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Democratic Socialist Republic of Sri Lanka

Ministry of Mahaweli Development

ISN-53951

Maduru Oya Project

Feasibility Report

Annex G
Agroeconomic Studies

Acres International Limited, Niagara Falls, Canada

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FOREWORD

The Feasibility Report on the Maduru Oya Project, of which this Annex forms a part, is made up as follows:

Main Report

Annex A - The Project Area

Annex B - Soils and Land Classification

Annex C - Hydrology and Water Balance

Annex D - Engineering Works

Annex E - Agronomic Studies

Annex F - Livestock

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SUMMARY AND CONCLUSIONS

Annex G, Agroeconomic Studies, serves as a bridge between the technical-physical analysis in the livestock and agronomic annexes and the economic and financial analysis in Annex L. Its purpose is to examine development proposals from an agro-economic point of view and determine what is economically feasible in System B.

In terms of market potential, rice (paddy), cotton, sugarcane, and fibres are suitable for the domestic markets. As they are import substitution crops, their economic price has been calculated on the basis of the import parity price. Groundnuts, soybeans, tobacco, and possibly cassava pellets and fruit are potential export products and their economic prices are based on export parity prices. Less favorable opportunities in either the domestic or export markets exist for such products as pulses, vegetables, sorghum, and maize. Consequently their extensive production in System B is not recommended.

Economic and financial crop budgets have been prepared for eight crops - paddy, groundnuts, soybeans, pulses, cotton, kenaf, tobacco, cassava, and sugarcane. The financial crop budgets suggest that industrial crops such as cotton, tobacco, and sugar should be relatively profitable whereas paddy would be one of the least profitable crops. The major reason for this is that the price paid by the Paddy Marketing Board is about two-thirds of the current world price.

In the economic crop budgets, prices are adjusted to world levels and the economic return to paddy production is about Rs 3,900/ha higher than the financial return. The net revenue estimates for other products are somewhat lower when expressed in economic terms.

For purposes of calculating agricultural benefits for the project, a rotation of paddy/paddy is used for the lowland soils. A representative cropping pattern for the upland soils--groundnuts/soybeans--is chosen as a conservative indicator of the economic return from these upland areas.

Livestock activity in System B is based on the development of multipurpose Murrah buffalo to serve three basic purposes

(a) Home consumption of milk and perhaps beef
(b) Draft power for crop production and transport
(c) Sale of surplus stock.

The return from livestock production in either economic or financial terms is substantial. If livestock products are consumed on the farm, the farmer's cash income position will not be improved but the availability of milk and particularly draft animals for farm use should make the farm a much more viable financial operation.

Economic returns from fish production in the project area are expected to arise from development of the major reservoirs and possibly from "fish farming" in areas which are subject to long-term inundation.

The farm income objective for the Maduru Oya project is Rs 10,000 to Rs 12,000/family/yr. This includes income-in-kind. This is approximately 80 percent of the national average and is consistent with the objectives of the Mahaweli Programme. Incomes of this level can be achieved with 1.0 ha of irrigated lowland (paddy) and 1.5 ha of irrigated upland (upland crops).

Income composition for the lowland and upland farmers varies considerably. Paddy farmers on the lowlands receive a higher percentage of their income as income-in-kind: rice, livestock products, and homestead produce. This is a very desirable characteristic of small-farm agriculture. The risk for paddy farmers is lower and thus slightly higher incomes can be justified for upland farmers. The importance of livestock production and a productive homestead to the farmer is significant. Financial benefits from homesteads are more important than economic benefits to the project, as the farm entity becomes a financially more viable operation once these are established.

The level of income under the project should allow for a "betterment charge" or "water charge" to be paid out of farm income. The actual levying of the charge and its magnitude will depend on what farm standard of living is acceptable to policy-makers.

Given the theoretical family size of 5.3 persons and 2.8 man units of labor available from this family, relatively minor labor bottlenecks occur for both the rice farmer and upland farmer. However, actual family size and composition are unknown and therefore the financial crop budgets are prepared with significant hired labor inputs. It is concluded that migrant labor will probably have an important role to play in the future agricultural development of the System B area. This is consistent with most developments in Sri Lanka where the use of hired labor is substantial.

Agricultural development in System B would rely very heavily on buffalo power with supplementary power provided by both two-wheel and four-wheel tractors. However, the buffalo herd will not be fully developed until Year 16 and thus mechanized power will be extremely important in the early

development years. In the first few years of agricultural production, 600 to 700 four-wheel tractors will be required to meet the farm power needs of the settlers. Assuming that settlers cannot purchase their units individually, a tractor hire service is required. Provision of this mechanized farm power in the early years of the project is a vital component of the proposed development.

The supply of other farm inputs, fertilizer, farm tools, chemicals, etc, is through the Multipurpose Cooperative Society (MPCS) which ideally would have selling points in every hamlet. The next higher unit, the Branch Depot, would be stocked from a primary cooperative warehouse. Provision of adequate credit facilities is also an important factor in the farm delivery mechanism.

Marketing of paddy is expected to be undertaken in traditional fashion either through the Paddy Marketing Board or the open market. Both the PMB and private sector involvement should be encouraged in the System B project area. The role of the PMB should be somewhat greater than the national average, particularly in the early years of project implementation. Without reference to government or private sector ownership, the facility requirements are as follows:

- 47 small village hullers
- 49 collection centers
- 25 milling, drying, and storage complexes.

Agricultural production of other crops would require substantial improvements in the present marketing infrastructure.

Agricultural credit is a prerequisite for successful crop production in System B. The technology of commercial agriculture is such that farm cash flow requirements increase with a corresponding increase in credit requirements. Institutional credit to the agricultural sector comes from the People's Bank and the Bank of Ceylon, both nationalized commercial banks. However, institutional credit accounts for only about 25 percent of total rural credit. Defaulting is a serious problem and recovery rates are typically low. The credit program for System B will be part of the prevailing national scheme.

1 - INTRODUCTION

This annex serves as a bridge between the technical/physical analyses in Annex E and Annex F (Agronomic and Livestock Studies) and the purely economic and financial analysis in Annex L.

The basic objective is to identify what development proposals are both physically possible and economically feasible. To do this, market prospects for various agricultural and livestock products are evaluated and the financial feasibility of actually producing various products in System B is assessed. An assessment of farm input delivery systems and product market delivery systems complements the on-farm evaluation. With this background, an evaluation of projected farm income levels in the region can also be conducted.

Consistent with these concerns, this annex is organized as follows.

Section	Subject
2	Supply and Demand
3	Crop Budgets
4	Livestock Budgets
5	Farm Income
6	Farm Labor
7	Farm Power
8	Other Farm Inputs
9	Marketing
10	Credit

2 - SUPPLY AND DEMAND

An assessment of the projected supply and demand for selected agricultural and livestock products in Sri Lanka serves two purposes

(a) It helps identify which technical production possibilities may also be economically feasible, and

(b) It indicates whether production would serve as an import substitute in the domestic market or an export commodity in the international market.

An understanding of (b) allows the analyst to calculate relevant economic ("shadow") prices for the commodity in question, as calculated in Annex L (Economic and Financial Analysis).

Detailed supply and demand projections for numerous commodities in Sri Lanka have already been prepared by other research organizations.* The unedited reproduction of this material in the present study is not warranted. In what follows, only the highlights are reiterated.

*The principal sources are NEDECO(1) and Hunting Technical Services Ltd.(2)

2.1 - Rice (Paddy)

Actual and projected supply and demand conditions for rice are indicated in Table G-2.1. This supply projection assumes that all of the Mahaweli projects will take 6 years to come into full production and in the case of the Accelerated Mahaweli Programme, the start has been delayed until 1985. The projection assumes that paddy will be produced in lowland areas during both the Maha and Yala while for the upland areas, paddy will only be produced during the Maha. Furthermore, the cropping intensity on existing lands with reliable irrigation is projected to increase by 25 percent by 1990, (from 1.45 to 1.70). For new lands, a cropping intensity of 1.70 is assumed throughout. The demand projections are based on a population growth rate of 1.7 percent/yr and a consumption level of 100 kg/capita. Actual and projected supply and demand conditions are illustrated on page 6.

The significance of this analysis is that it clearly indicates that Sri Lanka could become a net exporter of rice by the year 1990. Allowing for poor seasons and for higher per capita consumption levels suggests that self-sufficiency in rice may not actually be achieved until later in the 1990's.

Based on the above analysis, projected economic farm-gate prices are calculated on the basis of anticipated conditions during the 1980's and, possibly, the early 1990's, a period during which rice imports will still be mandatory. The resulting calculations are provided in Annex L.

TABLE G-2.1

RICE: SUPPLY-DEMAND-PRICES AND PROJECTIONS TO 1990

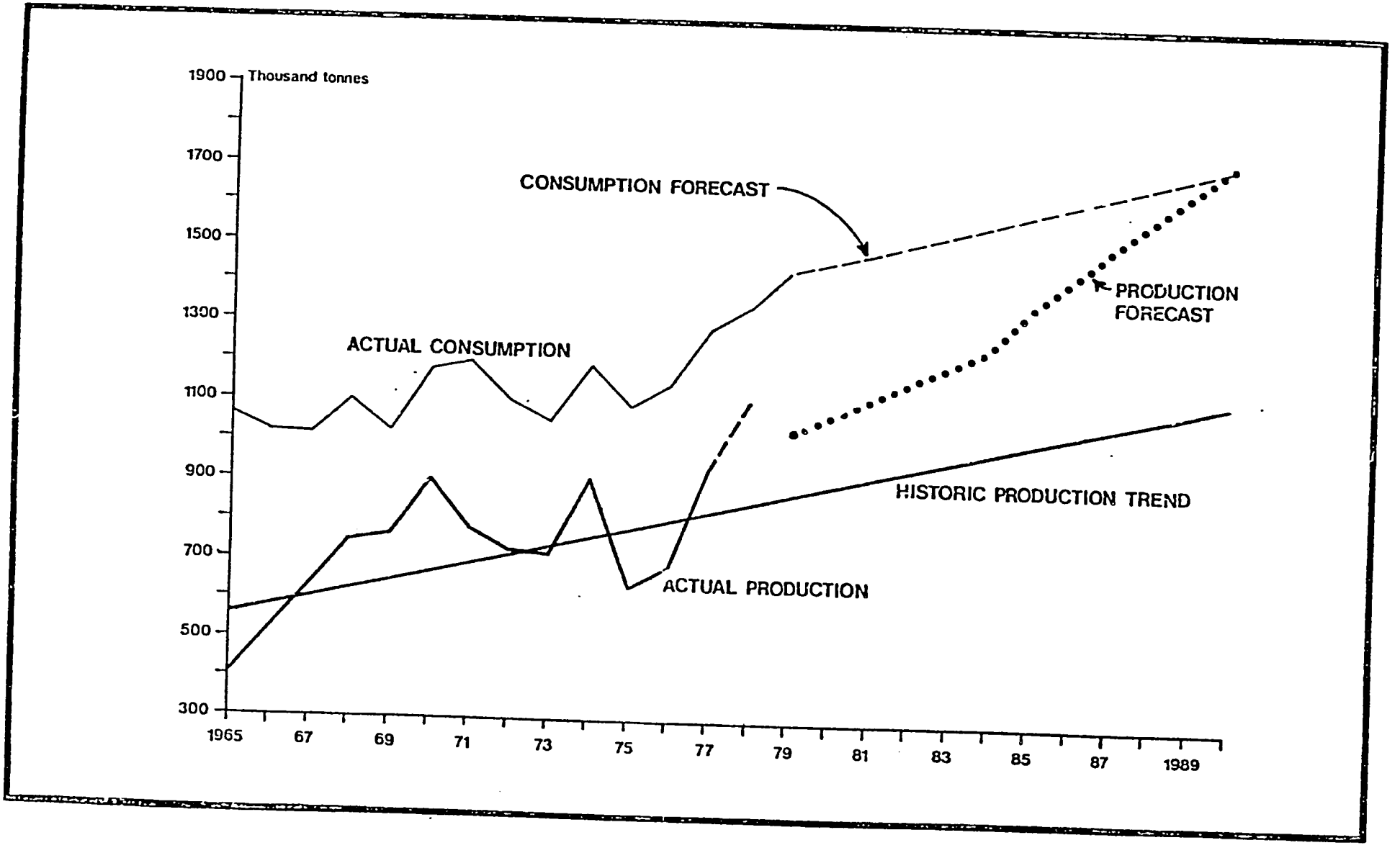
Year	Supply ('000 t) Net Domestic (1)	Supply ('000 t) Imports (2)	Apparent Consumption ('000 t) (3)	Prices (Rs/t) Domestic (4)	Prices (Rs/t) Import (5)
Actual					
1970	909	534	1 184 (95)	699	661
1971	779	339	1 197 (94)	683	555
1972	730	266	1 102 (85)	701	534
1973	723	343	1 056 (80)	1,145	1 065
1974	904	302	1 188 (89)	1,947	2 642
1975	636	459	1 089 (81)	1,976	2 100
1976	688	426	1 151 (84)	1,765	1 730
1977	939	542	1 295 (93)	1,664	1 770
1978	1 118	175	1 350 (95)	na	3 030
1979	na	na	na	na	
Projected					
1980	1 078		1 469 (100)		
1981	1 117		1 494 (100)		
1982	1 162		1 519 (100)		
1983	1 211		1 545 (100)		
1984	1 255		1 571 (100)		
1985	1 356		1 598 (100)		
1986	1 435		1 625 (100)		
1987	1 513		1 653 (100)		
1988	1 584		1 681 (100)		
1989	1 665		1 709 (100)		
1990	1 745		1 739 (100)		

Notes: Column (1) = .65 (Area x yield less seed retention at 105 kg/ha and wastage at 10 percent).

Column (3) = Columns (1) + (2) adjusted for stocks. Per Capita consumption (kg) indicated in brackets.

Source: Hunting Technical Services Ltd.(2)

RICE PRODUCTION AND CONSUMPTION WITH PROJECTIONS TO 1990



2.2 - Groundnuts

Groundnuts are not a major crop in Sri Lanka. Groundnut production and pricing during the period 1971 to 1978 are indicated in Table G-2.2. There have been no significant imports of groundnuts and virtually all domestic production has been consumed either whole or as peanut butter.

Groundnuts can be used to obtain a good quality cooking oil (45 percent) and groundnut meal (55 percent), a high protein constituent of livestock feeds. But in Sri Lanka, the oil would have difficulty competing with the traditional and widely-available coconut oilcake (poonac), as well as other oilcakes (sesame, kapok, soybean, and palm) which are already available. In short, increased production would probably have to be exported. The projected economic price for groundnuts (Annex L) has been calculated accordingly. Current groundnut prices in Sri Lanka are far below world prices. However, if an efficient export marketing organization is set up (a necessity if significant quantities are to be grown under the Mahaweli Programme), world prices would be realized.

2.3 - Soybeans

As with groundnuts, soybeans are still of minor importance to agriculture in Sri Lanka. Production and prices during 1972 to 1978 are provided in Table G-2.3.

The small quantities which have been produced over the period 1972 to 1978 have been used entirely for human consumption. The Department of Agriculture has purchased a considerable portion for the CARE programme, while small quantities have been purchased by the Oils and Fats Corporation for oil extraction. Future production would probably go to the oil extraction industry to produce both oil and meal. The high-

TABLE G-2.2

GROUNDNUTS: PRODUCTION, CONSUMPTION AND PRICES

Year	Production and Consumption (t)	Prices (Rs/t)
1971	4 936	not available
1972	5 496	not available
1973	5 715	979*
1974	7 522	2,205*
1975	7 604	2,381
1976	6 198	3,439
1977	5 791	4,123
1978	7 315	2,491

*Guaranteed price for unshelled groundnuts.

Source: Hunting Technical Services Ltd.(2)

TABLE G-2.3

SOYBEANS: PRODUCTION, CONSUMPTION AND PRICES

Year	Production and Consumption (t)	Prices (Rs/t)
1972	25	not available
1973	230	not available
1974	952	not available
1975	1 176	7,099
1976	722	8,113
1977	1 130	5,842
1978	na	5,600*

*Guaranteed price.

Source: Hunting Technical Services Ltd.(2)

quality and versatile oil can be used as either a cooking oil or as a component of numerous industrial products (paints, soaps, pharmaceuticals). The meal can be used in food preparations or as an animal feed.

Existing market conditions in Sri Lanka (particularly the traditional dominance of coconut) suggest that large increases in the production of soybeans could only find an immediate market in the international arena. Accordingly, economic price projections for soybeans are established on the basis of export parity (Annex L).

2.4 - Tobacco

There are basically three kinds of tobacco produced in Sri Lanka: sun-cured (beedi), air-cured, and flue-cured. Production of the latter two is controlled by the Department of Agriculture while the processing and marketing of all three is dominated by the Ceylon Tobacco Company (CTC).

The Ceylon Tobacco Company manufactures about two-thirds of the beedi used in Sri Lanka (some 3,765 t/yr) and nearly all the air-cured and flue-cured tobacco. CTC production and price estimates for the latter two are provided in Table G-2.4.

In general, the tobacco industry in Sri Lanka is a well-integrated production and marketing system which adequately provides for the needs of the domestic market. About 10 percent of total production is generally exported. Any large production increases would have to find additional outlets in the competitive international tobacco market. Projected farm-gate prices for additional production should therefore be established on the basis of export parity, as calculated in Annex L.

