	56	12.8	100	67.6
		P	78	31.9	44	7.8	0	0.0	78	39.7
		K	44	8.4	44	12.9	0	0.0	44	21.3
N-4	Enadur Big	N	100	24.6	100	21.7	100	21.7	100	68.0
		P	44	8.2	11	2.2	0	0.0	44	10.4
		K	33	5.7	78	15.8	33	4.8	78	26.3
N-5	Vadakkupattu	N	100	35.1	83	18.3	100	22.2	100	75.6
		P	33	9.1	67	17.6	50	13.8	67	40.5
		K	33	6.3	33	7.1	33	7.1	33	20.5
S-1	Siruvalai	N	100	11.6	100	29.2	100	28.7	100	69.5
		P	100	75.4	0	0.0	11	0.8	100	76.2
		K	100	48.1	89	25.4	22	3.5	100	77.0
S-2	Ramalingapura	N	67	25.5	56	29.4	56	25.6	67	80.5
		P	56	23.5	0	0.0	0	0.0	56	23.5
		K	22	2.5	0	0.0	0	0.0	22	2.5
S-3	Pandikanmoi	N	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
		P	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
		K	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
S-4	Sengaluram	N	100	34.4	100	26.6	88.9	22.3	100	83.3
		P	100	39.2	0	0.0	0.0	0.0	100	39.2
		K	100	43.3	100	27.8	0.0	0.0	100	71.1
S-5	Kurumbi	N							100	36.2
		P							100	49.8
		K							0	0.0
Average		N	96	29	88	25	69	18	87	62
		P	76	32	17	4	8	2	74	35
		K	44	15	43	11	12	2	40	22

Source: Farmers' interview survey, JICA

Table A.5.5 Labour Input in Pilot Tank Areas, 1995-96

1) Rice (Man-day/ha)

Code No.	Pilot Tank	Land Preparation	Sowing	Transplanting	Irrigation	Weeding	Plant Production	Harvesting	Miscellaneous	Total
N-1	Echur	6.7	6.9	31.1	2.4	51.0	3.0	57.2	3.0	152.0
N-2	Cherukkanur Big	25.6	31.0	-	12.0	36.9	15.5	60.5	8.0	163.2
N-3	Polambakkam	29.7	3.7	29.0	5.3	58.3	3.6	65.6	5.0	193.6
N-4	Enadur Big	2.7	24.2	23.0	1.4	46.1	5.2	55.2	4.9	139.3
N-5	Vadakkupattu	17.3	25.9	-	3.8	32.8	4.0	40.6	7.0	123.9
S-1	Siruvai	33.2	12.4	109.2	89.6	86.7	12.7	112.7	13.7	458.8
S-2	A. Ramalingapuram	28.1	13.0	61.1	7.2	63.8	6.9	36.7	5.5	224.0
S-3	Pandikanmoi	4.4	5.1	7.5	2.6	6.6	4.1	5.9	5.6	36.1
S-4	Sengaluram	24.4	7.8	42.0	107.0	41.2	9.3	70.4	12.4	315.8
S-5	Kurumbi	12.0	4.6	17.2	7.6	34.4	10.4	31.1	15.4	129.7
Average (%)		18.4	13.5	40.0	23.7	45.8	7.5	53.6	8.1	193.6
		9.5	6.9	20.7	12.2	23.6	3.9	27.7	4.2	100.0

Source: Farmers' interview survey, JICA

2) Vegetable (Man-day/ha)

Code No.	Pilot Tank	Land Preparation	Sowing	Transplanting	Irrigation	Weeding	Plant Production	Harvesting	Miscellaneous	Total
S-1	Siruvai	40.0	3.0	15.0	60.0	360.0	100.0	200.0	50.0	828.0
(%)		4.8	0.4	1.8	7.2	43.5	12.1	24.2	6.0	100.0

Source: Farmers' interview survey, JICA

3) Sugarcane (Man-day/h)

Code No.	Pilot Tank	Land Preparation	Sowing	Transplanting	Irrigation	Weeding	Plant Production	Harvesting	Miscellaneous	Total
N-2	Cherukkanur Big	10.0	-	12.5	40.0	55.0	-	105.0	-	202.5
N-3	Polambakkam	180.0	-	75.0	3.0	100.0	10.0	170.0	50.0	588.0
S-5	Kurumbi	50.0	-	50.0	50.0	100.0	20.0	200.0	100.0	570.0
Average (%)		80.0	-	45.8	31.0	85.0	15.0	158.3	75.0	453.5
		17.6	-	10.1	6.8	18.7	3.3	34.9	16.5	100.0

Source: Farmers' interview survey, JICA

4) Ground nut (Man-day/ha)

Code No.	Pilot Tank	Land Preparation	Sowing	Transplanting	Irrigation	Weeding	Plant Production	Harvesting	Miscellaneous	Total
N-2	Cherukkanur Big	10.0	4.0	-	6.0	60.0	5.0	15.0	-	95.0
S-5	Kurumbi	12.5	17.5	-	10.0	45.0	3.5	40.0	12.5	136.0
Average (%)		11.3	10.8	-	8.0	52.5	4.3	27.5	12.5	115.5
		9.7	9.3	-	6.9	45.5	3.7	23.8	10.8	100.0

Source: Farmers' interview survey, JICA

Table A.5.6 Agricultural Labor in Pilot Tank Areas

Code No.	Tank Area	No. of Farm Households	Per Household		Per Area		
			Agril. Labor (Man/House)	Potential* Agril. Labor (Man/House)	Total Family Member (Man/House)	Agril. Labor (Man)	Potential* Agril. Labor (Man)
N-1	Echur	166	2.5	4.2	4.7	415	697
N-2	Cherukkanur Big	268	2.5	5.1	5.7	670	1,367
N-3	Polambakkam	139	1.1	3.3	4.6	153	459
N-4	Enadur Big	448	2.9	4.1	4.1	1,299	1,837
N-5	Vadakkupattu	355	2.1	5.1	5.4	746	1,811
S-1	Siruvai	106	2.3	5.2	5.9	244	551
S-2	A.Ramalingapuram	49	2.2	4.7	4.7	108	230
S-3	Pandikanmoi	110	3.0	5.2	6.4	330	572
S-4	Senganguram	313	1.4	2.5	4.2	438	783
S-5	Kurumbi	112	4.9	5.2	6.2	549	582
	Average	2,066	2.5	4.5	5.2	5,144	9,214

* Potential labor: Number of family member between 15-70 years old

Source: Farmers interview survey, JICA

Table A.5.7 Minimum Staggering Period Required for Paddy Cultivation by Family Labor in Pilot Tank Areas

Code No.	Tank Area	No. of Farm Households in Tank Area	Potential* Family Labor (Man.day)	Paddy Area in Rainy Season in 1995	Land Preparation		Transplanting		Harvesting	
					Labor Requirement	No. of Days	Labor Requirement	No. of Days	Labor Requirement	No. of Days
N-1	Echur	166	697	56.8	1,045	1.5	2,272	3.3	3,044	4.4
N-2	Cherukkanur Big	268	1,367	83.0	1,527	1.1	3,320	2.4	4,449	3.3
N-3	Polambakkam	139	459	90.4	1,663	3.6	3,616	7.9	4,845	10.6
N-4	Enadur Big	448	1,837	357.6	6,580	3.6	14,304	7.8	19,167	10.4
N-5	Vadakkupattu	355	1,811	374.8	6,896	3.8	14,992	8.3	20,089	11.1
S-1	Siruvai	106	551	53.9	992	1.8	2,156	3.9	2,889	5.2
S-2	A.Ramalingapuram	49	230	52.0	957	4.2	2,080	9.0	2,787	12.1
S-3	Pandikanmoi	110	572	40.6	747	1.3	1,624	2.8	2,176	3.8
S-4	Senganguram	313	783	20.2	372	0.5	808	1.0	1,083	1.4
S-5	Kurumbi	112	582	24.1	443	0.8	964	1.7	1,292	2.2

* Potential family labor: Number of persons between 15-70 years old

Source: Farmers interview survey, JICA

Table A.5.8 Raising Livestock in Pilot Tank Areas, 1995-96

Code No.	Tank Area	No. of farmers in Avacut	Cattle		Goat		Sheep		Pig		Chicken		Duck	
			% of Farmers Raised	No. of Cattles Raised	% of Farmers Raised	No. of Goats Raised	% of Farmers Raised	No. of Sheeps Raised	% of Farmers Raised	No. of Pigs Raised	% of Farmers Raised	No. of Poultry Raised	% of Farmers Raised	No. of Ducks Raised
N-1	Echur	166	84.3	295	2.1	120	6.0	65	7.2	-	-	-	-	-
N-2	Cherukkanur Big*	268	-	50(250)	2.4(0.9)	100	0	100	0.4	-	-	2,000	7.5	0
N-3	Polambakkam	139	-	650	4.2	840	5.2	1,200	50.0	2.9	250	62.5	650	3.5
N-4	Enadur Big	448	-	-	-	-	-	-	-	-	-	-	-	-
N-5	Vadakkupattu	355	16.9	1,140	19.0	100	10.0	200	50.0	1.1	30	7.5	200	100.0
S-1	Siruvalai	106	3.2(39.6)	87(147)	2.8(3.5)	342	15.5	320	53.3	-	-	-	-	-
S-2	A.Ramalingapura	49	22.4(8.2)	18(8)	1.6(2)	76	2.0	22	5.5	-	-	260.0	-	-
S-3	Pandikanmoi	110	10.9	50(8)	4.2(0.7)	39	-	-	-	-	-	-	-	-
S-4	Senganguram	313	-	85	-	80	-	60	-	-	-	400	-	-
S-5	Kurumbi	112	-	88(40)	-	-	-	21	-	-	-	30	-	-
	Total	2,066		3,163	1.5	1,697	0.8	1,988	1.0	280	0.1	3,540	1.7	600
														120.0
														0.3

(*) : Draft cattle
Source: District office, Agricultural Department

Table A.5.9 Raising Livestock in Pilot Tank Areas, 1995-96

1) Cattle

(Heads/Raised Farm Household)

Code No	Tank Area	No. of Farmers Raised (%)	No. of Cattles Raised on Jan 01	No. of Cattles Born in 1996	No. of Cattles Dead in 1996	No. of Cattles Sold in 1996	No. of Cattles Purchased in 1996	No. of Cattles Consumed in 1996	No. of Cattles Raised on Dec. 31
N-1	Echur	44.4	3.0						3.0
N-2	Cherukkanur Big								
N-3	Polambakkam	11.1	2.0						2.0
N-4	Enadur Big								
N-5	Vadakkupattu								
S-1	Siruvilai	44.4	4.8	2.3					7.0
S-2	A Ramalingapuram								
S-3	Pandikanmoi	22.2	6.0	3.5	1.5	2.0			6.0
S-4	Senganguram	11.1	1.0	1.0					2.0
S-5	Kurumbi	77.8	4.0						4.0
	Average	35.2	3.5	1.1	0.3	0.3			4.0

Source: Farmers' interview survey, JICA

2) Goat

(Heads/Raised Farm Household)

Code No.	Tank Area	No. of Farmers Raised (%)	No. of Cattles Raised on Jan 01	No. of Cattles Born in 1996	No. of Cattles Dead in 1996	No. of Cattles Sold in 1996	No. of Cattles Purchased in 1996	No. of Cattles Consumed in 1996	No. of Cattles Raised on Dec. 31
N-1	Echur	11.1	2.0						2.0
N-2	Cherukkanur Big								
N-3	Polambakkam								
N-4	Enadur Big								
N-5	Vadakkupattu								
S-1	Siruvilai	11.1	3.0	2.0					5.0
S-2	A Ramalingapuram								
S-3	Pandikanmoi	11.1	2.0						2.0
S-4	Senganguram								
S-5	Kurumbi								
	Average	11.1	2.3	0.7					3.0

Source: Farmers' interview survey, JICA

3) Sheep

(Heads/Raised Farm Household)

Code No.	Tank Area	No. of Farmers Raised (%)	No. of Cattles Raised on Jan 01	No. of Cattles Born in 1996	No. of Cattles Dead in 1996	No. of Cattles Sold in 1996	No. of Cattles Purchased in 1996	No. of Cattles Consumed in 1996	No. of Cattles Raised on Dec. 31
N-1	Echur								
N-2	Cherukkanur Big								
N-3	Polambakkam								
N-4	Enadur Big								
N-5	Vadakkupattu								
S-1	Siruvilai								
S-2	A Ramalingapuram	11.1	5.0	4.0		1.0			8.0
S-3	Pandikanmoi								
S-4	Senganguram	11.1	2.0						2.0
S-5	Kurumbi								
	Average	11.1	3.5	2.0		0.5			5.0

Source: Farmers' interview survey, JICA

4) Poultry

(Heads/Raised Farm Household)

Code No.	Tank Area	No. of Farmers Raised (%)	No. of Cattles Raised on Jan 01	No. of Cattles Born in 1996	No. of Cattles Dead in 1996	No. of Cattles Sold in 1996	No. of Cattles Purchased in 1996	No. of Cattles Consumed in 1996	No. of Cattles Raised on Dec. 31
N-1	Echur	33.3	3.7						3.7
N-2	Cherukkanur Big								
N-3	Polambakkam								
N-4	Enadur Big								
N-5	Vadakkupattu								
S-1	Siruvilai	77.8	20.7	41.9	9.3	14.3		4.3	34.7
S-2	A Ramalingapuram								
S-3	Pandikanmoi								
S-4	Senganguram								
S-5	Kurumbi								
	Average	55.6	12.2	21.0	4.7	7.2		2.2	19.2

Source: Farmers' interview survey, JICA

Table A.5.10 Number of Farm Holders and Area Operated in Pilot Tank Area

Description	Northern Study Area										Southern Study Area									
	Echur Tank (NR-1)		Cherukkanur Big Tank (NR-2)		Polambakkam Tank (NR-2)		Enadur Big Tank (NR-3)		Vadakkupattu Tank (NR-4)		Siruvai Tank (SP-1)		A. Ramalingapuram Tank (SR-1)		Pandikannai Tank (SP-4)		Sengangulam Tank (SP-3)		Kurumbi Tank (SP-1)	
	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)	No. of Farm House holds	Percent (%)
Registered Ayaout(ha)	58.6		91.3		94.6		574.7		417.3		53.2		75.6		41.9		99.2		52.7	
Medium to Large(2ha<	7	4	9	3	16	12	23	5	17	5	4	4	2	4	5	5	24	8	6	5
Small(1-2ha)	92	55	61	23	81	58	68	15	54	15	20	19	7	14	30	27	39	12	27	24
Marginal(1ha>	67	40	198	74	42	30	357	80	284	80	82	77	40	82	75	68	250	80	79	71
Total	166	100	268	100	139	100	448	100	355	100	106	100	49	100	110	100	313	100	112	100
Ave. Farm Size(ha)	0.35		0.34		0.68		1.28		1.18		0.50		1.54		0.38		0.32		0.47	
Percentage to Average of State(%)	38.0		36.6		73.2		137.9		126.4		54.0		165.9		41.0		34.1		50.6	
Percentage to Average of All India(%)	22.5		21.7		43.3		81.7		74.9		32.0		98.3		24.3		20.2		30.0	

Data Source: P.W.D
Ave. Farm Size: Study Areas: 0.71 ha, Tamil Nadu State:0.93 ha, All India: 1.57 ha