TABLE G-2.4

TOBACCO: PRODUCTION AND PRICES

Year	Air-Cured Production (t)	Air-Cured Price (Rs/kg)	Flue-Cured Production (t)	Flue-Cured Price (Rs/kg)
1970	-	-	3 164	7.08
1971	-	-	4 004	7.04
1972	-	-	3 441	6.73
1973	-	-	3 729	6.95
1974	53	6.31	3 867	8.71
1975	113	7.61	3 569	9.92
1976	559	7.41	3 914	11.77
1977	1 833	8.18	5 464	11.42

Source: Hunting Technical Services Ltd.(2)

2.5 - Cotton

Cotton production in Sri Lanka has fluctuated considerably during the last two decades, but a moderate upward trend is apparent. Yet in 1977, locally grown cotton still did not amount to over 2.5 percent of total national requirements. Comparative figures for 1970-77 are provided in Table G-2.5.

Predictably, the manufacturing sector has remained import-oriented:

Ginning capacity	1 943 tonnes (lint)
Spinning capacity	17 282 tonnes (yarn)
Textile capacity	230 million metres.

Considerable capacity exists in the spinning and textile sectors; very little capacity in the gin mills. Actual capacity utilization levels have typically been about one-half of potential utilization levels.

The garment industry expanded rapidly in the 1978 - 1979 period, particularly in the Free Trade Zone. But obviously this expansion remains heavily dependent on imported lint, yarn and textiles.

Clearly, the potential scope for import substitution by the local cotton-growing industry is very substantial. Farrington(3) concluded that

(a) With no improvement in quality, locally grown cotton could supply 18 percent of the current requirements.

(b) A quality improvement to allow spinning of 40-count yarn would allow 92 percent of requirements to be supplied by local producers.

TABLE G-2.5

COTTON: PRODUCTION AND IMPORTS (LINT EQUIVALENTS)

Year	Production[1] (t)	Imports[2] (t)
1970	204	not available
1971	214	not available
1972	172	not available
1973	120	not available
1974	262	14 222
1975	211	16 347
1976	299	9 151
1977	486	22 871

Notes:

[1]Based on 35 percent lint out-turn.
[2]Raw cotton, cotton yarn, and cotton cloth.

Source: Farrington(3)

With respect to prices, Farrington further suggested that:

"The recent expansion of cotton acreage seems to have been achieved by pricing local lint and seed cotton at some 30 percent higher than world market prices during 1976-77."(3)

This underlines the importance of relating the economic price projections for cotton to equivalent import prices as documented in Annex L.

2.6 - Sugarcane

The development of the domestic sugar industry has been similar to that of the cotton industry: sporadic and somewhat protracted. As indicated in Table G-2.6, domestic production has generally made up only a small fraction of consumer requirements. In recent years, sugar has been rationed.

Projected production estimates are based on the most current development proposals, as detailed in Annex E and illustrated on page 16. Even the most optimistic scenario (which includes jaggery production), however, suggests that Sri Lanka will still be a net importer of sugar at the turn of the century.

Accordingly, the economic price of sugar (and sugarcane) should be established on the basis of import parity. This calculation is found in Annex L.

TABLE G-2.6

SUGAR: PRODUCTION, CONSUMPTION AND PRICES

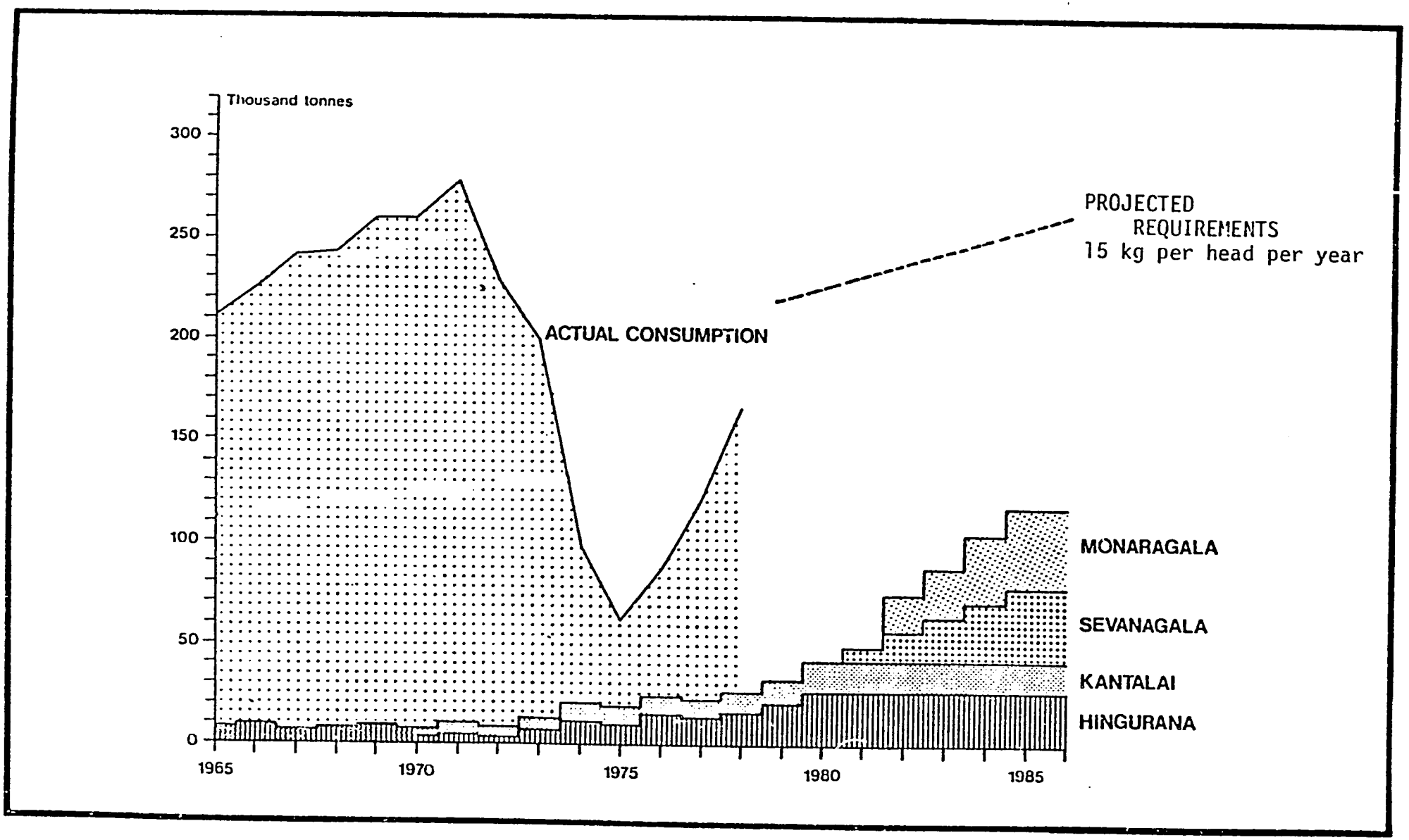
Year	Production[1] (1) ('000 t)	Imports (2) ('000 t)	Consumption[2] (3) ('000 t)	Import Price[3] (4) (Rs/t)
Actual				
1970	8.5	243.9	260.5 (20.8)	624
1971	9.4	287.4	278.1 (21.9)	832
1972	6.6	217.4	228.2 (17.6)	1,150
1973	11.9	193.0	198.3 (15.1)	1,731
1974	19.2	42.7	96.8 (7.2)	5,386
1975	18.0	62.0	59.8 (4.4)	4,323
1976	22.9	46.7	76.3 (5.6)	2,748
1977	23.3	100.1	120.4 (8.6)	1,952
1978	26.0[4]	142.2[4]	167.6[4] (11.8)	3,750
Projected				
1979	42.3		217 (15)	
1980	50.2		220 (15)	
1981	58.7		224 (15)	
1982	62.7		228 (15)	
1985	82.8		240 (15)	
1990	143.3		261 (15)	
1995	152.7		284 (15)	
2000	153.8		309 (15)	

Notes:

[1]Excludes jaggery. Estimated at 28 000 tonnes (sugar equivalent) in 1977 and projected to reach 43 000 tonnes in 1980 (FAO/IBRD).
[2]Per capita consumption estimates (kg) in brackets.
[3]Approximate "shadow" farm cane price = 4 percent of import price. Assumes yield = 9 percent; margin = 45 percent.
[4]Estimated.

Source: Hunting Technical Services Ltd.(2)

SUGAR PRODUCTION AND CONSUMPTION AND PROJECTIONS TO 1986



2.7 - Fibers

The two principal fiber crops are kenaf and sunnhemp. The most important uses of these fibres are in the manufacture of twines, ropes, sacks, and paper. Kenaf fiber is particularly attractive because it could substitute for the imported wood pulp fiber now used in local paper mills.

Present commercial production of kenaf in Sri Lanka is basically limited to operations conducted by the National Paper Corporation, generally less than 1,000 t/yr. Some 15 000 tonnes could be used for all purposes if it was readily available.

In short, the existing deficit is substantial and economic prices should therefore be established using projected import prices for equivalent fibers.

2.8 - Pulses

The principal pulses are cowpeas, green gram, and black gram. The production, consumption and price statistics for these crops during the period 1970 to 1978 are provided in Table G-2.7.

Clearly, the demand for domestic pulses appears to be very dependent on import controls (1974 to 1977). Import controls restricted supply such that prices rose sharply to stimulate local production. Producers responded.

Since comparative costs are apparently rather unfavorable vis-a-vis other countries, the economic price of pulses should be established on the basis of import parity. The

TABLE G-2.7

PULSES: PRODUCTION, CONSUMPTION AND PRICES[1]

Year	Production ('000 t)	Imports ('000 t)	Consumption[2] ('000 t)	Prices Domestic[3] (Rs/t)	Prices Import[4] (Rs/t)
1970	5.6	70.8	74.0 (5.9)	-	770
1971	4.7	30.7	34.2 (2.7)	-	1,004
1972	5.6	30.6	34.9 (2.7)	-	889
1973	8.2	10.4	17.8 (1.3)	-	1,780
1974	11.6	-	10.7 (0.8)	9,281	-
1975	28.9	-	27.2 (2.0)	10,150	-
1976	23.8	-	22.6 (1.7)	9,448	-
1977	41.7	-	37.5 (2.7)	6,289	-
1978	49.3	24.2	68.6 (4.8)	5,613	4,963

Notes:

[1]Various estimates are available. These estimates are at least indicative of general trends.

[2]Per Capita consumption (kg) in brackets.

[3]A weighted average of open market prices for cowpeas and green gram.

[4]Import prices for cooperatives.

Source: Hunting Technical Services Ltd.(2)

available data would also suggest that although there is still room for some increase in pulse production for the domestic market, the development of a large export market is highly unlikely.

2.9 - Vegetables

The various vegetables considered here are chillies, onions, and other vegetables.

Chillies

Chillies are an important crop in Sri Lanka. Estimated production, consumption and prices are summarized in Table G-2.8.

The consumption and price fluctuations which are characteristic of chillies are remarkably similar to the fluctuations typical of pulses during the same period (Section 2.8). The supply and price implications are similar. Supplies can be expanded modestly to satisfy domestic requirements; economic prices should reflect import parity.

Onions

Red onions and Bombay onions are also important crops in Sri Lanka. Red onions are produced in relatively large quantities and Bombay onions are a relatively large import item when restrictions are not imposed. The basic production, consumption and price data are summarized in Table G-2.9.

TABLE G-2.8

CHILLIES: PRODUCTION, CONSUMPTION AND PRICES

Year	Production ('000 t)	Imports ('000 t)	Consumption[1] ('000 t)	Prices Domestic (Rs/t)	Prices Import (Rs/t)
1970	32.2	13.7	45.9 (3.7)	-	1,935
1971	7.4	12.8	20.2 (1.7)	-	2,360
1972	12.1	19.8	31.9 (2.5)	-	1,236
1973	19.6	1.2	20.8 (1.6)	-	2,596
1974	17.5	-	17.5 (1.3)	25,794	-
1975	16.4	-	16.4 (1.2)	28,660	-
1976	19.1	-	19.1 (1.4)	26,477	-
1977	32.0	1.0	33.0 (2.4)	20,459	13,824
1978	29.8	8.2	38.0 (2.7)	16,535[2]	12,666

Notes:

[1]Per capita consumption (kg) in brackets.
[2]Estimate.

Source: Hunting Technical Services Ltd.(2)

TABLE G-2.9

ONIONS: PRODUCTION, CONSUMPTION AND PRICES

Year	Production[1] ('000 t)	Imports[2] ('000 t)	Consumption[3] ('000 t)	Prices	
				Domestic[4] (Rs/t)	Import[5] (Rs/t)
1970	na	65.8	89.8	-	440
1971	42.5	28.2	56.6	-	260
1972	61.0	1.0	49.6	-	218
1973	69.8	-	55.8	-	-
1974	72.2	0.5	58.2	2,115	-
1975	74.4	3.6	62.4	2,801	-
1976	44.3	na	35.5	2,717	-
1977	68.3	4.1	57.9	5,154	2,404
1978	na	31.8	na	6,732	2,611

Notes:

[1]98 percent red onions.
[2]91 percent Bombay onions.
[3]Production plus imports less 20 percent for seed and wastage.
[4]Red onions.
[5]Bombay onions.

Source: Hunting Technical Services Ltd.(2)

The production of onions has increased relatively steadily during the last decade. But, like chillies and pulses, domestic prices jumped rapidly when import restrictions were imposed. Further, prices have continued to climb far above import prices, even after some relaxation in the import controls occurred in 1978.

Again, it seems apparent that only modest increases in onion production are warranted, such that the domestic market is self-sufficient. Exports are highly unlikely. "Shadow" prices should, accordingly, be established in relation to import prices for onions.

Other Vegetables

There are no official statistics for other vegetables in Sri Lanka. They are produced mainly in small garden plots and, because of their perishability, are not generally moved long distances. Imports are nominal despite seasonal supply fluctuations in the domestic market.

As for chillies and onions, the potential for expanding production to supply the domestic market is limited. Thus projected economic prices should again be tied to the hypothetical price of imports.

2.10 - Cassava

The farmer in Sri Lanka understands cassava, and substantial quantities are consumed within the country. At the same time, this traditional market has shown very little promise because the price and income elasticities of demand for

cassava are relatively low. Indeed, it may even be an "inferior good" in that per capita consumption declines as incomes rise.

However, there may be a good market for recently developed cassava derivatives, both at home and abroad. The export potential of cassava pellets to developed countries (for livestock feed) is particularly bright. Economic price projections for cassava pellets would logically be tied to potential export markets. This is the basis for the farm-gate price calculation in Annex L.

More research is required to anticipate accurately future supply and demand conditions for cassava derivatives in Sri Lanka. Further, it is apparent that the introduction of these products into Sri Lanka would first require an initial investment in pelletizing equipment and related technology.

2.11 - Maize

Maize is a traditional crop in Sri Lanka which is generally grown as a "subsistence" rather than commercial crop. As a human food, maize serves as a limited substitute for rice and imported wheat flour. It is not used extensively as livestock feed, although small amounts are sometimes purchased by the Oils and Fats Corporation. Production, imports, and price levels during the period 1970 to 1978 are summarized in Table G-2.10.

In short, maize remains a minor crop in Sri Lanka. Domestic demand is limited and the foreign market is unknown. Because maize imports have traditionally been rather small, the economic price of maize should reflect export parity prices.

TABLE G-2.10

MAIZE: PRODUCTION, IMPORTS AND PRICES

Year	Production ('000 t)	Imports ('000 t)	Price Domestic (Rs/t)	Price Import (Rs/t)
1970	13.2	0.3[1]	-	748
1971	16.4	3.5	-	525
1972	13.8	0.4	-	467
1973	13.7	7.3	-	779
1974	23.9	4.9	-	1,461
1975	34.7	0.1	1,653	2,648
1976	31.9	5.8[2]	1,830	2,127
1977	41.8	-	1,257	-
1978	30.1[1]	-	1,433	-

Notes:

[1]Estimate.
[2]Maize flour.

Source: Hunting Technical Services Ltd.(2)

2.12 - Sorghum

Sorghum in Sri Lanka has many of the same characteristics as maize (see Section 2.11). It is produced in relatively small quantities and foreign trade in sorghum is negligible. Similarly, it can also serve as a limited substitute for rice and imported wheat flour or it can be incorporated into animal feeds. Production and price levels during the period 1970 to 1978 are indicated in Table G-2.11. Market prices are similar to maize prices. Economic prices should also be calculated on the basis of export parity.

2.13 - Fruits

The production and marketing of fruits in Sri Lanka is not highly commercialized. Foreign trade in fresh fruit is relatively unimportant. Yet a number of fruits offer considerable potential for commercial production: pineapple, bananas, mangoes, passion fruit, papaya, and citrus. Prices should be established on the basis of export.

Processed fruit products for the domestic market would seem to offer potential as well, although most existing processing facilities are presently underutilized, and some are completely idle. Development of high quality fresh fruit varieties which are less subject to seasonal fluctuations in output would also expand the existing domestic market for fruit. In such cases, fruit prices should be established on the basis of import parity.