Table A.5.11 Promising Crops

Crop	Productn (kg/ha)	Unit Price (Rs/kg)	Gross Income (Rs/ha)	Production Cost (Rs/ha)	Net Income (Rs/ha)	Duration of Crop (Days)	Net Income per day (Rs/day/ha)	Net Income to Paddy (%)	Season of Planting
Turmeric(Fresh)	25,000	10.0	250,000	39,125	210,875	300	703	1,586	Jul-Nov
" (Cured)	5,000	30.0	150,000	39,125	110,875	300	370	834	Jul-Nov
" (Surface irrigation)*	27,680	4.0	110,720	25,100	85,620	300	285	644	
" (Drip irrigation)**	33,950	4.0	135,800	32,100	103,700	300	346	780	
Banana(Surface irrigation)*	27,965	3.0	83,895	25,100	58,795	365	161	442	
" (Drip irrigation)*	32,070	3.0	96,210	32,100	64,140	365	176	482	
Tomato	15,000	4.0	60,000	21,488	38,513	135-150	270	290	Mar-June, Nov-Feb
Brinjal	20,000	3.0	60,000	20,000	40,000	150-160	258	301	Dec-Jan, May-June
Ladies' finger	15,000	4.5	67,500	23,463	44,038	90-100	464	331	June-Aug, Feb-Mar
Chilli(Green)	10,000	10.0	100,000	23,938	76,063	210-240	338	572	Jan-Feb, June-Jul, Sep
Chilli(Dry)	2,500	25.0	62,500	23,938	38,562	210-240	171	290	Jan-Feb, June-Jul, Sep
Sugarcane(Surface irrigation)	125,000	0.5	61,460	26,175	35,285	330	107	265	
" (Drip irrigation)*	167,000	0.5	90,120	34,675	55,445	330	168	417	
" (Surface irrigation)	125,000	0.5	62,500	24,215**	38,285	330	116	288	
Groundnut(in pods)	1,900	13.0	24,700	7,340**	17,360	105	165	131	
Cotton	2,000	14.0	28,000	10,650**	17,370	210	83	131	
Paddy	5,000	5.0	25,000	11,700**	13,300	125	106	100	
Blackgram	1,200	14.0	16,800	4,144**	12,656	75	169	95	
Casuarina*** (Per Year)	22,500	1.4	31,500	9,513	21,987	365	60	165	

Source: Director of Horticulture and Plantation Crops, Chennai-2

* : Bavanisagar Research Station

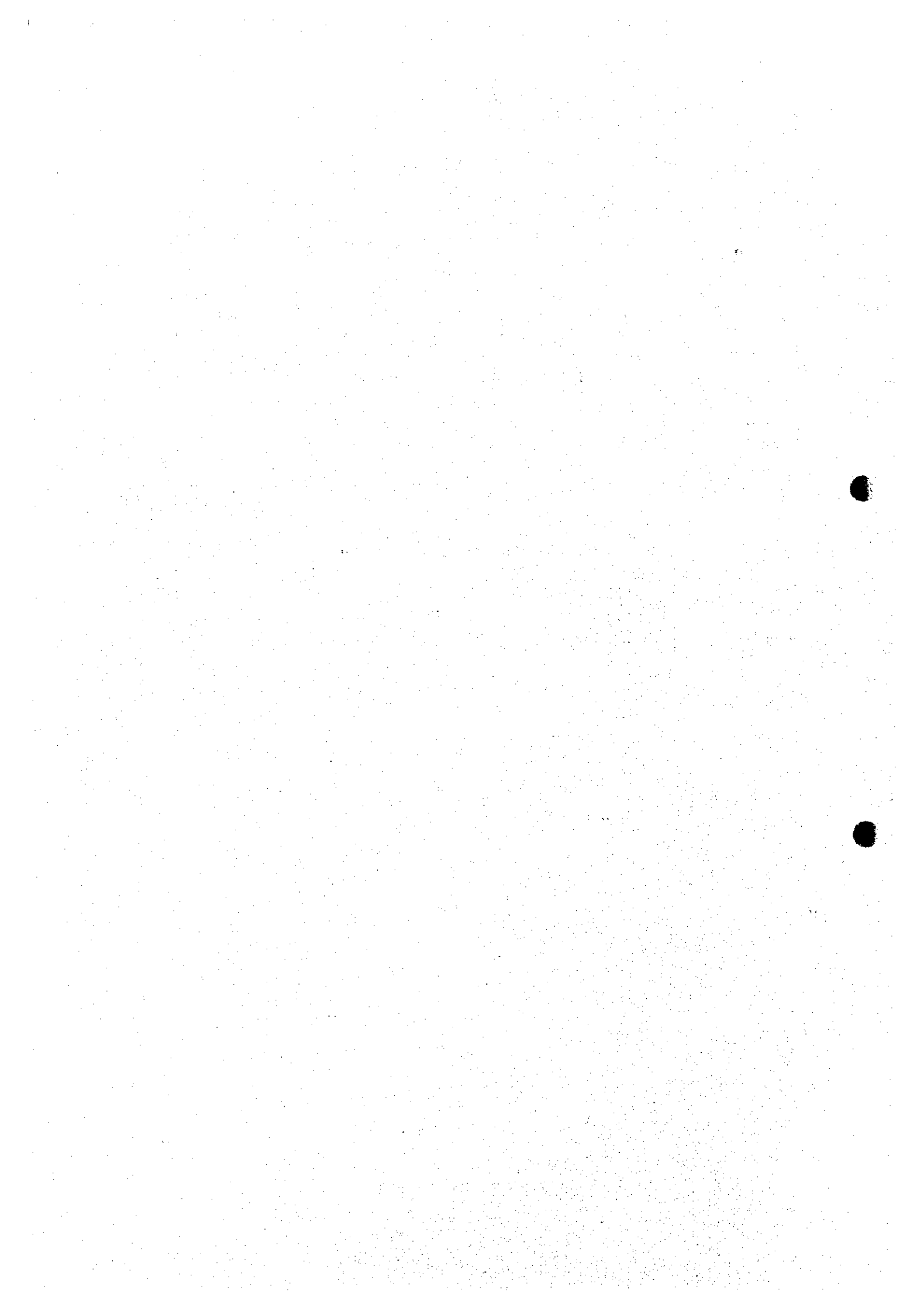
** : A. D.

*** : Farmers interview survey

B AGRO-ECONOMY

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B AGRO-ECONOMY

B.1 Farm Household Economy

B.1.1 General Characteristics

The basic aspects of farm household economy in India including the Tamilnadu State are characterized by two major issues: the limited agricultural land for a large agricultural population making the presence of landless farmers (agricultural laborers) in rural areas and the low agricultural revenues to farmers, especially marginal and small farmers, resulted from mostly old-typed farming practices affected by various causes including unstable irrigation water, traditionally staple foods production, old-fashioned farming system, rather mono-channel marketing system fluctuated pricing system and rather weak agricultural supporting framework.

The rural population in the State as well as in all India is estimated at more than 65 % of the total population; meanwhile, in general, the population of landless farmers is more than half of the rural population or approximately 35 % of the total population.

There are some drastic disparities between the State and all India, especially on the proportion of marginal farms with 74 % in the State compared with 58 % at national level. Besides, the proportions of semi-medium, medium and large farms in The State are low, 7.85 %, 2.9 % and 0.86% compared with 13.56 %, 8.10 % and 1.97 % of national levels, respectively. However, the average holding area for large farm in the State (19.15 ha) is higher than the national level (17.2 ha).

B.1.2 Farm Size and Land Reform

(1) Land Holding

The number of farmland holders in India in 1985 was counted at about 90 million, or about one-tenth of the present total population of approximately 900 million inhabitants. Considering the total agricultural land as 53% of the national land area of about 3 million km², the area subjected to farm land would be 1.55 million km² or 155 million ha. The average farmland per holder, therefore, was approximately 1.68 ha in national level. Yearly data showed a constant decline in average farm size per holder from 3.12 ha in 1953-54 to 2.62 ha in 1960-61, 2.30 ha in 1970-71, 2.0 ha in 1976-77, 1.80 ha in 1980-81 and 1.67 ha in 1985-86, and presently estimated at the level of about 1.50 ha. This implies also an increasing proportion of marginal holders (up to 1 ha) which made 36.84 % in 1961-62 to 51.0% in 1970-71, 58.0% in 1985-86 and presently estimated at more than 60% of the total number of farmland holders in national level. In Tamil Nadu the situation was observed more severe with the average farm size per holder was 1.01 ha with 72.59 % of marginal farmers in 1985.

(2) Land Tenure

The present situation of land tenure has been considered as consequence of land reforms from the three systems of land tenure in pre-independence India : (1) *Zamindari* system or landlord tenant system (the landlord owns and provides the land, pays the revenues to obtain a predetermined share of the produce; meanwhile, the tenant provides all the management and labour), (2) *Mahalwari* system or communal system of farming (Land ownership by a collective body as village made for a management unit to distribute each portion to individual peasant for collecting revenues. Revenue to the State was paid by the village) and (3) *Ryotwari* system or owner-cultivator system (Proprietorship of a farmland portion to a peasant for agricultural production and revenue-payment). In pre-independence India more than 60 percents of farmland areas were under the first two systems.