TABLE G-2.11

SORGHUM: PRODUCTION AND PRICES

Year	Production ('000 t)	Market Prices (Rs/t)
1970	0.5	-
1971	0.5	-
1972	0.5	-
1973	1.0	-
1974	3.1	3,086
1975	6.5	2,205
1976	1.7	1,940
1977	2.2	1,257
1978	-	1,433*

*January-April.

Source: Hunting Technical Services Ltd.(2)

2.14 - Livestock Products

Details on supply and demand conditions for livestock can be found in Annex F and a more detailed study by the Tropical Products Institute.(4) Essentially the domestic market for livestock products is characterized by the following:

- relatively low per capita consumption levels for most livestock commodities, as a result of numerous cultural, social, and economic constraints

- relatively static (but fluctuating) production levels which adjust to costs of production and, to a lesser extent, to product price changes in a semicommercial ("soft") domestic market

- a relatively unsophisticated production technology in conjunction with primitive marketing facilities, the logical outcome of the above.

Very few intensive commercial operations exist. Given the above, extensive development of commercial livestock activities in the immediate years ahead would depend on the development of integrated production and marketing systems and the development of reliable export markets. Livestock expansion for the domestic market will generally rely on

- modest changes in the above conditions

- the development of new product markets

- expansion of livestock enterprises as a supplementary farm activity

- further development to satisfy draft power requirements.

In some cases, economic livestock product prices should be tied to comparable import prices (e.g. milk and milk products) while in other cases export parity prices are desirable (e.g. beef).

2.15 - Summary

A summary table of the foregoing analysis is provided in Table G-2.12. This assessment is generally consistent with other studies on the subject.*

Obviously, however, market conditions are only one component of the overall assessment. Agronomic conditions, environmental conditions, farm management considerations, existing infrastructure, and financial-economic considerations must also influence the final decision regarding the most appropriate agricultural production for the project area.

*See, for example: "Crops for the Mahaweli Scheme"(5).

TABLE G-2.12

SUMMARY OF POTENTIAL MARKET DEMAND

Commodity and Derivatives	Domestic Market	Export Market	Economic Price
Rice	Yes	Yes, in future	Import parity
Groundnuts	Limited	Yes	Export parity
Soybeans	Limited	Yes	Export parity
Tobacco	Limited	Yes	Export parity
Cotton	Yes	No	Import parity
Sugarcane	Yes	No	Import parity
Fibre	Yes	No	Import parity
Pulses	Limited	No	Import parity
Vegetables	Limited	No	Import parity
Cassava	Limited	Yes	Export parity
Maize	Limited	Possible	Export parity
Sorghum	Limited	Possible	Export parity
Fruits	Limited	Possible	Export parity
Livestock	Limited	Possible	(Product Specific)

Note: Limited - small additional quantities are required to satisfy domestic demand.

Possible - market potential exists, but other factors (e.g. perishability) will influence marketability.

3 - CROP BUDGETS

Despite their limitations, comparative crop budgets are useful in assessing the relative profitability of alternative crops at a given point in time. But they are static budgets in that no consideration is given to the time dimension which is so often critical in the farm decision-making process. In addition, they assume that input levels are directly proportional to yields. Simplified crop budgets also ignore the yield differences which can be attributed to different soils, climatic conditions, etc. Perhaps most importantly, static crop budgets implicitly assume that the specified technology is optimal, a relationship which may be defined either physically or economically. Changes in relative input prices are ignored; no input substitution is possible. This occurs because relative prices are fixed at some point in time, in this case projected prices in terms of constant 1979 prices. It should also be observed that the growing period for various crops is different. Thus, for example, a comparison of paddy (4 months) versus sugarcane (14 months) cannot be made without adjusting the figures accordingly.

With the above reservations in mind, two tables have been prepared. Table G-3.1 summarizes financial crop budgets, and Table G-3.2 summarizes economic crop budgets.

3.1 - Financial

Table G-3.1 indicates, approximately, the expected financial return for various crops. In most cases, the prices used are current prices in constant 1979 Rupees and include the various subsidies currently in existence. The net revenue

TABLE G-3.1

FINANCIAL CROP BUDGETS PER HECTARE (Rs)

Category	Paddy	Ground-nuts	Soy-beans	Pulses	Cotton	Kenaf	Tobacco	Cassava	Sugarcane Plant	Sugarcane Ratoon
(1) Gross Revenue	7,708	8,400	8,160	9,010	18,215	6,000	19,610	7,500	16,946	13,202
Yield (t)	4.1	1.5	1.6	1.7	1.4	1.5	1.0	15	74	58
Price	1,880	5,600	5,100	5,300	13,011	4,000	19,610	500	229	229
Total Cost										
Fertilizer	364	319	277	277	423	299	1 609	194	413	516
Crop protection	399	156	192	279	1 678	93	142	-	57	-
Farm power	900	600	600	400	600	400	600	280	1,420	-
Hired labor	480	320	384	-	640	384	2,400	-	960	800
Miscellaneous (seeds, bags, etc)	625	924	723	349	1 269	267	705	322	2,925	132
(2) Total	2,768	2,319	2,176	1,305	4,610	1,443	4,456	796	5,775	1,448
(3) Net Revenue	4,940	6,081	5,984	7,705	13,605	4,557	15,154	6,704	11,171	11,834

Note: In most cases, yields are averages for the different land classes for which the crops are recommended. In the case of paddy, the yield for Land Class 2R is used. For Land Class 1R, gross returns are higher. Farm power costs are reduced to reflect the availability of farmer-owned draft animals.

Basic Sources: Annex E (Crop Budgets) and
Annex L (Financial Prices).

TABLE G-3.2

ECONOMIC CROP BUDGETS PER HA (Rs)

Category	Paddy	Ground-nuts	Soy-beans	Pulses	Cotton	Kenaf	Tobacco	Cassava	Sugarcane Plant	Sugarcane Ratoon
(1) Gross Revenue	14,215	8,400	8,160	9,090	18,215	6,000	19,610	7,500	16,946	13,282
Yield (t)	4.1	1.5	1.6	1.7	1.4	1.5	1.0	15	74	58
Price	3,467	5,600	5,100	5,300	13,011	4,000	19,610	500	229	229
Cost of Production										
Fertilizer	1,281	1,028	882	882	1,336	993	1,865	615	1,376	1,717
Crop Protection	399	156	192	279	1,678	93	142	-	57	-
Farm Power	1,800	741	741	494	741	494	741	346	1,420	-
Labor	1,050	678	774	582	1,182	1,020	1,812	420	1,116	660
Miscellaneous (seeds, bags, etc)	863	1,045	836	477	1,429	410	786	413	3,037	238
(2) Total Cost	5,393	3,648	3,425	2,714	6,366	3,010	5,346	1,794	7,006	2,615
Net Revenue (1) - (2)	8,822	4,752	4,735	6,296	11,849	2,990	14,264	5,481	9,940	10,667

Note: In most cases, yields are averages for the different land classes for which the crops are recommended. In the case of paddy, the yield for Land Class 2R is used. For Land Class 1R, gross returns are higher.

Basic Sources: Annex E (Crop Budgets) and
Annex L (Economic Prices).

figures are indicative of returns under the project when expressed in constant 1979 currency. These estimates suggest that industrial crops (cotton, tobacco, and sugar) should be relatively profitable whereas paddy would be one of the least profitable crops.

3.2 - Economic

In Table G-3.2 the financial prices are adjusted to reflect more closely international supply and demand conditions under the project. All economic ("shadow") prices ignore subsidies and taxes whereas nominal labor rates are also adjusted to reflect actual (noninstitutionalized) labor conditions in the country.

The principal adjustments are as follows

	Financial	Economic
Paddy (Rs/t)	1,880	3,500
Fertilizer: (Rs/t)		
Urea	980	3,899
Triple Super Phosphate	1,335	4,145
Muriate of Potash	1,065	1,649
Sufate of Potash	1,420	3,532
Labor: (Rs/d)		
Hired	16	6
On-farm	-	6

The implications of these adjustments are important: the real (social) value of paddy is much higher than the financial net revenue (by about Rs 3,900) whereas all other net revenue estimates are somewhat lower. This is due to the fact that producer prices for paddy are about two-thirds of the current world market price.

These relative profitability estimates compare fairly closely with other recent studies which have also constructed crop budgets;[1,2] the results are obviously very sensitive to product price and product yield changes. In this context, additional refinements to the production cost estimates calculated herein would not be warranted.

In short, these estimates are only indicative of projected relative profitability levels. A farmer may not actually adopt a cropping pattern which is consistent with the above projections because of

(a) market constraints (Section 2)

(b) agronomic considerations, e.g. restrictive crop rotations

(c) farm management considerations:
- social-cultural constraints
- managerial capability
- capital constraints and credit availability
- labor constraints
- cash-flow considerations
- risk
- input availability.

A realistic composite assessment must take all these factors into account.

4 - LIVESTOCK BUDGETS

4.1 - Introduction

Numerous livestock budgets could be developed: cattle, swine, poultry, sheep, and others. Furthermore, each sub-class could be produced in a variety of ways, each of which has different budget implications.

The budget prepared below is consistent with the proposed development of multipurpose cattle in System B (see Annex F). In this development scenario, Murrah buffalo would be assigned to new settlers in the region to serve three basic purposes

(a) home consumption of milk and (perhaps) beef,

(b) draft power for crop production and (possibly) transport, and

(c) the sale of surplus stock.

Settlers would thereby be more self-sufficient, have reliable and timely farm power, and be provided with supplementary cash income to offset crop income fluctuations and generally improve their overall standard of living. The risk and uncertainty inherent in crop production and marketing would be reduced.

In the following three sections the capital cost, operating cost, and projected net revenue associated with one Murrah cow are estimated. Further details can be found in Annex F.

4.2 - Capital Costs

All capital costs are calculated on a per-cow basis after the herd buildup is complete. The mature herd would be composed as shown in Table G-4.1.

Table G-4.1 indicates that one Murrah cow will, on average, have 1.185 followers for a total of 2.185 head, and that the grazing pressure would be equal to some 1.689 cow equivalents. Based on a carrying capacity of five cow equivalents per hectare, about one-third of a hectare of improved pasture would be required for the cow and followers. Capital costs are calculated on the basis of these capacity requirements, as summarized in Table G-4.2.

The estimated financial and economic capital costs per cow differ substantially because of existing subsidies for fertilizer. For simplicity, minor price distortions have been ignored.

4.3 - Operating Costs

Annual operating costs per Murrah cow (plus followers) on 0.33 ha of improved pasture are summarized in Table G-4.3. Pasture maintenance would commence in the second year of operation.

It is once again important to distinguish between financial (farm) costs and economic (social) costs. The real cost of fertilizer (excluding subsidies) far exceeds the projected financial cost to farm settlers.

TABLE G-4.1

EQUILIBRIUM HERD COMPOSITION
FOR SINGLE COW AND FOLLOWERS

Class	Actual	Cow Equivalent Factor (CE)	Net Cow Equivalent* Factor (CE)
Cow	1.000	1.00	1.000
Bull	0.020	1.00	0.020
Calves	0.850	0.50	0.425
Weaner heifers	0.155	0.75	0.116
Weaner bulls	0.004	0.75	0.003
Replacement heifers	0.152	0.80	0.122
Replacement bulls	0.004	0.80	0.003
TOTALS	2.185		1.689

*Column (3) = Column (1) x Column (2).

TABLE G-4.2

ESTIMATED CAPITAL COSTS PER COW
FINANCIAL (ECONOMIC)
(Rs)

Item	Capital Cost
Cow at Rs 2,112/head	2,112
Bull (portion of capital cost)	24
Fences and shelter/paddock	600
Equipment (buckets/troughs)	150
Pasture establishment (0.33 ha)[1]	350 (745)
Land clearing (0.33 ha)[2]	2,277
TOTAL	Rs 5,513 (5 908)

Notes:

[1]Ploughing and planting = Rs 568/ha.
Fertilizer application = 251 kg/ha urea; 126 kg/ha superphosphate; 63 kg/ha muriate of potash. Financial and economic prices as per Annex L.

[2]Estimated at Rs 6,900/ha.

Sources: Annex F and Annex L

TABLE G-4.3

ANNUAL OPERATING COST PER COW
FINANCIAL (ECONOMIC)
(Rs)

Item	Annual Cost (Rs)	
Buildings/equipment maintenance[1]	23	
Pasture maintenance[2]	159	(550)
Disease control/incidentals	30	
TOTAL	212	(603)

Notes:

[1]Three percent of original cost.
That is, .03 x 750 = Rs 23.

[2]Annual fertilizer application. See Table G-4.2.

4.4 - Gross Revenue

Livestock revenue would be derived from three sources: milk, draft power, and the value of surplus stock.

Draft power benefits are accounted for by reducing draft power costs in the financial crop budgets (Table G-3.1). The relevant parameters employed to derive these revenue estimates are provided in Table G-4.4.

The build-up of the draft animal population on a per-cow basis would be approximately as indicated below, with the first sale of cull draft bulls in Year 14

Year 4	.367	Year 10	2.422
5	.727	11	2.741
6	1.080	12	3.054
7	1.426	13	3.360
8	1.765	14-end	3.360
9	2.097		

The economic value of each draft bull is estimated to be Rs 900/yr, calculated as follows

1 buffalo (excluding labor) costs	Rs 17.50/day
Total annual draft requirements	72 days
Unadjusted total economic value	Rs 1,260/yr
Less other farm power sources	360/yr
Net Value per Buffalo	Rs 900/yr

TABLE G-4.4

PRICES, QUANTITIES,
AND INITIAL REVENUE YEAR

Source	No.	Quantity/ Unit	Financial (Economic) Price/Unit (Rs)	Initial Revenue Year
Milk	1	858 L	2.21/L (1.31/L)	1
Draft	3.36*	-	- (900/head)	4
Surplus stock				
Weaner heifers	.227	150 kg	6.60/kg	3
Cull breeding bulls	.003	360 kg	3.30/kg	9
Cull breeding cows	.103	320 kg	3.30/kg	11
Cull draft bulls	.303	-	Rs 1,188/bull	14

*After stock build-up.

As indicated previously, no financial benefit is realized as the draft animals are assumed to be used on the farm and not hired out.

4.5 - Net Revenue

The expected net revenue for the proposed livestock activity over the project period in both financial and economic terms is calculated in Tables G-4.5 and G-4.6.

In either case, the calculations strongly suggest that the payoff to livestock would be substantial. In a financial framework, for an initial investment of (about) Rs 5,700, the annual net return would climb from about Rs 1,900 in the first year to about Rs 2,600 in the fourteenth year (this is on a per-cow basis).

The financial net return, however, will not necessarily indicate to what extent a livestock operation could improve the farmer's annual net cash flow position. If all milk is consumed by the farm family, only the income from the sale of weaner heifers and culls would actually augment cash farm income. The other would be considered as "income in kind". However the availability of milk and draft animals for farm use should make the farm a much more viable operation in the financial sense.

TABLE G-4.5

FINANCIAL LIVESTOCK BUDGET
PER COW PLUS FOLLOWERS[1]
(Rs)

Item	Year 1	2	3	4	5	6	7	8	9	10	11	12	13	14 - 40
A - Gross Revenue[2]														
Milk	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896	1,896
Weaner heifers	-	-	225	225	225	225	225	225	225	225	225	225	225	225
Cull breeding bulls	-	-	-	-	-	-	-	-	4	4	4	4	4	4
Cull breeding cows	-	-	-	-	-	-	-	-	-	-	109	109	109	109
Cull draft bulls	-	-	-	-	-	-	-	-	-	-	-	-	-	360
GROSS TOTAL REVENUE	1,896	1,896	2,121	2,121	2,121	2,121	2,121	2,121	2,125	2,125	2,234	2,234	2,234	2,594
B - Total Costs														
Capital costs[3]	5,513													
Operation and maintenance[4]	212	212	212	212	212	212	212	212	212	212	212	212	212	212
TOTAL COSTS	5,725	212	212	212	212	212	212	212	212	212	212	212	212	212
C - Net Revenue														
(A-B)	(3,829)	1,684	1,909	1,909	1,909	1,909	1,909	1,909	1,913	1,913	2,022	2,022	2,022	2,382

Notes:

[1]Actually relies on the "law of large numbers" to get fractions of animal units.
[2]Calculated from Table G-4.4, Columns (1) x (2) x (3).
[3]Table G-4.2.
[4]Table G-4.3.

TABLE G-4.6

ECONOMIC LIVESTOCK BUDGET PER COW PLUS FOLLOWERS[1]
(Rs)

Item	Year 1	2	3	4	5	6	7	8	9	10	11	12	13	14-40
A - GROSS REVENUE[2]														
Milk	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124	1,124
Weaner heifers	-	-	225	225	225	225	225	225	225	225	225	225	225	225
Cull breeding bulls	-	-	-	-	-	-	-	-	4	4	4	4	4	4
Cull breeding cows	-	-	-	-	-	-	-	-	-	-	109	109	109	109
Cull draft bulls	-	-	-	-	-	-	-	-	-	-	-	-	-	360
Draft benefit	-	-	-	330	654	972	1,283	1,589	1,887	2,180	2,467	2,749	3,024	3,024
Gross Total Revenue	1,124	1,124	1,349	1,679	2,003	2,321	2,632	2,938	3,240	3,533	3,929	4,211	4,486	4,846
B - TOTAL COSTS														
Capital Costs[3]	5,908													
Operation and Maintenance[4]	603	603	603	603	603	603	603	603	603	603	603	603	603	603
Total Costs	6,511	603	603	603	603	603	603	603	603	603	603	603	603	603
C - NET REVENUE														
(A-B)	(5,387)	521	746	1,076	1,400	1,718	2,029	2,335	2,637	2,930	3,326	3,608	3,883	4,243

Notes:

[1]Actually relies on the "law of large numbers" to get fractions of animal units.