(3) Land Reform

In the era of post-independence, India had continuously implemented a land reform program by abolishing the *Zamindari* system (landlord system) by the U.P. *Zamindari* Abolition and Land Reform Act in 1950 with necessary legislation enacted in all States in 1952. This had facilitated the distribution of about 5.8 million hectares of land to landless farmers in the whole country. However, due to social system, some kinds of land-types were not subjected to the law, permitting the presence of landlords in some areas.

From this social background, efforts on regulating the tenancy-system with rental rate and produce-sharing as well as rights of tenants and land owners have been applied; but disparities among States were observed also. Tamil Nadu has taken measures in the form of an order for staying ejection to give a temporary protection to tenants. The measures relating to the security of tenure restrict liable to ejection only when (1) non payment of rent, (2) destructive act to land, (3) subletting the land, (4) using for non-agricultural purpose, and (5) resumption of land for personal cultivation by the landlord.

Besides, the fixation of ceiling on land holding was an important aspect in the land reform program in India. The Working Group on Land Reforms appointed by the National Commission on Agriculture had proceeded related formula and regulations enacted in two distinct phases: (1) First phase up to 1972 for deciding ceiling limits per State. Before 1971 the ceiling limit in Tamil Nadu varied from 12 to 60 acres. Since 1972, these limits have been rationalized i.e. 10 to 18 acres for land with assured two crops and water supply, 1.25 acres for 1 acre if private irrigation for assured two crops, limit of 27 acres for provision of irrigation for only one crop and limit to 54 acres for the remaining land type, and (2) Second phase from 1972 for the adoption of "National Guidelines" prepared by the Central Government for uniformly implementing in all States. The provisions under the ceiling laws consisted of (1) The unit for ceiling application, (2) The level of

ceilings and (3) Exemptions allowed.

The main objectives of land reform program are for (1) social justice and (2) economic efficiency. Through its implementation procedure and consequences, despite of criticisms on halfway-oriented measures, results have been gradually observed as basic initiatives emerged from an old agrarian and complicated social system to be further improved in the next steps.

In 1990, out of 70 million holdings in the whole country, 64 millions or 92 percents of holdings are wholly owned and self-operated, 3 millions are partly owned and partly rented, and 3 millions are wholly leased. On areas of farmland, out of 162 million hectares under holding, 148 million hectares or 91 % are wholly owned and self-operated, 10 million hectares or 6 % are partly owned and partly rented, and the balance of 4 million hectares or 3 % are wholly leased.

B.1.3 Farm House Hold Economy

Based on the characteristics of farm holding situation in the State as well as in India, the farm holding economy for each category of farmer is generally specified as follows:

Firstly, for agricultural laborers or landless farmers, as they possess no farmland and carry out farming activities on seasonal basis of hiring, their farming income are very unstable, depending on seasons and employers. As they are classified as unskilled workers, their daily salaries are Rs.30-50 for men and Rs.15-30 for women upon work-type, region and season. There is a tendency of relatively high daily salary rate in Northern Tamil Nadu where agricultural production is well done; meanwhile, a low rate in Southern Tamil Nadu where drought conditions are severe for the agricultural production. Besides, as a matter of fact, the population of agricultural laborers (landless farmers) in the South is much less in comparison with the North.

For a family of agricultural laborers with two labor forces (1 man and 1 woman) their average annual farming incomes would be in the range of Rs 5,000 for equivalent to a 5-month work-period per year. This would basically support their basic expenditure for mainly foods only. A lack of works would be resulted in no revenue for buying foods, causing a labor migration to other prospective areas, sometimes very far from the previous place, or looking for off-farm works in nearby urban areas. Basically, their farming economy is considered very severe to be subjected to basic living stabilization.

For other farm categories, details on their farm holding economy are described in the following. Basically, the surplus of their farm produces will be sold for using in family expenditure and operation capital for the next crops. On this basis, marginal farmers of less than 1 ha are basically found without considerable surplus, particularly in case of only one crop is available, for having some revenue for even family expenditure. Most marginal farmers, therefore, have to carry out salary-works like coolies outside their farm works for supporting their family expenditure.

In general, the characteristics of farm holding economy in the Project Area are observed as follows:

(1) Large Scale Farmers

For big farmers of land holding more than 10 ha, their farm holding economy is considered very stable for making a good profit. Basically their crops are for economic purposes, not mainly for family consumption purpose. They do not do farming works by themselves but mainly hiring agricultural laborers (landless farmers) for carrying out their seasonal farming works under their supervision. Their cropping systems, therefore, are based on the high profitable marketability with basic crops as paddy, gingelli, cotton to high-valued cash crops such as sugarcane, vegetables and fruit trees. Recently, big farmers have a tendency of cropping fruit trees and sugarcane which can make an average annual profit of Rs.30,000 per ha. Supposing a big farmer has 10 ha only, his annual net income would be roughly Rs.300,000 or Rs.27,000 per month after tax. A maximum family-expenditure of Rs.7,000 per month would give a monthly balance of Rs.20,000 or Rs.240,000 as annual balance after family expenditure for a big farmer of minimum 10 ha. Generally, big farmers have sufficient supplies of irrigation water, operation capital and inputs, and farming knowledge to efficiently manage their farms. Supporting assistance, therefore, are considered basically unnecessary.

(2) Medium Scale Farmers

For medium farmers land holding of more than 2 ha up to 10 ha, the characteristics of their farm holding economy have been observed similar to big farmers, based on high marketable produces, except for a lower annual financial surplus after family expenditure due to a rather smaller farm-size. However, they can obtain an annual financial surplus after all expenses, calculated in the range from Rs.40,000 - 200,000 upon their farm sizes. Like big farmers, most medium farmers have supplies of irrigation water, operation capital and inputs, and farming knowledge to manage their farms. Supporting assistance, therefore, would be basically negligible, especially for farmers of more than 4 ha in this category.

(3) Small Scale Farmers

For small farmers land holding of 1 - 2 ha, their farm holding economy is basically based on family consumption at first with surplus to be sold in the market. Their cropping system, therefore, is mostly based on staple crops for self consumption, mainly paddy with a minor part for other cash crops. The revenue from selling the surplus farm produces will be used for paying loans, family expenditure and inputs for the next cropping operations. For cash crops seasonal or annual crops such as vegetables, sugarcane etc are often appraisal but no perennial crops like fruit trees due to needs for quick revenues. In case of assured irrigation water supply, they can

enlarge the cropping areas of these high-valued cash crops for more revenues. Therefore, there are 2 basic cases; if they could perform 2 crops, they would have a financial surplus after all operation expenses and basic family expenditure and, in case of only one crop, their produces are basically for family consumption and a minimum revenue for family expenditure. Small farmers, therefore, need supplies of irrigation water, operation capital and inputs, and also farming knowledge for improving their farm revenues.

(4) Marginal Farmers

For marginal farmers land holding of less than 1 ha, their production is mainly for family consumption. Their farming is substantially based on traditional farming style to crop mainly paddy combined with millet for assuring their staple food in any cases of rainfall precipitation. Generally their farms are not assured with irrigation water supply for cropping wholly paddy. In dry season, they try to cultivate groundnut for making some farm revenue. They essentially need stable supplies of irrigation water, capital, inputs and knowledge for a stable farming operation, especially in the drought-prone region in the South of the Project Area.

(5) Regional Differences

Regarding differences on farm incomes between the North and the South of the Project Area, farm holders in the North are basically gaining higher farm revenues than farmers in the South of a same farmland area due to better farming conditions, especially on irrigation water and soil, for assuring 2 crops in a year. Particularly, for marginal farmers of less than half ha (0.6 acre) their farm revenues could not support the whole family expenditure in a year. The situation of these farmers is more severe in the Southern Study Area. Generally, marginal farmers have to do other labour works like coolies for earning some revenue for supporting their family expenditure.

(6) Crop Budget

The crop budgets show some deficiencies in seasonal factors for a same crop. In general, for a same crop budget in the dry season is higher then that in the wet season. On the contrary, the yield for a same crop cultivation in the dry season is higher than that of the wet season.

(7) Farm Expenditure

Regarding the farm expenditures, the results from the Farm Household Economy Survey were mentioned in the relative parts of the Feasibility Report (Volume III). These results showed that the total amounts of family expenditures were generally proportional with the far size possessed by farmers e.g. the family expenditure portion for foods made the highest percentage in the whole amount. For marginal

and landless farms, this portion covers almost 2/3 of the whole family expenditure; meanwhile, for the medium and big farms, this portion is almost 40% of the whole family expenditure. Other major expenditures are housing fees, clothes, ceremonies and medicines. These expenditures are found also proportional with the income or farm size of each farm.

From these results, the situation of landless and marginal farmers on incomes and expenditures is considered very critical, generally in deficit. For small scale farmers, the situation is somehow better, but, in general, their living conditions are at an inferior level due to an unstable production on a limited farm-land. Presently, only small scale farmers of more than 1.5 ha with assured rainfall or water supply can afford a considerable life.

B.2 Agricultural Marketing

B.2.1 General Situation

In general, the dominant marketing practice for agricultural products in India is an old and complicated conservative system carried out by multi-level traders to buy and sell these produces on the way to reach to consumers in urban areas from the ancient time up to nowadays. Recently the Government has been involved in this domain by setting up various facilities such as the Regulated Markets system to control the market prices and to collect revenues from these transactions.

In towns as terminal destinations for retailing to consumers, agricultural produces could be seen for retail sales at specific green shops, some kinds of supermarkets, road sellers, and specific markets of these products. The market system of growth-centers or town-markets selling all types of daily products as often applied in other countries, especially in Asian countries is not so common in India where various levels of traders forming their marketing territories with specific products.

This marketing system, despite of keeping a constant flow of major agricultural commodities, could not handle effectively the marketing of minor commodities and assure the good qualities of produces, especially for vegetables.

Besides, in the framework to help farmers in marketing their produces, to regulate the market of agricultural products, the government acts as an intermediary to buy and store certain major agricultural produces such as rice with fixed minimum prices based on market prices at corresponding periods and to issue legislative control acts and to implement facilities for proceeding this task.

B.2.2 Present Types of Agricultural Markets

Apart from the direct selling the produces at farms from farmers to traders during the harvest times for quickly gaining the capital for next crops etc., there are 7 types of

major markets for agricultural products which are functioning each specific marketing role in India as follows: 1) Primary or Local Market, 2) Secondary Market, 3) Terminal Market, 4) Fairs, 5) Regulated Markets, 6) Co-operative Marketing, and 7) State Trading.

At local rural sites, farmers with surplus will unload their agricultural products at primary or local markets known as "traditional" *shandies* held once or twice a week for both wholesale and retail sale, organized by Village Panchayats with the village bania acting as the middleman. More than 50 percents of the total marketed surplus are sold at these markets. There are about 22,000 shandies in all India.

Regarding Secondary Markets or Wholesale (Assembling) Markets known as "traditional" Mandis" or "Gungs" serving an area of 775 km² with a population of about 130,000 inhabitants, these markets operate transactions throughout the year by their various middlemen with storage and marketing distribution facilities. There are about 4,200 Mandis in all India.

Terminal Markets are special markets at major transportation places such as ports, city-distribution centers which operation areas extend over a State. This type of market is considered developing with the development of these facilities.

Fairs are occasional markets in a year, specially conducted during religious ceremonies-periods, for selling agricultural produces to the pilgrims. Some annual fairs are held by district-officers, local bodies etc. at specific places in each district.

Regulated Markets are set up by the Government to check up practices of traders in Primary and Secondary Markets, aiming at effectively checking market prices and collecting revenues based on rules and regulations of the Government. There are a number of regulated markets and corresponding facilities in each state for facilitating this important task.

Co-operative Marketing is the marketing practice to supply directly the agricultural produces from farms to their cooperative members, without the involvement of middlemen. This marketing practice, however, has been carried out in a very small scale in India.

State Trading practices through State Agencies such as the Food Corporation of India to procure some staple foods such as paddy from farmers at Government fixed prices.

B.2.3 Agricultural Marketing in the State

(1) Present Conditions

In order to facilitate the agricultural marketing in the State, the Agricultural Marketing in Commission of Agriculture was independently formed as Agricultural

Marketing Department at Trichy in 1977 and later shifted to Chennai in 1993.

With the operation of this Department, presently known as the Directorate of Agricultural Marketing Office, 14 market committees at district level with 270 regulated markets, 15 sub-regulated markets and 44 check posts have been set up. With related operations, 96 of the 270 regulated markets have been installed with commercial grading facilities and godowns of 1,000 ton were constructed in 98 regulated markets.

(2) Marketing Welfare Scheme in the State

In order to help farmers to avoid distress sales during harvest times and inferior pricing periods, the State government offers pledge loan facilities in 98 rural godowns and 39 regulated markets having godown facilities with maximum ceiling limit of Rs. 10,000-25,000 per farmer with nominal interest of 15 %.

Besides, to attract the farmers for selling their produces through regulated markets and to get better prices, the Tamil Nadu Farmers Development and Welfare Fund was implemented in 1995. By this scheme, a farmer of 18-60 years old selling one MT or more continuously will be compensated Rs 25,000 per year after his/her death or disability for an equivalent period of contribution.

(3) Tamil Nadu State Agricultural Marketing Board

In 1970 the Tamil Nadu State Agricultural Marketing Board was established to carry out the development activities of market committees and liaison with the Government. All the market committees are to pay 15 % of their incomes to the Board, and the Board will allocate a half of this payment to the market development fund for development activities concerning marketing of agricultural produces, and another half for the Board expenses. Also with this income source, the new construction of a building for the Board and the Directorate of Agricultural Marketing Office at Guindy is under way.

Paralleling with technical innovations on marketing procedures, the Board and the Directorate of Agricultural Marketing Office in the State are paying efforts to put additional commodities for marketing control such as groundnut in the system of regulated markets in adjoining with neighboring states.

B.2.4 Agricultural Marketing in the Study Area

The marketing system of agricultural produces in the Study Area is basically similar to the whole marketing system in Tamil Nadu but mostly limited in 5 produces: (1) paddy and foodgrains, (2) sugarcane, (3) cotton, (4) groundnut and (5) vegetables.

For general marketing routes, farmers can sell on the field their produces to traders

providing their cropping loans and traders coming to their fields on harvest time, or bringing their produces to sell in regulated markets, village or district markets or city-dealers.

In the Study Area, a number of regulated markets with official prices were established to handle major items of paddy, foodgrain, cotton and groundnut. Sugarcane farmers sell the harvested cane to nearby sugar factories or dealers with minimum prices fixed by the Government. For vegetables, farmers depend only on dealers and markets in villages or districts with a fluctuated pricing system.

In general the marketing system of agricultural produces in the Project Area is not well organized, especially for agricultural produces and the lack of related facilities for supporting marketing such as multipurpose storage, cold storage, transport means, central retailing markets of all goods to facilitate all kinds of marketing activities.

The number of regulated markets with related godown facilities in the Study Area, is considered sufficient at this moment. Only the items to be handled are limited and the supporting facilities should be reinforced for better activities on agri-business.

In general the advantages of the present marketing system are the ready presence of traders in the field at harvesting times to buy and to collect the produces at once. Farmers have no needs of measures to handle the post-harvest treatments which require facilities and techniques along with their costs.

However, the disadvantages this present system are farmers should sell the produces at almost lowest prices on the field and on-season due to no other choices for a quick revenue to pay loans, to collect capital for the next crop and because of lack of post-harvest treatment facilities to assure a safe handling for better off-season prices afterwards. Besides for minor products such as perishable vegetables etc. farmers are not sure on the marketability and handling techniques for producing in a profitable way, resulted in the present situation of a limited production scale.

B.3 Agro-industry

B.3.1 Agro-industry in India

Despite agriculture is the traditional and major industry in the national economy, the situation of agro-industries is observed to be under developed in India due to the status-quo of present marketing system of agricultural produces dually controlled by traders and regulated markets of the Government.

In general, there are two categories for agro-industries which are (1) cottage industries carried out by farmers themselves with almost simple procedures and tools at mostly home base in rural or semi-urban areas, and (2) Agro-based industries for processing agricultural produces which can be organized in (i) cottage scale, (ii) small scale with

some mechanical techniques and/or some hired employees, or (iii) large scale with large mechanization and/or large number of employees in the production line. Rural agro-based industries are almost cottage or small scale industries. Meanwhile, large scale agro-based industries are generally set up in large cities or semi urban areas.