[2]Excluding draft. Calculated from Table G-4.4, Columns (1) x (2) x (3).

[3]Table G-4.2.

[4]Table G-4.3.

5 - FARM INCOME

5.1 - Introduction

The basic objective of the proposed Maduru Oya project is to maximize settlement numbers while at the same time ensuring that they can enjoy an "adequate" standard of living. This definition invites two fundamental questions: What is "income"? And what is an "adequate standard of living"?

Various measures of farm income are defined in the illustration on the following page. For present purposes, the two most useful measures are gross value added and family income.

Secondly, an "adequate" standard of living must be defined in terms of existing income levels in Sri Lanka. Current average annual (mean) family income levels (for 5.3 persons) for the Maduru Oya region and Sri Lanka are approximately as follows[1]

Maduru Oya[2]	Rs 9,400
Sri Lanka[3]	13,780

Both estimates include income-in-kind.

The annual income objective established for the Maduru Oya project is Rs 10,000 to Rs 12,000 per family, including income-in-kind. This is approximately 80 percent of the national average and is consistent with the broad objectives of the Ministry of Mahaweli Development.[4]

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[1]For further details, see Annex L.
[2]Derived from Reference 7.
[3]Gross National Product of factor cost, projected to represent mid-1979 national income levels.
[4]As defined in a meeting between MMD and Acres, February 9, 1979.

CALCULATION OF FARM PROFITABILITY

Gross Product

(Sales + produce for human consumption on the farm + rental of dwelling ± changes in stocks)

less

Purchase of goods and services (including irrigation water)

gives

Gross value added (at market prices, i.e. received or expended by the farmer)*

less

Depreciation

gives

Net Value Added

less

Indirect taxes and taxes on capital (land tax)

gives

Farming income

less

Wages, rent, interest (real)

gives

Family income (cash + produce consumed on a farm)

less

Notional Remuneration of farmer and family workers

gives

Farm profits (return on family's own funds)**

less

Notional interest and rent (where the farm belongs to the family

gives

Net Product from Production

(rarely used)

---

* Actual receipts of expenditures at farm level.

**In industrial accounting also called profit after tax.

Source: Reference 6.

5.2 - Farm Size

Farm income is obviously dependent, to some extent, on farm size. Thus the question arises: how large should farms be if settlement numbers are to be maximized while at the same time ensuring that family incomes (including income-in-kind) reach Rs 10,000 to Rs 12,000 levels/yr?

The methodology employed to determine farm size, however, actually involves a large number of interdependent variables: type of crop, technology, social and physical intrastructure requirements, etc. An iterative procedure is therefore required. The farm sizes determined in this manner are

Irrigated lowland	1 ha	(2.5 acres)
Irrigated uplands	1.5 ha	(3.7 acres)

These areas exclude the nonirrigated 0.4-ha homestead plot which is also given to each farm family. The rationale for these farm sizes will be more apparent in the analysis conducted in this chapter. Other annexes also discuss "optimum" farm sizes using alternative criteria.*

5.3 - Annual Family Income

Projections of family income for the System B area have been prepared by considering three major income components

- net value added from crop production
- net value added from livestock production
- income from homestead plots.

*See, for example, Annex I (Settlement Planning).

Each of these income sources has a cash component and an income-in-kind component. For the sake of simplicity, miscellaneous sources of income, such as off-farm income, have not been included.

5.3.1 - Crop Production

The revenue from crop production for the Maha and Yala seasons is calculated on the basis of the following cropping patterns

Irrigated lowlands - paddy-paddy
Irrigated uplands - groundnuts-soybeans.

It should be emphasized that the groundnut-soybean rotation is selected only as a "representative" revenue-producing upland rotation. It is only a proxy for the actual rotation ultimately developed.

Lowland Paddy

Table G-3.1 indicates what net revenue 1 ha of paddy on Land Class 2R* (for a given level of technology) can be expected to generate, on average, during each cropping season

Gross Revenue (2 crops)	Rs 15,416
Less expenses (2 crops)	Rs 5,536
Net Revenue/yr	Rs 9,880

To this estimate, three adjustments are required

- calculation of home consumption requirements

*Income from paddy production on Land Class 1R would be 20 percent higher.

- reduction in the effective area due to the bunds allowance and cropping intensity

- the inclusion of credit charges.

Home consumption requirements are estimated as follows*

100 kg rice/person = 147 kg paddy
147 kg x 5.3 = 780 kg paddy/family

This is income-in-kind. Seed requirements are not deducted because seed costs are included as an annual expense.

The effective cropping area is reduced by the following amounts

Maha:	(.98) (.95) (1.0) =	0.931 ha
Yala:	(.90) (.95) (1.0) =	0.855 ha
TOTAL		1.786 ha

Credit charges are calculated from Table G-10.4 and include intermediate-term loans for cattle purchases and short-term (production) loans. The resulting calculations are indicated in Table G-5.1.

*See Section 2.1.

TABLE G-5.1

FARM INCOME PROJECTIONS
FROM CROP PRODUCTION
(Rs)

Year (Post-Settlement[1]	Lowland Paddy Farm		Upland Farm
	Cash Income[2]	Income-in-Kind[3]	Cash Income
1	3,557	1,466	6,265
2	4,440	1,466	6,796
3	5,322	1,466	7,327
4	6,204	1,466	7,860
5	7,267	1,466	8,920
6	7,267	1,466	9,451
7	7,267	1,466	9,982
8 and over	7,267	1,466	10,513

Notes:

[1]5-yr and 8-yr yield build-up periods are used for paddy and upland crops respectively.

[2]Including allowance for credit charges. For paddy farmers, this includes allowance for intermediate credit for purchase of livestock and short-term (production) credit. The upland farm incomes include only short-term credit charges.

[3]Family paddy consumption - 780 kg at Rs 1,880/tonne netted out of cash income.

Upland Crops

Table G-3.1 indicates the approximate net revenue a groundnut-soybean rotation is expected to generate on a per hectare basis. That is

	Groundnuts (Maha) (Rs)	Soybeans (Yala) (Rs)	Total (Rs)
Gross revenue	8,400	8,160	16,560
Less expenses	2,319	2,176	4,495
Net revenue/yr	6,081	5,984	12,065

To these estimates, four adjustments are made

- Adjustment for farm size, i.e. 1.5 ha

- Reduction in the effective area due to bunds and cropping intensity

- Inclusion of credit charges

- Deflating gross revenue to allow for risk.

The effective cropping area is reduced as follows:

Groundnuts (Maha): (.98) (.95) (1.5) = 1.397 ha
Soybeans (Yala): (.90) (.95) (1.5) = 1.283 ha

Credit charges include only short-term (production) loans as no intermediate-term loans are included for the upland farmer.

In addition, because of the greater risk associated with upland cropping (production and marketing), all gross revenue estimates are deflated by 25 percent. This is roughly equivalent to assuming a complete crop failure (or absence of markets) 1 year in 4.

The resulting projected net income flow is provided in Table G-5.1.

5.3.2 - Livestock Production

The revenue from livestock production also consists of two components: cash income and income-in-kind.

The revenue calculations are based on the "per-cow" financial net revenue estimates provided in Table G-4.5, subject to two adjustments

- conversion to "per lowland farm" basis; and

- adjustment of the total costs to exclude the capital costs of the cow (this is included in the credit charges for intermediate loans developed in Section 10.5).

The conversion to a per-farm basis employs the following ratio

$$\frac{\text{No. of cows}}{\text{No. of settlers}} = \frac{8\ 631}{34\ 330} = .25 \text{ (or 25 percent)}$$

Revenue from the sale of surplus stock is all considered to be cash income. The revenue from milk production is assumed to be income-in-kind although some of it may be sold in which case it would be included in cash income. The resulting

estimates are provided in Table G-5.2 and are indicative of the individual farm income from livestock production in that particular year. As only one of every four farmers will be assigned a cow, the computation of individual farm incomes implies the development of a cooperative ownership scheme (see Section 5.3.4).

5.3.3 - Homestead Production

All production on the homestead plot is assumed to be income-in-kind, although small quantities may actually be sold. To estimate the potential for homestead benefits, two approaches are used. First, the potential net income from the productive part of the homestead plot is computed using a representative Maha upland crop. This income level is compared against the need of the family for food products which can be produced on the homestead, and a net homestead benefit is then estimated as the lower of the two.

The productive portion of the 0.4-ha homestead is estimated to be 0.24 ha, which allows for 0.08 ha for buildings and 0.08 ha for livestock grazing for which a benefit has already been computed. Referring to Tables G-3.1 and G-3.2, a net return of Rs 7,500 ha can be used to reflect an average return for a homestead crop mix which could include pulses, cassava, chillies and onions. This results in a net return to the homestead of Rs 1,800/yr (Rs 7,500/ha on 0.24 ha).

To estimate the requirement (and, by inference, the potential) for income-in-kind from a 0.4-ha homestead plot to farm families (with 5.3 persons/family), five basic data sources were employed, as summarized in Table G-5.3. These estimates range from Rs 3,600/family to Rs 6,975/family. The mean

TABLE G-5.2

LOWLAND FARM INCOME FROM LIVESTOCK PRODUCTION
(Rs)

Year Post-Settlement	Cash Income	Income-in-Kind
1	(903)	474
2	(53)	474
3	3	474
4	3	474
5	3	474
6	3	474
7	3	474
8	3	474
9	4	474
10	4	474
11	31	474
12	31	474
13	31	474
14-over	121	474

Notes:

[1]Derived from Table G-4.5 and converted to a "per-farm" basis. Capital costs of the cow are excluded as they are included in the intermediate term credit requirement.
[2]Milk income is assumed to be income-in-kind.

TABLE G-5.3

ALTERNATIVE SUBSISTENCE FAMILY INCOME ESTIMATES, 1979

Data Source*	Total Annual Income (Rs)	Est. Food Expenditure (Rs)
1 - Project Area Socioeconomic Survey	6,964	4,318**
2 - World Bank Absolute Poverty Level	6,445	3,996**
3 - Nutritionally Balanced Diet	4,800	4,800
4 - Income Maximum for Food Stamps	3,600	3,600
5 - Maximum Family Budget Simulation (10/79)	8,978	6,975
Simple Average		4,738

* Data Sources:

1 - Mahaweli Development Board, Reference 7: Assumes an average family size of 5.3 persons.

2 - World Bank, Unpublished social indicators for Sri Lanka, Colombo, November 8, 1979. Converted from U.S. $76.00 per capita at Rs 16 = $1.00 and assuming an average family size of 5.3 persons.

3 - Based on a daily per capita consumption of 2,200 calories and 48 grams of protein. Medical Research Institute/UNICEF, Colombo, 1979.

4 - Government of Sri Lanka, late 1979.

5 - Acres International Limited, October 1979.

**Column (1) x 0.62. At the above level, an estimated 62 percent of the total is required for food and nonalcoholic beverages. The basic data is from Reference 8. Adjusted for inflation.

value is Rs 4,738/yr. Excluding rice, meat, milk and fish (since these projected benefits are considered under "paddy lands", "livestock" and "fisheries" respectively), the estimated value of the remaining food is equal to about

0.40* (Rs 4,738) = Rs 1,900/yr.

In addition, local sales of perhaps Rs 400/yr can be expected.* Thus food to the equivalent value of Rs 2,300 is needed by the family and/or can be sold locally.

Since the income potential from the productive portion of the homestead plot is lower than the estimated need of the family, the former figure of Rs 1,800/ha is used to calculate the homestead benefit, which is considered to be "income-in-kind".

5.3.4 - Total Family Income

Total annual income is estimated for lowland and upland settlers in Tables G-5.4 and G-5.5 respectively. These calculations are only general indicators of average real income levels for the two basic farm types considered.

In this context, however, a number of comments are in order.

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* Represents the percentage of a family food budget which can be grown on a homestead plot. Based on simulated family budgets. This is an upper limit. Other sources[9] indicate that perhaps as much as 57 percent of the value of all foods could be produced on a homestead plot.

**To put this is perspective, some settlers with a one-half acre homestead at Galnewa report a supplementary income of Rs 200 per month.

TABLE G-5.4

TOTAL FAMILY INCOME PROJECTIONS - LOWLAND PADDY FARMS*

Year (Post-Settlement)	Crop Production		Livestock		Noncash Homestead Income	Total		
	Cash	Noncash	Cash	Noncash		Cash	Noncash	Total
1	3,577	1,466	(903)	474	1,800	2,654	3,740	6,394
2	4,440	1,466	(53)	474	1,800	4,387	3,740	8,127
3	5,322	1,466	3	474	1,800	5,325	3,740	9,065
4	6,204	1,466	3	474	1,800	6,207	3,740	9,947
5	7,267	1,466	3	474	1,800	7,270	3,740	11,010
6	7,267	1,466	3	474	1,800	7,270	3,740	11,010
7	7,267	1,466	3	474	1,800	7,270	3,740	11,010
8	7,267	1,466	3	474	1,800	7,270	3,740	11,010
9	7,267	1,466	4	474	1,800	7,271	3,740	11,011
10	7,267	1,466	4	474	1,800	7,271	3,740	11,011
11	7,267	1,466	31	474	1,800	7,298	3,740	11,038
12	7,267	1,466	31	474	1,800	7,298	3,740	11,038
13	7,267	1,466	31	474	1,800	7,298	3,740	11,038
14-over	7,267	1,466	121	474	1,800	7,388	3,740	11,128

*Based on yield projections for Land Class 2R.

TABLE G-5.5

TOTAL FAMILY INCOME PROJECTIONS - UPLAND FARMS
(Rs)

Year (Post-Settlement)	Crop Production Cash Income	Homesteads Noncash Income	Total (Rs)
1	6,265	1,800	8,065
2	6,796	1,800	8,796
3	7,327	1,800	9,127
4	7,860	1,800	9,660
5	8,920	1,800	10,720
6	9,451	1,800	11,251
7	9,982	1,800	11,782
8-over	10,513	1,800	12,313

(a) At project maturity, both farm types should be able to achieve their Rs 10,000 to Rs 12,000/yr income objective. However, in the critical early years of the project, income levels will be lower and the need for supplementary income will be greater.

(b) The income composition varies substantially between lowland and upland producers. Paddy producers receive a higher percentage of their incomes as income-in-kind (rice, livestock products, and homestead produce), a desirable characteristic of small-farm agriculture.

(c) Because the risk of paddy producers is lower, a small "premium" is given to upland producers in the form of a slightly higher income level.

(d) Livestock costs are assumed to be shared equally by settlers (i.e. some form of cooperative will exist). In this context, the income figures are on an individual farm basis.

(e) Paddy farm incomes are based on projected yields for Land Class 2R. A farmer situated on 1R paddy land would have a total family income about 16 percent higher than the estimates shown here.

5.4 - Potential Water Charges

In 1972, SOGREAH proposed service charges at an average of Rs 145/acre (about Rs 700/ha in 1979 prices). These were intended to cover operation and maintenance costs of the project, and part of the depreciation on the irrigation works.

The IBRD Missions of 1976 and 1977 also proposed a "betterment charge" to cover the cost of water and land improvements. The 1976 Mission recommended Rs 120/acre (about Rs 375/ha in 1979 prices), and the 1977 Mission proposed Rs 200/farm (of 2.5 acres) i.e. about Rs 240/farm in 1979 prices.

Despite the foregoing proposals, no water charges or "betterment charges" are now being levied, even in the newly settled areas such as System H. Yet the application of a "betterment charge" remains a possibility for the settlers in the Maduru Oya project. Reference to Tables G-5.4 and G-5.5 indicate that settlers should actually be able to pay a "betterment charge" of about 10 percent of family income without endangering the financial viability of the farm unit.

Rather than impose an immediate "betterment charge" on settlers, however, it is recommended that an "ex post facto" analysis be conducted to determine if these relatively high income levels are actually being achieved at full development.

5.5 - Final Comments

(a) It is highly desirable that the paddy farmer have his own draft buffalo and be a part owner of a buffalo cow. Buffalo ownership reduces his farm production costs by 25 to 30 percent and reduces his cash food outlay considerably. The saving is about Rs 2,000/yr, which is particularly beneficial just prior to harvest when a cash squeeze is inevitable. With his own buffalo, less short-term production credit will be required and more income security will be achieved. The financial benefit from livestock production far exceeds the economic importance of livestock to the project as a whole.

(b) It is equally desirable that all farm families quickly establish a highly productive homestead. A good homestead will improve real family income by about Rs 1,800/yr, the ramifications of which are similar to those of buffalo ownership. This financial benefit also far exceeds the economic importance of homesteads to the project as a whole.

(c) Even with (a) and (b) above, the first few years may be difficult. For example, if a farmer only obtains a yield of 60 percent of that expected, (see Tables G-5.4 and G-5.5) the family disposable income will only purchase very basic necessities. This reemphasizes the need for good support services, particularly in the early years of project development.