In India cottage and small scale industries have been carried out mainly with hand loom products and some simply processed agricultural products only e.g. drying chili, date, coffee etc. This situation, therefore, could not absorb a considerable number of labor forces in the rural areas where there is a surplus of labor forces. For products of rather complicated processes, these products are mostly made by large-scaled industries with a mechanized procedure with a certain number of employees only.

B.3.2 Agro-industry in Tamil Nadu

The general situation in the State is firstly similar to all India with a gloomy development in agro-industries. For large-scaled agro-industries, most factories have been installed in large cities, mostly in Chengalpattu, Madurai etc. For cottage and small scaled industries, the State has a rich heritage of hand-loom, ranking first in India with about 428,000 looms of which about 390,000 looms in cooperative units, mainly in South Tamil Nadu. In Salem, Madurai, Coimbatore, Hosur, Ranipet, Trichy, Dindigul, Tiruppur, Vellore, Katpadi, and Sivakasi , there are important centers of small industries.

In The State, the productivity per loom per day is about 4.77 m, compared with the national average of 5.12 m, due to the inferior working environment , old equipment and a rather low quality of the products. In order to assist this cottage industry, the Government has implemented various schemes for its promotion including the cooperative program. In the State 77 % of weavers have been formed in primary weavers cooperative societies. The primary societies and the cooptex are subjected to the concessional credit from the assistance framework of working capital by NABARD through the Tamil Nadu State Cooperative Bank and District Central Cooperative Banks.

Besides, in order to support this industry, programs have been undertaken by the State for modernization of handlooms and conversion to power-loom to deal with the situation of inferior working conditions and higher wages. Design development and related market activities have been practiced at the same time to promoting this important cottage industry in the State.

Regarding the situation of agro-processing in the State, important items are rice mills, oil mills and sugar factories which are performed in cottage and small industries types.

B.3.3 Agro-Industry in the Study Area

In general, the situation of agro-industries in the Study Area is similar to its basic

conditions in the State but handloom is basically not carried out in the 5 districts. Meanwhile, rice mills and oil mills of cottage or home type are in operation in each village in these 5 districts. The charge of rice milling is Rs.0.15 - 0.20 per kg of paddy.

For sugar factories all the 5 districts of the Project Area have large scale factories for producing refined sugar. For other services supporting the agricultural production, in Chennai Corporation, there are state corporations like ENCOFED (Tamil Nadu Agro-Engineering Co-operative Federation Ltd.), TANCOF (Tamil Nadu Co-operative Oilseeds Growers Federation Ltd.), TAI (Tamil Nadu Agro-Industries Corporation Ltd.), TANHIOPE (Tamil Nadu Horticultural Producers Co-operative Enterprises Ltd.) apart from private companies of agro-inputs, chemicals, food processing etc.

But at village level in the Project Area, agro-industries and even cottage industries are basically not existing. Generally, farmers sell their produces in raw types. Some minor and simple activities like threshing paddy, drying chilli, collecting milk for sale etc., however, have been carried out on family or individual basis.

In order to improve farm incomes and create job-opportunities in the rural area, particularly in the dry season, the development of simple applications for processing the local agricultural produces such as rice cake, brown sugar, chilli sauce, etc. at home base as cottage industries is considered necessary.

B.4 Pilot Tank Area Feasibility Study

B.4.1 Farm Management

(1) General Conditions

The farm management at farmer level in the Pilot Tank Areas has been observed to being carried out in a rather traditional manner mainly based on the present critical conditions on hydro-meteorology, small farm sizes and production for mainly family consumption purpose as well as the basic restrictions in technical and financial capabilities of local farmers. Small and marginal farmers, therefore, have been generally in a difficult situation for largely improving farm management on this basis. Only some big farms in the areas have been concerning on the application of modern farm management for higher farm revenues.

The initiatives on farm management are observed basically made by local farmers who inherited the experiences on farming practices traditionally applied by their ancestors in their villages up to now. The Government is mainly providing local farmers with some basic means for their production such as agricultural inputs (seeds, water, electricity etc.) and the regulated marketing system for selling their produces but the systematic engagements by the Government in providing local farmers with modern techniques on farm management have been found very limited.

As a matter of fact, in the subjected tank areas as well as in most parts of Tamil Nadu, except for some medium and big farms, and some special areas with specific programmes for intensive management of some crops i.e. agricultural research stations, small and marginal farms, in general, have not applied the modernized procedure of intensive farm management for a higher farm income. As for the suitable conditions of their small-scaled production, only some related applications i.e. new seed varieties, motor pumping, cultivation of some field cashcrops etc. have been partly observed, but the whole process of a new farm management system aiming at highest farm revenues has not been occurred.

Most categories of farms in the tank areas are fundamentally engaged in the traditional cultivation of rice, basically for family consumption. The surplus is subjected to commercial purposes for cash revenues to pay the expenses for production and family living. Their present farm management system, therefore, has been observed as substantially based on the cultivation of this crop for producing rice as the staple food for their family consumption at the basis.

(2) Specific Aspects in Farm Management

For the crop management in rice cultivation, despite of the method of transplanting is generally applied for both regions, due to the basic different conditions on hydro-meteorology between both regions, in the South where the rainfall pattern is short and scarce, paddy seedlings are generally sown at the start of rainy season, generally in light moist soil condition, for mainly rainfed cultivation. This situation causes an unassured crop yield in every year. If available water in tanks after the supplementary irrigation for the first crop, one more crop would be done under tank-water irrigation. The successful ratio for the main paddy crop in the South is reportedly obtained as once in three years. In the Southern region, a single (first) crop, therefore, has been generally applied. But in the Northern region, due to the normally good annual rainfall, farmers can grow at least one (first) paddy crop under assured water level during the rainy season, and, with available tank water, they can have one more (second) paddy or field crop depending on the available volume of tank water supply. Basically, the farm management in all tank areas in both regions have been intensively applied in terms of cropping proceedings based on the local hydrological conditions.

For the capital invested in related production costs which is an important factor for their agricultural production, local farmers, particularly small and marginal farmers are reportedly borrowing a basic capital for carrying out their necessary farm works. In general, small and marginal farms have no sufficient basic capital to cultivate cash crops in large scale as the main harvest, whose production costs are generally higher than rice cultivation along with a longer time requirement for harvests. Even for rice cultivation, they have to borrow money from local loan lenders or from the crop loan scheme distributed through the local loan society with the average amount limited at Rs.2,000 to 3,000/ha (generally disbursed in half by cash and half by

fertilizers etc.) for mainly rice cultivation whose production cost per ha needs at least 5,000 Rs excluding family labour force cost. The annual interest rate from this loan scheme is generally 12 - 14 %. This loan amount and interest rate are reportedly flexible to some extent depending on various factors such as area, season, performance etc. In case of loans from loan lenders, farmers should have properties (gold, house, engines, etc.) to make guarantees, and the loan annual interest is generally more than 22 %. However, due to the main reason of overdues, a large number of farmers have not been borrowing money from local loan societies for cropping. This situation is observed to be more critical for farmers in drought prone areas, particularly in the Southern region, where the harvests generally resulted in unstable yields.

For the main purpose of cash revenues, some seasonal crops such as groundnut, cotton, pulse, ragi, gingerly, etc. and perennial crops such as sugarcane, casuarina, etc. have been partly practiced in the tank areas in both regions. The cultivation of these crops, however, has been observed initially promoted by local farmers themselves as sub-crops based on their own capabilities in cultivation techniques and marketing distribution. The crop diversification in large scale for small and marginal farms has not been performed as yet.

In principle, the farm management for each individual farm in both regions has been observed being mainly based on the basic hydro-meteorological conditions and crops suitable to its farm size and farm economy. But due to the basic conditions of being located in the drought prone areas, the farm management in the Southern region has been found in more intensive cares on the utilization of rainfall than farms in the North where tank water is more reliable.

(3) Problems in Farm Management

In general, local farmers in both regions have been found being worked with great efforts for achieving the best way in farm management based on the aforementioned basic conditions in the process of farm management for each individual farm.