(d) The commercial character of the entire farm operation must be appreciated. Economic interdependence with the nonfarm sectors will be established, thereby exposing the farmer to risks from factors beyond his control. Short-term production credit and other public infrastructure must be available, as must farm supplies and product markets.

(e) It might be suggested that farmers should eventually contribute to the operation and maintenance costs of the system. The issue is ultimately dependent on what farm standard of living is acceptable to policymakers.

The present analysis suggests, however, that after lowland farmers have their own farm power, all farmers have their own homestead production, and projected yields have been obtained, a water "tax" based on about 10 percent of family income would be feasible.

(f) The present price structure for paddy and inputs results in financial returns to paddy cultivation which are substantially less than their economic returns. Revision of farm-gate prices to levels indicative of world prices would provide paddy farmers with substantially higher income levels.

6 - FARM LABOR

6.1 - Introduction

Farm labor requirements must be calculated before projected farm budgets can be prepared. Total farm labor requirements are also indicative of hired labor requirements, a vital concern when hired farm labor is at a premium.

The following analysis focuses on

- total labor requirements for alternative crops
- seasonal labor requirements for specific crops
- the implications for hired labor
- labor costs.

6.2 - Total Labor Requirements

Fundamentally, labor use for a particular crop is dependent on

- the nature of the production process itself and the type of technology employed
- relative product and factor prices.

Different technologies (implying different capital-labor ratios) in different agronomic conditions with different price relationships all have unique labor requirements. The practical implications of these various situations is

illustrated in Table G-6.1, compounded by the fact that different researchers define a "man-day" in different ways.

In System B, projected labor requirements are also unique to the area, the proposed technology, and projected relative prices. These estimates are tabulated in Table G-6.2.

At the same time, it is obvious that total seasonal crop requirements disguise most of the labor problems which might be encountered by the farm family. Intraseasonal "bottlenecks" are of much more concern, as discussed in the following section.

6.3 - Intraseasonal Labor Requirements

Labor requirements within each cropping season fluctuate considerably. Labor constraints arise when the monthly labor requirement approaches the total amount of labor available from the farm family.

Monthly labor requirements for selected crops are provided in Table G-6.3.

The available family farm labor supply is calculated as follows

Available labor/farm family	2.8 man-units
Working days/month	24.0
Total available labor/month	67.2 man-days/month

TABLE G-6.1

LABOR REQUIREMENTS FOR SELECTED CROPS: VARIOUS STUDIES
(man-days/ha)

Crop (Season)	SOGREAH(10)	Ag. Econ.(11) Study #15	IBRD(12)	NEDECO(1)	Hunting(2)	JICA F/S Team(13)
Wetland paddy (M)	91*	138	151	175	205	190
Wetland paddy (Y)	91*	138	151	175	205	185
Groundnuts (Y)	82	151	89	120	138	133
Soybeans (Y)	69	148	89	132	147	135
Cowpea/grams (Y)	69	126	82	103	118	115
Sugarcane	-	-	-	144	193	200
Maize (Y)	49	146	111	145	145	148
Sorghum (Y)	49	133	111	145	145	148
Chillies (Y)	336	363	341	290	290	328
Red onions (Y)	385	356	-	360	360	328
Bombay onions (Y)	497	371	-	380	380	380
Vegetables (Y)	-	294	235	206	243	245

*130 days broadcast in mud. Other estimates based on transplanted paddy.

TABLE G-6.2

SYSTEM B LABOR
REQUIREMENTS, SELECTED CROPS
(man-days/ha)

Crop (Season)	Man-Days[1]
Wetland rice (M/Y)[2] - machine threshing	157
Wetland rice (M/Y) - buffalo threshing	173
Groundnuts (M)	113
Groundnuts (Y)	125
Soybeans (M)	117
Soybeans (Y)	129
Pulses (M)	86
Pulses (Y)	97
Cotton (Y)	197
Kenaf	170
Tobacco	302
Cassava	70
Sugarcane[3]	135

Notes:

[1]Defined as an 8-hour day.
[2]M-Maha, Y-Yala.
[3]3-yr average. First year 186 man-days.

Source: Annex E

TABLE G-6.3

INTRA-SEASONAL CROP
LABOR REQUIREMENTS
(man-days/ha)

Month	Irrigated Paddy* Lowlands 1	Lowlands 2	Floodplains 1	Floodplains 2	Irrigated Upland Groundnuts (M) - Soybeans (Y)
January	2	2	37	37	48
February	40	40	34	34	16
March	70	54	24	24	12
April	34	34	2	2	28
May	24	24	77	77	17
June	2	2	67	51	3
July	40	40	24	24	37
August	33	17	2	2	32
September	37	37	40	40	11
October	34	34	33	17	18
November	20	20	-	-	19
December	7	7	-	-	1
TOTALS	343	311	340	308	242

*1 = buffalo threshing
2 = machine threshing.

Source: Annex E

By comparing available supply with per hectare labor requirements (via Table G-6.3) the following implications are apparent.

- For lowland paddy, a bottleneck would probably arise in March unless threshing is mechanized.

- For floodplain paddy, a bottleneck may arise in May of each year irrespective of how the threshing is done.

- One hectare of soybeans-groundnuts can easily be operated by the farm family without hired labor. The upland farms of 1.5 ha would suffer a labor bottleneck in the month of January.

6.4 - Implications for Hired Labor

According to the calculations in Section 6.3, the seasonal demand for hired labor should be relatively small. However, it is still not obvious how much hired labor will ultimately be required. Four factors which contribute to this uncertainty are

- Total crop labor requirements may be underestimated. The System B estimates (Table G-6.2) are generally somewhat lower than those used by other researchers (Table G-6.1).

- Settler family size and family composition are unknown. Existing farm families in the area average 4.8 persons(7) while the average household size in Mahaweli Subsystems H4 and H5 is 5.9 persons(14). The size of the labor force/farm family in two different areas is

Polonnaruwa(15)	3.7
Subsystem H4/H5(14)	3.4

In subsystems H4 and H5, this means that 3.4/5.9 = 58 percent of the people are contributing fully to the labor force.

For this study, the number of available labor units has been developed as follows:

Man	1 x 1.0 = 1.0
Woman	1 x 0.8 = 0.8
Children	2 x 0.5 = 1.0
TOTAL	2.8*

Depending upon settler selection criteria, families may not have this much labor available.**

- Only the labor required for crop production is considered here. The proposed livestock enterprise and homestead production will also require time. The livestock enterprise, in particular, is expected to require some 60 man-days/yr, some of which cannot be delayed during peak periods in the field. To a lesser extent, this is also true of the homestead plots. In addition, no allowance is made for "downtime"--traveling to and from fields, adverse weather conditons, personal emergencies, etc.

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* See Annex I, Appendix I for survey information on productive man-work units in the Pimburettewa Scheme.

**This may well be the reason that Hunting Technical Services Ltd. assumed only 1.9 man-units of family labor would be available to settlers in System C, i.e. 45 man-days per month. See Reference 2.

- The available empirical evidence with respect to paddy also suggests that the actual use of hired labor is somewhat more extensive than the preceding calculations indicate. Some comparative estimates are instructive.(13, 14,15)

	Man-Days/ha			
	Maha 70/71	Maha 71/72	Yala 77	Maha 77/78
Family labor	75	-	72	84
Hired labor	61	64	42	35
Exchange labor	-	-	7	10
TOTALS	136	-	121	129

The implications of these data is that, even with relatively low yields, a substantial portion (perhaps one-third) of total labor is often hired. Between 70 and 80 percent of this hired labor is employed for two specific operations: land preparation and harvesting.

In short, it is probably somewhat unrealistic to suppose that the proposed family farm units for System B will not require considerable hired labor, even if 2.8 man-units/farm are provided by each farm family.* This is true irrespective of the crops produced. Thus, migrant labor probably has an important role to play in the future agricultural development of the System B area. The situation, however, is somewhat ambiguous and further research would be highly desirable.

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*Farm sizes have been established using income criteria, subject to the proviso that the number of farms be maximized within the System B area. For further details, see Section 5.

For the purpose of developing financial crop budgets for System B (see Section 3), hired labor requirements for selected crops were estimated to be the following.

Crop	Man-days/ha
Paddy	30
Groundnuts	20
Soybean	24
Pulses	0
Cotton	40
Kenaf	24
Tobacco	150
Cassava	0
Sugarcane - plant	60
- ratoon	50

6.5 - Labor Costs

Projected labor costs (1979 Rs) are estimated as follows: (Rs/d)

	Financial	Economic
Hired labor	16	6
On-farm labor	0	6

The rationale for these estimates can be found in Annex L.

7 - FARM POWER

7.1 - Introduction

The agricultural development of System B, as envisaged here, would eventually rely very heavily on buffalo power, with some supplementary power being provided by tractors. In the early years, when the cattle herd is being developed, however, the extensive use of tractors will be mandatory. The following subsections discuss

- the rationale for the proposed reliance of buffalo at project maturity
- draft buffalo requirements
- tractor requirements
- farm power costs.

7.2 - Background

Farm power is critical during two periods: land preparation and harvesting. Nationwide, for paddy cultivation, this work is apparently shared about equally between buffalo and tractors.[17]

	Percent
Tractors	42.3
Buffalo	36.2
Mamoties (hand labor)	18.1
Other	3.4
TOTAL	100.0

Other studies specific to the eastern Dry Zone indicate a greater use of buffalo. In Polonnaruwa District[15], for example, the type of farm power used in land preparation is

	Percent
Buffalo	44
Two-wheel tractor	7
Four-wheel tractor	15
Buffalo + two-wheel tractor	3
Buffalo + four-wheel tractor	29
Other	2
TOTAL	100

This also corresponds very closely to present agronomic practices in Mahaweli Subsystems H4 and H5[14].

	1st Ploughing (percent)	2nd Ploughing (percent)	Puddling/ Leveling (percent)
Buffalo	50-60	56-63	88-94
Two-wheel tractors	22-24	21-24	2-3
Four-wheel tractor	16-28	13-23	4-9

Where possible, it is a common practice for farmers to hire four-wheeled tractors for the first ploughing, then use their own buffalo for subsequent field operations. This, apparently, is what the farmers want, as suggested by a recent survey in the western Dry Zone[14].

	First Choice (percent)
Buffalo	49
Two-wheel tractors	21
Four-wheel tractors	30
TOTAL	100

Farmers prefer to use buffalo for a number of reasons; the most important of which is ownership(15).

	Percent
Own buffalo	44
Cheaper to use	8
Easily available	7
More satisfactory work	7
Boggy soil	6
Tractors not available	5
Other reasons	23
TOTAL	100

Although there are perhaps 200 000 pair of draft buffalo in Sri Lanka (3 ha/pair), the national herd is thought to be decreasing at a rate of some 2 percent/yr because of an increased demand for meat. Conversely, the supply of tractors is rapidly increasing.

	Four-wheel	Two-wheel
Estimated total, 1974	7 308	4 181
Imports, 1975-78	2 233	5 779
Total	9 541	9 960
Percent over 5 yr old	62	8
ha/tractor	3.0	

The four-wheel tractors are dominated (80 to 90 percent) by the 35- to 40-hp group whereas the two-wheel tractors generally fall in the 6- to 12-hp group. Relative costs are considered in Section 7.5 following.

It should be noted that following the demise of the subsidized government tractor hire services (1950 to 1978) and strict import controls (via the Sri Lanka State Trading (Tractor) Corporation), private imports and private custom contract hire arrangements are now quickly expanding into most regions of the country. Generally, however, private farmers cannot afford to purchase a tractor.

In summary, it is recommended that the proposed development of System B rely heavily on buffalo power, with tractor power being required during the buffalo build-up period and as supplementary power during the subsequent period. This emphasis on buffalo power is desirable for at least six reasons.

(1) Reliability - Buffalo do not have mechanical problems. Timely operations will not be delayed.

(2) Farm Self-Reliance - Farmers will not have to rely on tractor pools, the Sri Lanka State Trading (Tractor) Corporation, distant locations for repairs and service, etc.

(3) Reduced Cash Operating Expenses - A seasonal payment for farm power will not be required. Rising fuel prices could make tractor power relatively more expensive in the future.

(4) Versatility - Buffalo can operate under adverse field conditions; a tractor cannot.

(5) Enterprise Complementarity - The buffalo can be home-grown as a part of the total livestock operation whereby milk and surplus stock will also be produced.

(6) Farmer preference.

7.3 - Animal Power

Approximately one buffalo is required for each settler family, based on the time required for land preparation:*

- coverage by 1 pair, working 4 h/day = 0.1 ha/day
- time required/ha = 10 days
- days available/crop = 20 days
- area/pair = 2 ha
- area/animal = 1 ha

*There is little doubt about the validity of this calculation. See, for example, References 18 and 19.

According to the proposed livestock development program, these draft animals would be produced by the settlers themselves (Annex F). That is, selected settlers would first be provided* with a Murrah cow from which draft animals could be obtained. After the initial build-up period, 1,000 cows could sustain a herd including 3,360 draft bulls. (See Section 4.4). Thus, about 1 out of every 4 settlers would need a cow to provide each lowland paddy farm with 1 draft animal.

To provide some indication of how draft animal numbers should grow during the initial stages of project implementation, a practical example is instructive. This example employs all the technical coefficients developed in Annex F and further assumes** that there are already some 4,900 draft animals within the System B area. In addition, it is postulated that settlers will begin production in the System B lowland paddy areas (after construction) according to the following schedules which correspond to Scenarios A and B in the Main Report.

Year	Scenario A	Scenario B
1	9 020	5 540
2	11 293	5 315
3	7 954	5 669
4	6 063	5 764
5		5 194
6		5 133
7		1 715
TOTALS	34 330	34 330

* The capital cost of the cow is accounted for in the intermediate credit requirements for the lowland farmer. All other capital and operating costs are included in the livestock financial budgets.

**See Annexes A and F for information on the existing situation in the project area.

All of these 34 300 lowland settlers would have 1 ha of land and therefore require 34 300 draft animals. This is an increase of about 29 000 head above the existing population level. Hence, the number of cows needed would be 29 000/3.36 = 8,631.

Dividing these cows equally among all of the settlers, and assuming the 4,900 existing animals remain in the area with their owners, results in the build-up indicated in Table G-7.1 for Scenario A. Table G-7.2 contains a corresponding build-up for Scenario B.

The three points which should be emphasized are:

(a) The build-up is prolonged, slowly climbing to the required 34 000 animals only after 16- and 19-yr growth periods for Scenarios A and B, respectively.

(b) In light of (a), it is vitally important that

- the livestock program not be delayed

- provision for mechanical power in the interim period be adequate. (See Section 7.4 below.)

(c) The financial viability of farms during the first 15 yr will be much tenuous than at project maturity. (See Section 5.)

7.4 - Tractor Power

A program to obtain draft buffalo for lowland paddy farmers has been outlined in Section 7.3. However, a farm power shortage will occur for at least three reasons:

TABLE G-7.1

INDIGENOUS DRAFT ANIMAL NUMBERS
WITH PROJECT IMPLEMENTATION - SCENARIO A

Year (Post-Construction)	Existing Herd	Settler Group I	Settler Group II	Settler Group III	Settler Group IV	Total Draft
1	1 289	-	-	-	-	1 289
2	2 901	-	-	-	-	2 901
3	4 033	-	-	-	-	4 033
4	4 900	833	-	-	-	5 733
5	4 900	1 650	1 042	-	-	7 592
6	4 900	2 452	2 065	732	-	10 149
7	4 900	3 237	3 067	1 450	560	13 214
8	4 900	4 007	4 050	2 154	1 110	16 221
9	4 900	4 760	5 013	2 843	1 649	19 165
10	4 900	5 498	5 955	3 519	2 178	22 050
11	4 900	6 222	6 878	4 181	2 695	24 876
12	4 900	6 933	7 784	4 829	3 202	27 648
13	4 900	7 267	8 673	5 466	3 698	30 364
14	4 900	7 267	9 542	6 090	4 186	32 345
15	4 900	7 267	9 542	6 700	4 663	33 432
16-over	4 900	7 267	9 542	6 700	5 131	33 900

TABLE G-7.2

INDIGENOUS DRAFT ANIMAL NUMBERS WITH PROJECT IMPLEMENTATION - SCENARIO B

Year (Post-Construction)	Existing Herd	Settler Group I	II	III	IV	V	VI	VII	Total Draft
1	789		-	-	-	-	-	-	789
2	1 548	-	-	-	-	-	-	-	1 548
3	2 357	-	-	-	-	-	-	-	2 357
4	3 180	510	-	-	-	-	-	-	3 690
5	3 920	1 011	491	-	-	-	-	-	5 422
6	4 655	1 501	973	523	-	-	-	-	7 652
7	4 900	1 982	1 445	1 035	532	-	-	-	9 894
8	4 900	2 453	1 908	1 538	1 054	478	-	-	12 331
9	4 900	2 915	2 362	2 031	1 566	947	475	-	15 196
10	4 900	3 367	2 806	2 513	2 068	1 407	941	158	18 160
11	4 900	3 810	3 241	2 986	2 559	1 858	1 399	313	21 066
2	4 900	4 245	3 667	3 449	3 041	2 300	1 847	465	23 914
13	4 900	4 670	4 086	3 903	3 512	2 732	2 286	615	26 704
14	4 900	4 670	4 496	4 349	3 974	3 156	2 716	761	29 022
15	4 900	4 670	4 496	4 785	4 428	3 572	3 136	904	30 891
16	4 900	4 670	4 496	4 785	4 872	3 979	3 550	1 044	32 296
17	4 900	4 670	4 496	4 785	4 872	4 378	3 955	1 181	33 237
18	4 900	4 670	4 496	4 785	4 872	4 378	4 351	1 316	33 768
19-over	4 900	4 670	4 496	4 785	4 872	4 378	4 351	1 448	33 900

- The unavoidable shortage during the buffalo build-up period

- Upland tractor requirements

- Supplementary farm power requirements on all farms.