From the preliminary results of the Farm Household Economy Survey, the actual constraints in farm production cited by farmers in the Pilot Tank Areas are summarized as follows:

- i) Constraints in Irrigation and drainage control (approx. 70 %)
- ii) Limited finance arrangement (approx. 45 %)
- iii) Unavailable agricultural inputs on timing arrangement (approx. 35 %)
- iv) Insufficient labour arrangement at peak farming periods (approx. 30 %)
- v) Inferior marketing distribution system (approx. 15 %)

Regarding the item of irrigation and drainage, about 40 % of total farms (all of them are small and marginal farms in the Northern region) have the problem of water

logging in the wet season, But in the dry season, all farms in the Southern region and most farms in the Northern region have the problem of lack of irrigation water.

As showed in the survey results on seasonal problems, the problem of insufficient finance, mainly occurred in the cropping season(s) for all farm categories except big farms. The problems in arrangements of agricultural inputs and labor force are also reportedly occurred in the farming periods. Meanwhile, on the contrary, unemployment is a major chronicle problem for both regions in dry season, along with the problem of lacking water.

For the problem of farm credit, more than 40 % of the total surveyed farms have no borrowing at all; meanwhile, 25 % of them were reported for an annual borrowing of less than Rs.5,000 and only 15 % of them for annually borrowing more than Rs.5,000.

These above problems in farm management have been basically found in both regions with some variations depending on the specific characteristics of each area and individual farm.

Apart from these fundamental aspects on farm management in the tank areas mentioned above. the other specific aspects of the farm management in each tank area surveyed by the Farm Household Economy Survey etc. were notified in the related parts of each individual Pilot Tank description.

B.4.2. Marketing

(1) Marketing Channels for Farmers

Despite of its importance in agricultural production, the marketing aspect has been placed in rather low concerns by local farmers in the Farm Household Economy Survey in the tank areas where most farms are in the small and marginal farm categories.

Basically, except for sugarcane which is the crop item to be mainly marketed through the specific channel of local sugar factories with their imposed fixed prices based on different grades, in general, there are two major marketing distribution systems for agricultural produces in the Pilot Tank Areas, namely the marketing distribution system through non-regulated marketing facilities (i.e. selling their produces either to their cropping loan providers or traders coming to buy at farm-sites or selling in retail or wholesale to dealers at local open markets of taluks, districts, etc.), and another marketing system by bringing the produces by themselves to sell in large quantities through a close bidding procedure at any official regulated markets in the State.

Besides, farmers can sell their food grain produces to the Government (India Food

Corporation) at the minimum assured prices which will be used in Public Distribution System to sell as monthly rations at generally half market prices to low-income families (less than 20,000 Rs per annum) at local Public Distribution Shops in all India..

The farmers, in principle, can voluntarily choose either any marketing channels to sell their produces; but, normally, small and marginal farmers have due responsibilities to sell produces to their loan lenders at the minimum prices for quick loan repayments. Besides, due to no proper facilities for storage and transportation by themselves, they prefer to sell their produces to dealers coming to buy at farm-sites with farmgate prices reportedly lower than the corresponding market prices at the average level of 10 %. According to the results from the Farm Household Economy Survey, local farmers generally keep a certain volume of their agricultural produce, mainly rice, at home for self-consumption and for occasional sale at markets in case of needing cash.

(2) Regulated Market System

For the regulated market system, the agricultural produces, however, are generally limited in major commodities such as; (1) rice of all grades, (2) groundnut, (3) cotton, (4) gingelly, (5) pulses, (6) coconut (7) chilli, (8) brown sugar and (9) other foodgrains. At regulated markets, which are generally located at an average distance of 20 km from the concerned villages, most related facilities such as drying yards, godowns, grading centers etc. have been found to be rather well established. Due to the

Regulated Market and Commercial Grading Center

Tank-Name	Regulated Market	Commercial Grading Center
Northern Region:		
1. Echer	Chengalpattu	
2. Cherukkanur Big	Tiruthani	Tiruthani
3. Polambakkam	Madurantagam	Madurantagam
4. Enadur Big	Kancheepuram	Kancheepuram
5. Vadakkupattu	Kancheepuram	Kancheepuram
Southern Region:		
6. Siruvalai	Sivaganga	
7. Kurumbi	Karaikudi	
8. A. Ramalingapuram	Sattur	Sattur
9. Sengulam	Mana Madurai	
10. Pandikamoi	Paramakudi	Paramakudi

close bidding procedure, the prices of agricultural produces at regulated markets, though normally lower than market prices, would be sometimes higher than prices at open markets at the same period. At present, the concerned officials and traders have largely utilized this regulated marketing system where licensed traders (for the purchasing right at regulated markets) should pay the market fee of 1% for each transaction amount. The regulated markets and commercial grading centers related to the Pilot Tank Areas are shown in the table.

(3) Open Market System

Commodities such as fruits, vegetables, flowers, meat and fish products, however, are not handled as yet by the regulated market system. These commodities, therefore, are mostly dealt through the specific channel of regular traders with local farmers. At related open markets, the present prices of vegetables are in the range of

Rs.5 to 10/kg depending on varieties, qualities, seasons, selling places, etc., which are almost double of the farm gate prices.

Besides, open markets in related taluks and districts with different sizes have been found in the Pilot Tank Areas with an average distance of 10 to 20 km from the concerned villages of tank areas. If having transportation means, farmers can bring to sell their produces in retail or wholesale in these nearby open markets in case of necessities. Some concerned villages have village markets (shandies) held on the common ground of the village once a week. These open markets are operated by the corresponding local body. For selling at these open markets, sellers should pay the market fee to the market controller designed by these bodies who decides the market fee for each seller depending on commodities and quantities. According to local farmers in the Tank Areas, the selling prices at these open markets are generally more than 10 percent higher than the farm gate prices. However, farmers should have transportation means or bearing related costs of transport, storage etc. At these open markets, farmers and local inhabitants can also purchase common foods, daily goods and basic agricultural inputs. In general, through our surveys, due to their basically small production and few available cash, farmers and local inhabitants, in general, have relatively few concerns about the present marketing system. They, however, expressed their inquiries to be supplied agricultural inputs such as seeds, fertilizers etc. for starting the cultivation on time.

At present, for small and marginal farms, the utilization of open markets for selling and buying is considered not so frequently, once per 1 to 2 weeks in average, mainly for purchasing some extra foods or daily goods only. The utilization of regulated markets for selling agricultural produces, therefore, is considered almost exclusively reserved for the categories of medium and large farms, and licensed traders using this marketing system. Besides, farmers can sell their rice production to the Government (India Food Corporation) at minimum prices (average Rs.3.5 to 4.0 per kg as for ration rice-price), but this would be occurred only in cases of needing urgent cash.

For low income families, they can buy rice as monthly rations at the Public Distribution Shop in each village with these minimum prices. Based on the family size, each subjected family can monthly buy 20 to 25 kg of rice with some other basic daily goods.

(4) Pricing System

According to the Study Team's price surveys, the pricing system of agricultural produces is freely fluctuates based on seasons, demands and bidding commitments, but as parameters the average prices of most commodities recently transacted at regulated markets in Tamil Nadu are showed in the table below:

Regulated Markets in Tamil Nadu

Through the knowledge on marketing channels and pricing levels, farmers, in principle, could select the crops of high cash values for cropping and selling, but due to many basic factors imposed on them for farming as mentioned in the above, most small and marginal farmers could not cultivate cash crops in large scale other than rice at its basis.