In short, during the project implementation period, tractors must be made available in the System B area.

The two kinds of possible tractor envisaged are

- Four-wheel tractors, diesel, 3-point hitch, power take-off, hydraulics, 35 to 45 hp, mud wheels, and tine tiller and trailer attachments.

- Two-wheel tractors, diesel, 8-1/2 hp, mud wheels, puddling wheels, and rotary tiller and trailer attachments.

The recommended capacity of each tractor is based on the time required for land preparation, subject to estimates of operational efficiency. This gives rise to a number of alternative estimates, as indicated in Table G-7.3.

For the purpose of this study, the estimates employed are

- Four-wheel tractor 40 ha/season
- Two-wheel tractor 10 ha/season.

Settlement rates (after construction) for both Scenarios A and B are summarized in Table G-7.4. On the basis of these settlement rates, the above capacity rates for tractors, and the availability of draft power (Tables G-7.1 and G-7.2), tractor requirements can be calculated. These are summarized

TABLE G-7.3

TRACTOR CAPACITIES/SEASON/HA

Source	Four-Wheel (35-45 hp)	Two-Wheel (8-12 hp)
Reference 19	65	16
Reference 18	40	10
Acres' studies	30	6

TABLE G-7.4

PROJECTED CUMULATIVE SETTLEMENT NUMBERS

Scenario A

Year (Post-Construction)	Lowlands		Uplands		Totals	
	Settlers	Area	Settlers	Area	Settlers	Area
1	9 020	9 020	-	-	9 020	9 020
2	20 313	20 313	-	-	20 313	20 313
3	28 267	28 267	837	1 255	29 104	29 522
4	34 330	34 330	1 000	1 500	35 330	35 830

Scenario B

Year (Post-Construction)	Lowlands		Uplands		Totals	
	Settlers	Area	Settlers	Area	Settlers	Area
1	5 540	5 540	-	-	5 540	5 540
2	10 855	10 855	-	-	10 855	10 855
3	16 524	16 524	-	-	16 524	16 524
4	22 288	22 288	-	-	22 288	22 288
5	27 482	27 482	417	625	27 899	28 107
6	32 615	32 615	837	1 255	33 452	33 870
7	34 330	34 330	1 000	1 500	35 330	35 830

in Tables G-7.5 and G-7.6 for Scenarios A and B respectively and are based on a tractor-hire service utilizing four-wheel tractors. For Scenario A the peak tractor requirement is 750 units in the fourth year of agricultural production. For Scenario B the peak requirement is 650 units in the sixth year of agricultural production. The calculation of four-wheel tractor requirements is undertaken for illustrative purposes only. The actual requirement will be dependent on the rate at which the settler organizations and cooperative groups organize and buy tractors (probably two-wheel) for their own use. The calculation does indicate the need for a tractor-hire service in the early years of project implementation, however.

The above exercise illustrates that with these purchases, national tractor imports must increase substantially. During the 4-yr period from 1975 to 1978, the total importation of four-wheel tractors and two-wheel tractors was 2,233 and 3,779 units respectively.

The tractor-hire service would require extensive infrastructure and equipment. In addition to the tractors which actually perform the land preparation work, the equipment list includes service tractors and field service equipment, trailers, harrows, ploughs, cage wheel sets, etc. Buildings are necessary for repair depots, offices, and stores. It is estimated that the cost of the additional equipment and buildings for each tractor would amount to about 2.5 times the cost of the basic 35- to 45-hp four-wheel tractor. (See Annex L for details of costs.) The development of these facilities has some obvious credit implications (Section 10).

Finally, it must be reemphasized that this mechanization proposal is in no way supplementary to accompanying proposals in other sections of this report. It is virtually <u>mandatory</u>; a prerequisite to nearly any increase in production in the

TABLE G-7.5

PROJECTED TRACTOR REQUIREMENTS
WITH PROJECT IMPLEMENTATION

Scenario A

Year (Post-Construction)	Total Area[1]	Area with[2] Buffalo Power	Area Needing[3] Tractor Power	Four-Wheel[4] Requirement	Purchases[5]
1	9 020	1 289	7 731	193	193
2	20 313	2 901	17 412	435	242
3	29 522	4 033	25 489	637	202
4	35 830	5 733	30 097	752	115
5	35 830	7 592	28 238	706	5 (average)
6	35 830	10 149	25 681	642	5 (average)
7	35 830	13 214	22 616	565	5 (average)
8	35 830	16 221	19 609	490	5 (average)
9	35 830	19 165	16 665	417	5 (average)
10	35 830	22 050	13 780	345	5 (average)
11	35 830	24 876	10 954	274	5 (average)
12	35 830	27 648	8 182	205	5 (average)
13	35 830	30 364	5 466	137	5 (average)
14	35 830	32 345	3 485	87	5 (average)
15	35 830	33 432	2 398	60	5 (average)
16-over	35 830	33 900	1 930	48	5 (average)

Notes:

[1]Table G-7.4
[2]Table G-7.1
[3]Area needing tractor power - area with buffalo power
[4]At 40 ha/tractor
[5]Assumes 10-yr life. Purchases after Year 4 are average annual over the project period.

TABLE G-7.6

PROJECTED TRACTOR REQUIREMENTS
WITH PROJECT IMPLEMENTATION

Scenario B

Year (Post-Construction)	Total Area[1]	Area with[2] Buffalo Power	Area Needing[3] Tractor Power	Four-Wheel[4] Requirement	Purchases[5]
1	5 540	789	4 751	119	119
2	10 855	1 548	9 307	233	114
3	16 524	2 357	14 167	354	121
4	22 288	3 690	18 598	465	111
5	28 107	5 422	22 685	567	102
6	33 870	7 652	26 218	655	88
7	35 830	9 894	25 936	648	5 (average)
8	35 830	12 331	23 499	587	5 (average)
9	35 830	15 196	20 634	516	5 (average)
10	35 830	18 160	17 670	442	5 (average)
11	35 830	21 066	14 764	369	5 (average)
12	35 830	23 914	11 916	298	5 (average)
13	35 830	26 704	9 126	228	5 (average)
14	35 830	29 022	6 808	170	5 (average)
15	35 830	30 891	4 939	123	5 (average)
16	35 830	32 296	3 534	88	5 (average)
17	35 830	33 237	2 593	65	5 (average)
18	35 830	33 768	2 064	52	5 (average)
19-over	35 830	33 900	1 930	48	5 (average)

Notes:

[1]Table G-7.4
[2]Table G-7.2
[3]Area needing tractor power - area with buffalo power
[4]At 40 ha/tractor
[5]Assumes 10-yr life. Purchases after Year 4 are average annual over the project period.

System B area after the irrigation facilities are in place, particularly in the early years of project implementation. It is a vital component of the proposed development "package". Failure to provide for these farm power requirements will have negative consequences for the entire project.

7.5 - Farm Power Costs

Relative farm power costs are important when making investment decisions. These costs include operating costs, as well as capital costs.

Relative capital costs, in 1979 Rs, are approximately as follows*:

Four-wheel tractor, 40 hp Three-point hitch, power take off, hydraulics	Rs 100,000 (12)
Two-wheel tractor, 10 hp, mud wheels, puddling wheels, hitch, rotary plough, trailer	28,000 (6)
Draft buffalo, bull	2,376 (10)

Current (1979) hire charges are summarized in Table G-7.7.

*Estimated life expectancy in brackets.

TABLE G-7.7

HIRE CHARGES FOR FARM POWER ALTERNATIVES[1]

Farm Power	Ha/Season	Unit	Cost/Unit
Four-wheel tractor	40	hour	Rs 75
Two-wheel tractor	10	hour	Rs 20
Draft buffalo (pair)	2	day	Rs 50[2]

Notes:

[1]Land preparation.
[2]Includes labor at approximately Rs 16/day.

Basic Sources: References 14 and 20

8 - OTHER FARM INPUTS

It has been emphasized that the agricultural technology proposed for the System B area represents an input "package". That is to say, the various inputs are not only complementary, but complementary with only limited scope for substitution. Obviously, a tractor alone cannot prepare land; a tractor and accessories are required. So too with water, fertilizer, labor, and most other capital inputs. In this section, three additional farm inputs are considered

- fertilizer and chemicals,
- farm implements, and
- small farm tools.

8.1 - Fertilizer and Chemicals

From an analysis of fertilizer demand in Sri Lanka, the three major influences appear to be

- the farmer's knowledge of the benefits of fertilizer use and of the techniques of fertilizer application

- the value-cost ratio of the additional crop yield and fertilizer cost

- the marketing and credit system for fertilizer.

One of the essential requirements of high-yielding rice varieties (HYV) is the consistent use of chemical fertilizers. Fertilizer application is one of the fastest

methods of increasing yields.[21] Yet actual fertilizer use in Sri Lanka is far below the recommended application rate, as illustrated by the following figures for the entire country:

Year	Fertilizer Use (kg/ha sown)
1970-71	43.2
1971-72	48.7
1972-73	56.6
1973-74	62.7
1974-75	26.3
1975-76	41.9

Although a large proportion of farmers use chemical fertilizers (some 75 percent), their level of usage is much lower than that recommended by the Department of Agriculture.* Part of the problem is ignorance, something that can only be overcome with a good extension service.

At the same time, farmers generally say that they do not apply more fertilizer because it doesn't pay. In this context, they not only consider the value-cost ratio, but also allow for risk (especially where water supplies are uncertain) and financial means. Thus, the farmer reacts strongly to fertilizer price fluctuations, as reflected in the following statistics.

Year	Fertilizer Price (Rs/bag)	Total Demand ('000 t)
1973-74	26.63	51.7
1974-75	94.00	18.3
1975-76	67.15	30.3

*Or, indeed, this report. Annex E (Agronomic Studies), calls for 340 kg of fertilizer/ha of paddy - about 7 times the national average.

The price elasticity of demand for fertilizer is approximately -1.0. That is to say, a 10 percent increase in fertilizer prices will reduce fertilizer use by about 10 percent, and vice versa.* The farmers' demand for fertilizers is highly sensitive to price changes, and offsetting product price changes do not generally temper this strong reactio to fertilizer price changes. This underlines the extreme importance of the existing fertilizer subsidy to farmers in Sri Lanka. Typically representing about two-thirds of the total cost of fertilizer, the current subsidies, expressed as percentages of the farmer's price, are estimated to be**

Urea	230 percent
TSP	137 percent
M/P	113 percent

One of the major reasons why the farmers' demand for fertilizer is so sensitive to price, however, also relates to the marketing and credit system for fertilizers--the third major factor affecting fertilizer demand. Without adequate credit facilities, the farmers' operating capital is limited. In most developing countries, credit sales account for 70 to 90 percent of all farm purchases.

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* The price elasticity of demand is defined as $\frac{\text{percent change in quantity}}{\text{percent change in price}}$

**Current subsidized prices compared against estimated prices without subsidies. The latter estimates are based on current world market prices.

It is proposed that the marketing of fertilizer be conducted through an integrated Multi-Purpose Cooperative Society (MPCS), as outlined in Annex E.

In summary, it is apparent that the Government must encourage the use of fertilizer in System B on three fronts: (a) agricultural extension, (b) fertilizer prices, and (c) fertilizer marketing and credit. It must be part of an integrated agricultural policy for the whole country, as illustrated by the diagram on page 97. The absence of such a policy will have a decidedly adverse affect on agricultural development in System B.

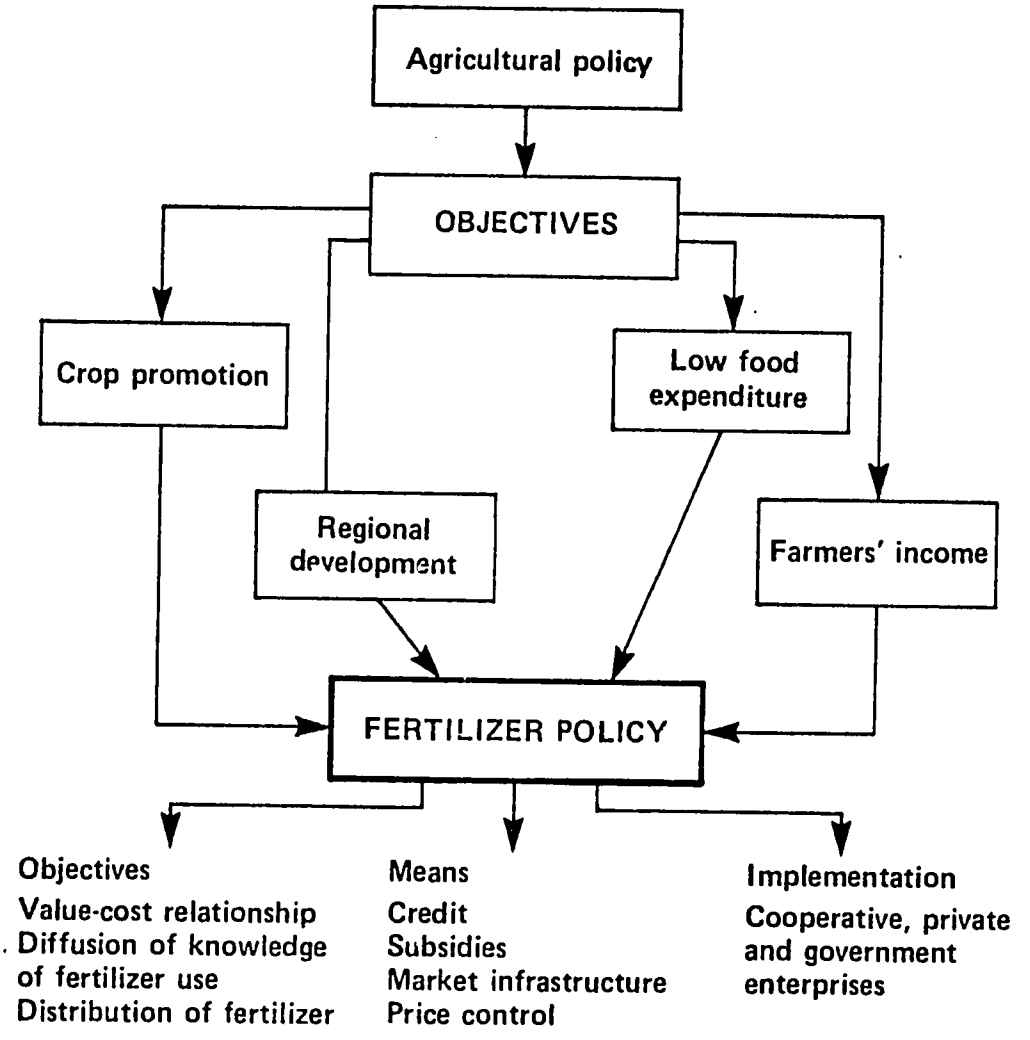
For chemicals, the situation is similar. The use of chemicals is also heavily dependent upon the farmers' agronomic knowledge of chemicals, chemical prices, and marketing and credit.

The use of various chemicals is already a common practice in Sri Lanka, but it is likely that the use of chemicals is slightly less dependent on price than in the case of fertilizers. Fundamentally, however, the situation is similar because in some situations other means of control are readily available, e.g., flooding and hand weeding.

Since fertilizer and chemicals complement each other in the entire marketing and production process, the same considerations outlined with respect to fertilizer are equally applicable to chemicals.

8.2 - Farm Implements

Numerous recommendations are included in this report which call for some farm mechanization. For example, the



Source Reference 23

associated equipment which would have to accompany the four-wheel tractors would include trailers, harrows, ploughs, and cage wheel sets (see Section 7.4).

Another example is the proposal to use mechanical threshers for paddy to eliminate anticipated labor and power "bottlenecks" during harvest, as well as to improve the quality of the grain. The capital cost of a grain thresher for use with a 10-hp tractor is about Rs 9,000. A larger thresher which can be driven by the power take-off (PTO) of a 35- to 45-hp tractor costs about Rs 27,000.

Because there will be a shortage of draft power during the early years of project implementation, it is imperative that provision be made for the supply of a threshing service for the farmers. This service could be supplied initially in conjunction with the tractor hire service discussed in Section 7.4. Based on production projections of the peak harvest month in the project area (See Section 9.2.5), it is estimated that about 460 large threshers (suitable for the power take-off of a four-wheel tractor) would be required at full development. (See Annex L for details of costs.)

Thus, project implementation must include institutional arrangements to allow for the introduction of this equipment into the project area. In addition, equipment which is required for a particular crop must be supplied on a crop-by-crop basis.

8.3 - Small Farm Tools

Small farm tools will also be required by virtually every farmer. This equipment is listed in Table G-8.1. The

TABLE G-8.1

ANNUAL INVESTMENT COSTS FOR IMPLEMENTS ON LOWLAND AND UPLAND FARMS

Implement	No. Tools/Farm		Depreciation (yr)	Price/Unit (Rs)	Investment Cost/Farm/Yr	
	Lowland	Upland			Lowland	Upland
Plough	1/2	1/2	5	150	15	15
Wooden harrow	1/2		5	40	5	
Iron harrow		1/2	8	160		10
Leveller	1/2		5	35	4	
Hoe	3	3	3	45	45	45
Weeder (paddy)	1		5	105	21	
Shovel (weeder)		1	5	40		16
Tiller		1	5	50		10
4-row seeder (hand pulled paddy)	1/10		5	60	1	
3-row seeder (upland)		1/2	8	1,000		65
Sprayer	1/5	1/5	5	900	36	36
Power sprayer	1/20	1/20	5	4,100	41	41
Sickle	3	3	3	12	12	12
Thresher (paddy)	1/10		5	9,000	180	
Processing equipment		1/10	5	5,000		100
Buckets, baskets, knives, etc	3	3	1	25	75	75
TOTAL INVESTMENT/FARM/YR					435	425

Note: For the homestead, no special investment in equipment has to be made. Maintenance is done by the farmers themselves. The operating cost of engine-powered equipment is not included.

annual cost is some Rs 430/yr. This estimate is included in the accompanying crop and farm budget estimates under the "miscellaneous" and "farm power" categories.

Once again, prices must be "fair" and supplies adequate and timely. They can be marketed through the same facilities as the fertilizers and chemicals. (See Section 8.4 following.)

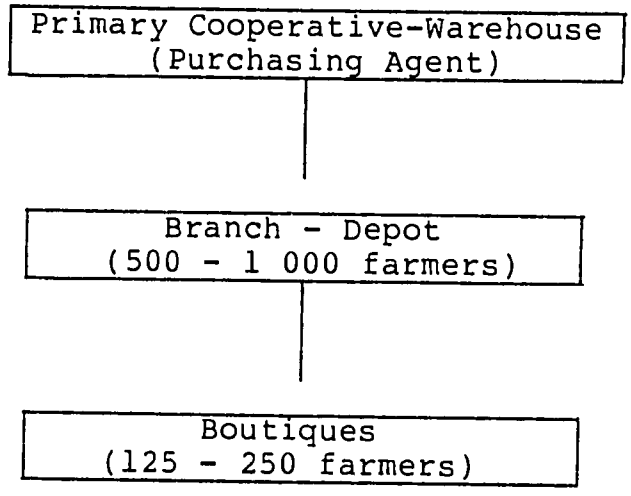
8.4 - Farm Supply Facilities

The proposed system for providing inputs to farmers is detailed in Annex E. It is outlined again here to underline operational significance.

The supply of seed, fertilizer, chemicals, and small implements would be done by the MPCS. To be effective, the MPCS would have selling points (boutiques) in every hamlet (125 to 250 farmers). In all of these boutiques, a stock of all inputs that a farmer needs at the beginning of the season would be kept. These would include fertilizers, chemicals, and common implements (hoes, sickles, weeders, etc). The MPCS would also function as a supplier of high quality seed, provided the farmer orders it in time.

Up to five boutiques would belong to each branch of the primary cooperative. One branch would coincide with a village of about 500 to 1,000 farmers. The branch would have a depot where everything is in sufficient supply to stock the boutiques. The depot would be open every day; the boutique at least once a week on a fixed day (market day). At the primary level, purchases would be made to supply the depots and boutiques. The primary MPCS would have a warehouse for storing a stock of everything that might be needed by farmers

for the next half year. There should also be sufficient transportation facilities to maintain a regular supply to the boutiques.



9 - MARKETING

9.1 - Introduction

Market functions can be classified as follows

(a) Exchange functions
- buying (assembling)
- selling

(b) Physical functions
- storage
- transportation

(c) Facilitating functions
- standardization
- financing
- risk-bearing
- market information.

Government market reform policies can usually be classified as regulatory, facilitating, or interventionist.

It is the purpose of this section to outline the market structure which already prevails for various agricultural commodities, and then assess the present operational and pricing efficiency of the marketing system in question.

The products considered here are

- paddy (rice)
- cereals, oilseeds and pulses
- vegetables
- fruits.

A discussion of the present marketing arrangements for industrial crops (tobacco, cotton, sugarcane, and fibers) and livestock can be found in Annex E and Annex F respectively.

9.2 - Paddy

The marketing of paddy and rice is of primary interest because the proposed agricultural development of System B would emphasize paddy production.

9.2.1 - Present Marketing Channels

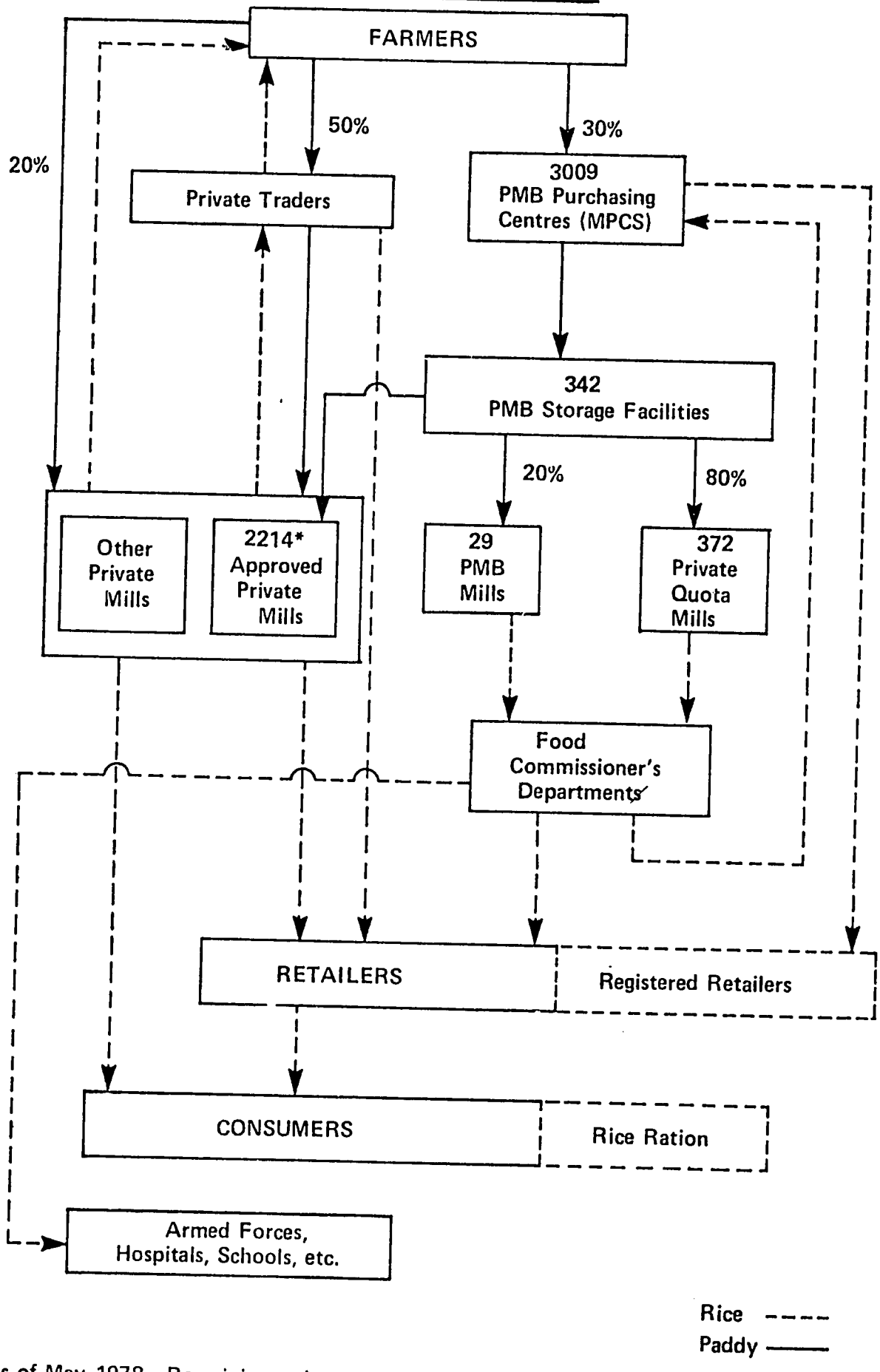
The present paddy and rice marketing system is illustrated on page 105. Farmers can either sell to the Paddy Marketing Board (PMB) at a guaranteed price, or they can sell in the open market. Depending on guaranteed price levels (relative to free market prices), the PMB generally purchases about one-third of the crop. The PMB's product share during 1970 to 1977 is calculated in Table G-9.1. In 1978, the PMB's product share reportedly increased to about 40 percent of the national market.

Paddy Marketing Board

PMB paddy is purchase by an accredited agent (Purchasing Center), normally a MPCS.* From the Purchasing Center the farmer can obtain an immediate cash payment on deliveries of up

*Includes Primary Societies (266), Pradesikas (2 887), and other authorized agents (122). All data from Reference 22.

MARKET CHANNELS FOR PADDY AND RICE IN SRI LANKA



*As of May 1978. Remaining estimates are for 1977.
Percentages represent long-term averages.

TABLE G-9.1

PADDY MARKETING BOARD
PRODUCT SHARE, 1970-77

	Total Production (1) (10^6 bushels)	PMB Purchases (2) (10^6 bushels)	PMB Percent (2)/(1) (3)
1970	77.4	26.2	39.9
1971	66.9	32.1	48.0
1972	62.9	26.4	42.0
1973	62.9	22.9	36.4
1974	76.3	20.9	27.4
1975	55.3	11.6	21.0
1976	60.1	12.9	21.5
1977	80.4	24.6	30.6

Source: Reference 22

to 15 bushels, the remainder being paid in the form of a draft on the People's Bank which involves some payment delay.

Once the paddy is purchased by the PMB agent (at the Purchasing Center) the paddy is temporarily stored at the center where there is usually storage for about 100 gunny bags of paddy. From the center, the bagged paddy is transferred to the nearest PMB storage facility where it is later allocated to either PMB mills or private quota mills. The milled rice (either raw or parboiled) is subsequently delivered to the Food Department (Commissioner) supply stations and then back to the Purchasing Centers. From the Purchasing Centers, the rice goes to registered retailers for issue to their customers in accordance with the prevailing ration regulations.

The existing PMB facilities in the eight districts* surrounding the project area include some 1 100 purchasing centers and 164 paddy storage facilities (Table G-9.2). Very few are located within the boundaries of the project area, however.

The Purchasing Centers named in Table G-9.2 (which constitute about one-third of the national total) averaged one center for every 433 tons of the 1977/78 Maha paddy harvest.** In these same eight districts, there are 164 paddy storage facilities,

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* The eight districts are indicated in Table G-9.2. The project area actually lies with Polonnaruwa (45 percent), Batticaloa (45 percent) and Amparai (10 percent). The other five districts lie within 100 km of System B.

**For 1976-77, the estimate was 391 tonnes, conditional upon a PMB market share of 50 percent of total production. See Reference 2.

TABLE G-9.2

PMB STORES AND
PURCHASING CENTERS, 1978

	Kandy	Matale	Badulla	Monaragala	Polonnaruwa	Trincomalee	Batticaloa	Amparai	Total or Average
Purchasing									
Number of centers	201	166	121	82	147	115	114	190	1 135
Average Maha harvest (1978) purchasing center (tonnes)	255	220	350	283	706	462	699	534	433
Storage									
Number of paddy stores	16	13	8	9	30	27	20	41	164
Capacity (tonnes)	17 913	10 132	5 895	8 014	33 369	29 774	16 207	42 355	163 659
Average Maha harvest/ storage capacity (1978)	2.9	3.6	7.2	2.9	3.1	1.8	4.9	2.4	3.0
Annual PMB purchases	20 450	19 384	17 501	13 159	125 068	56 006	39 828	105 700	397 096
Storage capacity percent of annual purchases)	88	52	34	61	27	53	41	40	41

each with an effective capacity of about 1 000 tonnes. This converts to approximately 1 tonne of paddy storage capacity for every 3 tonnes of Maha harvest. For the present island-wide situation, peak-season storage requirements have been estimated by the PMB to be 44 percent* of the annual procurement level, on the basis of an even distribution of milling activity throughout the year and 1 month reserve storage. As Table G-9.2 indicates, the situation was only slightly less favorable (41 percent) in the eight districts near the project area.

With respect to milling establishments in the System B area, Table G-9.3 provides a breakdown of the PMB mills and quota mills in the same eight districts. About 22 percent of total capacity is accounted for by PMB mills, with the remaining 78 percent from the quota mills. The percentage of PMB mill capacity for the eight districts is about the same as the all-island average. Little information is available regarding other private mills, both PMB approved and nonapproved.

Table G-9.3 also illustrates the breakdown between raw rice and parboiled rice mills. In general, the PMB mills have larger capacities than the quota mills. In addition, the PMB has about two-thirds of the parboiled rice capacity in the nine districts.

As one would expect, where the percentage of PMB purchases is very high, the average monthly purchase exceeds the milling capacity, implying a significant use of other "approved" private mills. But little in the way of planning guidelines

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*These PMB storage requirement guidelines are conditional on the PMB maintaining its present share of the market.

TABLE G-9.3

PADDY MILLING CAPACITY, SELECTED DISTRICTS, 1978

District	PMB Mills				Quota Mills (May 1978)				Total					
	Raw		Parboiled		Raw		Parboiled		Raw		Parboiled		Total	
	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.
Kandy	1	210	3	995	23	285	10	1 189	24	495	13	2 184	37	2 679
Matara	2	335	-	-	4	572	2	246	6	907	2	246	8	1 153
Badulla	-	-	-	-	11	1 359	-	-	11	1 359	-	-	11	1 359
Monaragala	1	300	-	-	5	648	-	-	6	948	-	-	6	948
Polonnaruwa	3	1 205	-	-	63	8 947	-	-	66	10 152	-	-	66	10 152
Trincomalee	1	170	3	1 700	11	1 702	2	161	12	1 872	5	1 861	17	3 733
Batticaloa	-	-	1	1 200	17	2 152	-	-	17	2 152	1	1 200	18	3 352
Amparai	-	-	2	200	40	4 888	2	257	40	4 888	4	457	44	5 345
TOTAL	8	2 220	9	4 095	174	20 553	16	1 853	182	22 773	25	5 948	207	28 721
Average Capacity		278		455		118		116		125		238		139

Note: All capacities expressed in Paddy Tonnage Per Month (PTM)

can be gleaned from the mill capacity statistics. The capacity of the PMB mills needed is dependent on the availability and suitability of "quota" and "approved" mills in the area. It is important to recognize that the small private mills serve a very important purpose in milling the farmers' domestic needs. However, it is likely that the PMB will play a major role in the early years of development of the proposed project.

Open Market

With respect to the paddy which is not purchased by the PMB (some 60 to 80 percent), there are two principal components. These components, which are depicted in the illustration on page 105 are

- domestic requirements for farmers

- a significant "residual" which moves directly to the private mills, then the retailers, and then the consumer.

Most of these private traders/millers are small village hullers. There are no specific features of the open market for rice which are unique to the System B area.

Foreign Market

Because the country is not yet self-sufficient in rice, it is imported both for distribution "on the ration" and for the open market. In the short run, this will also influence the project area.

9.2.2 - Operational Characteristics

The present structure, conduct, and performance of the paddy-rice market in System B can be better understood by examining how the PMB already operates in the region.

The predominant role of the PMB is apparent. Table G-9.4 indicates that in the 1978 paddy season (Maha 1977/78, Yala 1978), the PMB purchased about 50 percent of the paddy produced in the eight districts considered here. The percentage purchased ranged from a low of 24 percent in Kandy District to a high of 77 percent in Polonnaruwa District. Moreover, during the 1978 calendar year, purchases were typically concentrated in the March-June period (59 percent), a period which roughly corresponds to that of the Maha harvest. Only about 30 percent of all paddy was purchased during the Yala season.