Commodity	Unit	Price Range
1 Rice (High grade)	100kg	560 - 700 Rs.
2 Rice (Medium)	-	420 - 550 Rs
3 Groundnut	-	1,500 - 1,700 Rs
4 Gingelly	-	1,400 - 1,800 Rs
5 Cotton	-	1,600 - 1,800 Rs
6 Pulse	-	1,500 - 1,600 Rs
7 Chilly	-	2,200 - 2,500 Rs
8 Turmeric	-	1,950 - 2050 Rs
9 Tamarind	-	1,200 - 1500 Rs
10 Cholam	-	300 - 330 Rs
11 Kumbu	-	350 - 360 Rs
12 Ragi	-	410 - 420 Rs
13 Cashew nut	-	2,800 - 2,900 Rs
14 Rubber	-	3,500 - 3,800 Rs
15 Palm Sugar	-	220 - 250 Rs
16 Brown Sugar	-	950 - 1,000 Rs
17 Sunflower	-	380 - 1,000 Rs.
18 Coconut	100 fruits	400 - 500 Rs

Source: Information from Tamil Nadu State Agricultural Marketing Board, prices in the period of January - May 1997

According to the results from the Farm Household Economy Survey, related data showed that more than 50 % of surveyed farms selling their produces less than Rs.10,000 in the last year (drought year) including about 30 % selling nothing, and about 50 % of them selling more than Rs.10,000 per year with 27 % for Rs.10,000 - 25,000, and 22 % for more than Rs.25,000. Regarding places for selling for farmers in these tank areas, about 75 % of the produces were reportedly sold at farms, and only about 25 % were sold at market. This implies the present situation of needs for quick selling by local farmers for financial arrangements on debt repayment and money preparation for the next crop.

(5) Constraints in Marketing

Besides, from the results of the Farm Household Economy Survey on the marketing aspects for agricultural commodities, rice is the dominant commodity sold by all categories of farms in all subjected Tank Areas. Other major agricultural produces for marketing are groundnut, pulse, cotton and sugarcane.

Through the results from this farm survey, however, only about 15 % of the total farmers expressed their concern about the present marketing distribution system as a constraint in their agricultural production. Their main concerns, however, are in the supply of agricultural inputs on time for cultivation and the available transportation means for bringing their produces to markets.

In general, transportation means and basic agro-processing facilities are found insufficient in the concerned villages of tank areas. These local facilities at village level would be basic subjects to be considered in the Project framework.

B.4.3 Farm Household Economy

(1) General

According to the preliminary results from the Study Team's related surveys, the

characteristics of farm household economy in the Pilot Tank Areas showed basically the severe conditions experienced to the household economy for small and marginal farms. These two categories, however, represent 95 % for all farms where the category of marginal farms covers a major share of more than 70 % in these tank areas.

The farm economy, therefore, will be basically dealt with the situation of the categories of small and marginal farms. For the categories of medium and big farms, due to their very small share in the total farms (approx. 5 %) and their superior conditions in farm household economy as mentioned before, only some references would be made accordingly.

From the preliminary results of our basic surveys, the basic factor of general farm household economy in the tank areas is based on the high shares of small and marginal farms as tabulated.

Average Share of Farmers' Category

Tank Location	Average Share of Farmers' Category		
	Marginal farmers	Small farmers	Marginal and small
Northern Study Area	70.0%	15.0%	95%
Southern Study Area	75.5%	19.5%	95%

From the above figures, the shares for marginal and small farms are at the same level (95 %) in both regions, but the share of marginal farms in the Southern region (75.5 %) is rather higher than in the Northern region (70 %). This basically implies that the Southern region has more low-income farms than in the North.

For both regions, the average farm size for each tank in both regions is observed to be distributed in the same range of approximately 0.35 ha - 1.50 ha, but in absolute terms the average farm size in the Northern region (0.75 ha), however, is higher than the figure for Southern region (0.65 ha).

Average Farm Size

Study Area	Tank Name	Ave. Farm Size (ha)	Total Area (ha)	No. of Farms
Northern Study Area	Echur	0.35	58.6	166
	Cherukkanur Big	0.34	91.3	268
	Polambakkam	0.68	94.6	139
	Enadur	1.28	574.7	448
	Vadakkupattu	1.18	417.3	355
Southern Study Area	Siruvai	0.50	53.2	106
	A. Ramalingapuram	1.54	75.6	99
	Pandikamoi	0.38	41.9	11
	Sengangulam	0.32	99.2	313
	Kurumbi	0.47	52.7	112

Both of the above basic factors imply the severe situation faced by the farm household economy in both regions, but the conditions to be for the South are considered more severe. For each tank area, the average farm size is presently calculated as shown in the table.

(2) Basic Conditions

Due to the basic conditions of land use in small portions and various established facilities existing in all tank areas, even in the rainy season of a normal year, their total command area have been considered as not being sufficiently cropped. This implies the lower figures of real productive farmlands versus the nominal figures of

the average farm sizes mentioned above. The real shares of cropping areas per average farm would be different to some extent between regions and for each individual tank area, but the basic severe situation on the limited cropping area per farm for the categories of small and marginal farms is unchanged.

Besides, due to the meteo-hydrological conditions, even in the Northern region, small and marginal farms could do a considerable cropping in the dry season only in the frequency of once in 3 years.

Small and marginal farms in all tank areas have been observed to crop mainly paddy in the rainy season for their family consumption and selling the surplus for cash revenues to pay loans and expenses for production and living. From the marketing information, they even know that perennial crops such as coconut, banana, sugarcane, casuarina, etc. would definitely make a higher farm income, but the basic production and traditional conditions have created obvious restrictions against the crop change from the main harvest of rice to basically other cash crop(s).

Only for crops in the dry season as for the second crop, except for some limited areas with sufficient water growing paddy, dominant crops are found as groundnuts and pulses in the Northern region, and cotton as the main sub-crop and ragi, kumbu, cholam etc. as other sub-crops in the Southern region. Due to the unstable condition in water supply and the insufficiency of inputs and production techniques provided, the average yield of rice in these tank areas is considered at an average of 3.0 - 3.5 ton per ha with some variations depending on factors such as seasons, locations, farm categories etc. With the average composition of 4.5 members and, therefore, 1.5 labour per family, there are basic problems in their agricultural production e.g. lacking of labours for farming works during agricultural peak periods (planting and harvesting), especially for the paddy cultivation in rainy season, and the low cash revenues from selling the surplus of this farm produce through the year for paying all the expenses in production and living costs for supporting their family.

(3) Farm Income and Expenditure

Due to the basic difference in hydro-meteorological conditions between both regions, covering on-farm incomes, in general, farmers of the same farm sizes in the Northern region have relatively higher revenues than farmers in the South. According to the Study Team's hearing from farmers in the tank areas, for a farm size of 1 ha being mainly cropped with paddy, the annual farm revenues would be Rs.10,000 - 20,000 in average (before the deduction of production costs). The rice production cost per ha would be Rs.6,000 - 10,000. These figures show the basic severe situation faced by the farm household economy for small and marginal farms in both regions, particularly for marginal farms where the average farm size is less than 1 ha.

In the dry season, therefore, most small and marginal farms without sufficient

cropping due to lack of water, therefore, should go for coolies who are paid an average wage of Rs.30 - 60 per day. The wage for male coolies, in general, is 25 - 50 % higher than for female coolies. Even with a high rate of 200 days for working as coolies by a farm family in a year, the average income from this source in general would be limited in the range of Rs.6,000 - 12,000 per annum, considered as an extra income for covering the deficit of the family budget to some extent.

The sources for off-farm revenues, however, have been observed to be rather limited in the subjected tank areas. Only Polambakkam tank area has weaving as a cottage industry performed by about 50 families in the village. Some villages in the tank areas are found to be fortunately located nearby some factories of charcoal, match production etc. for getting their seasonal job-opportunities. This situation could be observed in some villages in the Southern region. In the dry season, women coolies are often hired by nearby farms for field works such as weeding and collecting groundnut in the Northern region and cotton in the Southern region at the lower wage of Rs.20 - 30 per day.

But the agricultural production on their own farmland is basically the main means for small and marginal farmers to earn their living. They, therefore, have had to put all their efforts on this task. Basically their on-farm revenues will be used for consumption and for paying extra expenses for their families.

For marginal farmers of less than 1 ha of farmland which presently make a dominant share of more than 70 % in the total farms in the subjected tank areas, their situation of farm household economy, therefore, is considered to be in general deficit. Therefore, they need to work as coolies as much as possible to cover their family expenditure, particularly when there is an uncertainty for cropping in the dry season. The stabilization of agricultural production in both seasons in tank areas, therefore, is considered as utmost important to guarantee a better situation for the farm household economy for local farmers in the tank areas, particularly for the category of marginal farms who are definitely in critical conditions for their farm household economy.

The detailed description on the situation mentioned above is notified in the following part of results from the Farm Household Economy Survey. This showed that more than 70 % of the surveyed farms have an annual on-farm income of less than Rs. 25,000 and about 45 % of the survey farms have annual an off-farm income of less than Rs.5,000.