Month	Season	Purchases - Percent of Total	
January	Maha	2.2	
February	Maha	5.3	
March	Maha	18.8	
April	Maha	19.0	Total Maha
May	Maha	13.8	= 70 percent
June	Maha	7.4	
July	Yala	3.9	
August	Yala	2.8	
September	Yala	10.7	Total Yala
October	Yala	12.9	[illegible] percent
November	Maha	2.7	
December	Maha	0.5	

TABLE G-9.4

PERCENT OF PADDY PURCHASED BY THE PADDY MARKETING BOARD, SELECTED DISTRICTS, 1978[1]

	Kandy	Matale	Badalla	Monaragala	Polonnaruwa[2]	Trincomalee	Batticaloa[2]	Amparai[2]	TOTAL
Maha harvest (acres) (gross area)	47 718	34 582	41 633	22 489	72 878	65 616	95 674	101 155	
Yala harvest (acres) (net area harvested)	32 299	10 104	15 566	4 060	48 725	25 063	19 620	63 615	
Yield (bu/ac)									
Maha	59.7	58.7	56.5	57.3	79.2	45.0	46.3	55.7	
Yala	47.5	48.2	41.8	47.6	56.9	50.0	51.7	56.3	
Maha production (tonnes) (gr area x yield x 0.85)	51 275	36 537	42 339	23 194	103 889	53 145	79 730	101 412	491 521
Yala production (tonnes) (net area x yield)	32 480	10 310	13 766	4 091	58 694	26 530	21 474	75 823	
Total annual production	83 755	46 847	56 105	27 285	162 583	79 675	101 204	177 235	734 689
PMB purchases (tonnes)									
Maha	14 721	17 312	13 445	10 261	84 796	39 179	29 601	69 686	279 001
Yala	5 729	2 072	4 056	2 898	40 272	16 827	10 227	36 014	118 095
TOTAL	20 450	19 384	17 501	13 159	125 068	56 006	39 828	105 700	397 096
PMB purchases (percent)[3]	24.4 (21.3)	41.4 (36.5)	31.2 (21.6)	48.2 (48.8)	79.6 (70.0)	70.3 (na)	39.4 (29.5)	59.6 (55.7)	54.0 (40.4)

Notes: [1]Maha 1977 - 78; Yala 1978.

[2]The immediate System B area.

[3]Comparable estimates for 1977 provided in brackets. See NEDECO.(1)

Source: Paddy Marketing Board(22)

The monthly maxima for each district are also found in the March-June period. At present, the size of purchasing centers, storage facilities, and mills are determined by the Maha season requirements, in addition to the percentage of total production which the PMB purchases in each district. Facilities must be adequate to handle PMB purchases during this period.

At the same time, there is no apparent pattern to PMB rice deliveries to the Food Commissioner's Department. For the eight districts in 1978, rice deliveries were fairly constant during the January-July period, averaging 10 to 14 percent of the total in each month of that period. By contrast, in 1977, peak deliveries of about the same magnitude as were observed in 1978 occurred during the August-December period. Seasonal delivery patterns during 1975/76 were also unique to the year in question. These patterns are illustrated on page 115. Delivery patterns are highly dependent on relative price levels (and, hence, PMB market participation), paddy production levels, and the timing of imports by the Food Commissioner's Department.

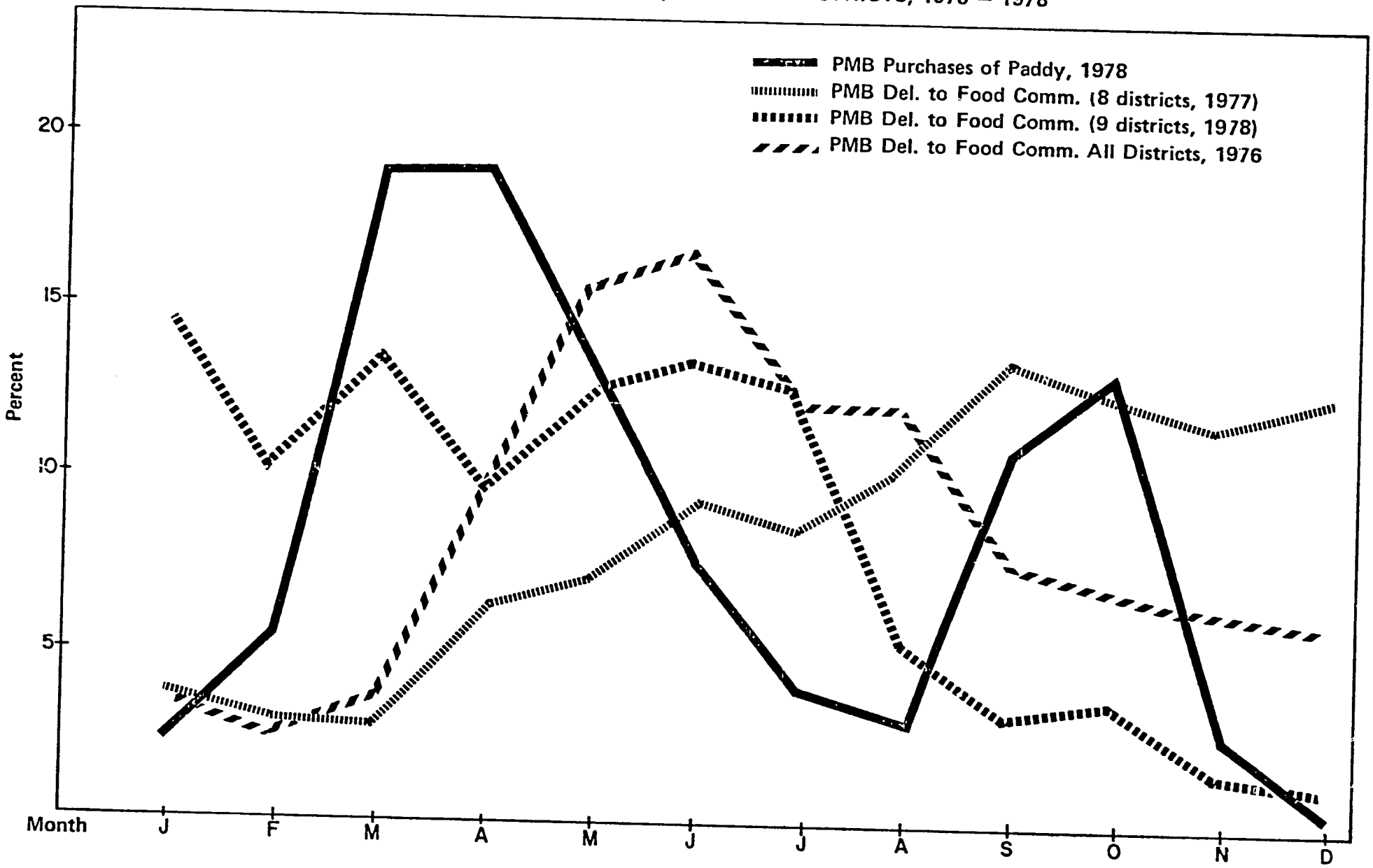
9.2.3 - Performance Criteria

Price Formation

The Guaranteed Minimum Price Scheme for paddy (administered by the PMB) serves a number of vital functions

- it reduces risk and uncertainty for farmers
- it guarantees stable and reasonable prices to consumers
- it stabilizes farm prices
- it introduces an element of competition into the rice market.

PMB SEASONAL PURCHASE AND DELIVERY PATTERNS, SELECTED DISTRICTS, 1976 – 1978



The principal difficulty is to establish a price which will ensure that the PMB maintains a 30 percent share of the market so that the twin objectives of stable and reasonable producer and consumer prices can be achieved.* Factors other than price (e.g. storage availability) also affect the PMB share, making it difficult to achieve a stable market share. This difficulty is illustrated in Table G-9.5 where similar price ratios (between PMB and open market rice) resulted in varying PMB market shares. (See 1973 vs 1975 and 1972 vs 1977.)

Moreover, because PMB payments to the farmer are made by way of a draft on the People's Bank (after the first 15 bushels), some payment delay is inevitable. Farmers prefer spot cash from private traders to avoid the cost of waiting.

Nevertheless, the existence of this alternative price (and the sales option to the farmer) is a valuable guide in the farm management and production decision-making process.

Storage and Transportation

On the supply side, storage at the farm level is required for consumption, payment of wages for farm labor, trade, and seed. Farm level storage in gunny sacks is generally unscientific and inefficient. On-farm storage should be encouraged to

- improve farmers' bargaining positions vis-a-vis seasonal price fluctuations, and

*Given the respective supply and demand elasticities, one-third of the market should be more than sufficient, based on experience with similar schemes elsewhere in the world.

TABLE G-9.5

RELATIVE PRICES AND
PMB MARKET SHARES

Year	Open Market Price/Rice* (Rs/t) (1)	Guaranteed PMB Price/Rice (Rs/t) (2)	Ratio (2)/(1)	PMB Market Share** (percent)
1972	701	980	1.4	42
1973	1 145	1 400	1.2	36
1974	1 947	2 170	1.1	27
1975	1 976	2 310	1.2	21
1976	1 765	2 310	1.3	22
1977	1 664	2 310	1.4	31
1978***	1 900	2 800	1.5	40

* Table G-2.1.
** Table G-9.1.
***Estimated.

- reduce storage requirements at other levels in the system.

Traditional village structures are recommended.

The storage situation on the demand side is also sub-optimal.(24) For the PMB, more temporary storage is required at the Purchasing Centers to avoid congestion and to ensure that delayed deliveries are not necessary. Restricting purchases to specific days (at Cooperatives) is a common complaint.(25)

The principal PMB storage facilities are also plagued by numerous inefficiencies--malfunctioning equipment, poor construction, and poor management. This is reflected in the low turnover ratios, as outlined in Section 9.2.2 above. This implies, unfortunately, a need to over-build.

Finally, the limited transportation facilities available (usually lorry, tractor-trailer, or bullock cart) also reduce the effective capacity of the marketing system. Transport from the farm-gate to the mill costs about Rs 20/tonne at present. Farm-gate transport is another important factor influencing the farmer's choice of purchaser. He often prefers to sell to private traders who assume the transport costs, which would otherwise be borne by the farmer.

Standardization and Financing

The PMB makes price adjustments for moisture content and quality, as indicated by the following allowable limits:

	Grade I (percent)	Grade II (percent)
Chaff	9	12
Foreign matter	1	2
Other varieties	10	10
Moisture content	16	16

Purchases by weight (1 bushel = 46 lb) are becoming more common, but paddy is normally purchased by volume. The private market is an important outlet for lower-quality paddy.

The availability of credit is another factor which greatly influences the way in which paddy is marketed. Institutional credit is limited and advance production credits frequently tie the farmer to a specific paddy market outlet. Further details on this subject can be found in Section 10.

Risk-Bearing and Market Information

This is a major role of the PMB in the national paddy market. The Guaranteed Minimum Price Scheme reduces farm risk, encouraging the use of more optimal production techniques. Dissemination of market information (especially price information) reduces "middleman" exploitation.

9.2.4 - Project Implications

The most apparent implication of the above evaluation is that both the PMB and the private trader should be encouraged to develop additional facilities in the System B area.

The PMB is particularly vital to assist in price formation and market information, to improve standardization (grading), and to provide storage capacity. Most important, it will serve as a countervailing power in the paddy market and assist in national supply management. At the same time, the private market performs some additional market functions

- spot payment for all paddy
- acceptance of lower quality paddy
- farm to mill transport
- auxiliary credit for rice purchases and other needs
- cheap and convenient milling services for paddy for home consumption.

The role of the PMB in the System B area should probably be somewhat greater than the national average, particularly in the early years of the project's life.

9.2.5 - Project Requirements

Notwithstanding the above discussion about the relative market shares of the PMB and the private sector in System B, it is possible that a project management authority could be made responsible for all paddy marketing in the project area. This organization would, in effect, be the owner/operator of all collection centers, drying facilities, mills, etc. For purposes of determining project requirements, it is assumed that this comprehensive organization is in effect. Thus all such facilities are assumed to be of a standard size with no reference to their ownership: i.e., private or PMB ownership. Annex L contains details of the amounts and phasing of the costs associated with them.

Project requirements for small village hullers, collection centers, milling, drying, and storage centers are discussed in this section.

Paddy Production in System B

At full development when target yields have been reached, paddy production in System B will approach 265 000 tonnes. Part of this production (27 000 tonnes) will be consumed by the paddy farm families after milling by small village hullers, and part will be handled by larger commercial facilities (238 000 tonnes). Based on harvesting schedules for the lowlands and floodplains outlined in Annex E, the monthly availability of the commercial paddy will be approximately as follows.

	Tonnes
January	11 000
February	66 000
March	33 000
April	900
May	5 400
June	13 700
July	66 000
August	36 600
September	5 400
Total	238 000

Small Village Hullers

A small village huller with a capacity of about 2 tonnes of paddy per day would be sufficient to mill the rice requirements of approximately 675 families. Thus about 47 units would be necessary to meet the requirements of the paddy farmers in System B.

Collection Centers

Because of the vast quantities of paddy that will be harvested in System B at full development, it will be necessary to provide specialized collection centers to handle peak requirements. The facilities of the MPCS will not be adequate to handle the expected harvest volumes. These collection centers would consist primarily of a building, collection bins, a scale, and a bucket elevator and would have a daily collection capacity of about 50 tonnes and a seasonal collection capacity of 2 250 tonnes. The peak seasonal requirement would be the Maha harvest on the lowlands (the harvest on the floodplains would be collected about 2 months later) and on this basis about 49 collection centers would be required.

Whenever possible, these centers would be sited adjacent to paddy milling complexes so that transport costs would be minimized.

Milling, Drying, and Storage Complexes

These complexes would consist of buildings, receiving bins, and drying, milling and storage facilities. Key parameters of these complexes are

- drying capacity of about 5 tonnes/h
- storage capacity of 2,500 tonnes
- milling capacity of 2 tonnes/h or 9 600 tonnes/yr.

Based on the milling capacity of 9 600 tonnes/yr and total paddy production of 238 000 tonnes (for commercial paddy), about 25 complexes would be required over the project area. The capacity estimates are based on a two-shift-per-day operation and it would be necessary for the mill to operate

three shifts per day for 2 to 3 months per year if storage capacity were only 2 500 tonnes.

9.3 - Cereals-Oilseeds-Pulses

The markets for cereals, oilseeds, and pulses are relatively unsophisticated. It is easy to argue that this is because the domestic demand is very small (Section 2) or, conversely, that the demand is limited because the market infrastructure is limited.

In any event, most trade in cereals, oilseeds, and pulses is done through imperfect private markets. The operational (physical) inefficiencies are considerable, and the efficiency of the pricing system (as reflected in relatively large marketing margins) is equally poor.

The PMB has been a reluctant participant in some of these markets, as indicated in Table G-9.6. Generally, PMB prices for subsidiary crops have been competitive with the open market. (See Section 2.) The real problem has been their reluctance to purchase the commodity at the designated price. Traditionally, their buying policies have been erratic, lending more (rather than less) uncertainty to the producer market for these commodities. PMB purchases have generally represented only a small fraction of the total market.

The general ineffectiveness of the PMB, however, cannot easily be traced to the PMB itself even though a "rice mentality" still prevails. Supply and demand conditions are paramount. The market, in effect, is simply too thin. PMB purchases have generally been sold to the Oils and Fats Corporation (maize and sorghum), international aid organizations (sorghum), private traders, or exported.

TABLE G-9.6

SUBSIDIARY CROPS PURCHASED BY PMB

Crop	1974	1975	1976	1977	April 1978
Maize					
Purchases (t)	4	11 776	10 704	15 172	5 755
Price (Rs/t)	2,150	1,840	1,254	1,254	1,254
Sorghum					
Purchases (t)	46	779	71	94	26
Price (Rs/t)	2,150	1,840	1,254	1,500	1,500
Soybeans					
Purchases (t)	-	-	-	-	288
Price (Rs/t)					5,600
Black Gram					
Purchases (t)	-	-	-	-	5 171
Price (Rs/t)				5,714	4,256

Source: Reference 22

These commodities probably cannot be produced on a large scale in the System B area before the market infrastructure is vastly improved. However, this investment in market infrastructure (either private of public) should be coordinated with the development of new and existing consumer markets for the products in question.

9.4 - Vegetables[26]

9.4.1 - Marketing Channels

About 80 percent of all vegetables produced in Sri Lanka are marketed through private marketing outlets. At the producer level, the alternative outlets (in descending order of importance) are the following.

(a) Assembly Agents - agents who collect the produce from the farmers for the trucker-buyers or commission agents

(b) Trucker/Buyers - retailers or wholesalers who buy through assembly agents or directly from the farmer

(c) Commissioner Agents - wholesale traders at major whole sale markets who sell on a commission basis

(d) Itinerant traders or hawkers

(e) Local periodic markets (fairs)

(f) Village boutiques.

In major urban centers (Colombo, Kandy, and Jaffna), private wholesalers and commission agents handle 90 percent of all

vegetables. The private retailers include stall holders at market centers and fairs, street vendors, and hawkers.

The remaining 20 percent of all vegetables produced in Sri Lanka go through channels which were either established or initiated by the government. The most important of these are the Cooperative Societies and the Cooperative Marketing Federation (MARKFED) which, together, handle about 15 percent of total vegetable production. The Marketing Department handles the remaining 5 percent. The fledgling Producers' Union has not yet made a national impact on the structure of vegetable marketing in Sri Lanka.*

MPCS now have nine collecting centers, and one wholesale stall. At present, therefore, they do not serve as effective marketing outlets for vegetables in Sri Lanka. MARKFED has been somewhat more successful. Acting as an apex organization for the MPCS for both agricultural production and marketing, MARKFED now operates a wholesale outlet in Colombo, three major retail stalls and a mobile consumer service. MARKFED also has a small number of collecting centers at the producer level.

The Marketing Department has cold storage facilites (1,500 tonnes), some 225 lorries for vegetable collection, as well as various retail outlets.

9.4.2 - Operational Characteristics

Despite the presence of numerous institutions in the vegetable marketing sector, the marketing of vegetables in Sri

*For more details, see Reference 26.

Lanka is still relatively inefficient. Some of these "inefficiencies" are inherent in the structure of the market itself; others can be traced to the operational characteristics of the existing institutions.

The fundamental difficulty is the presence of numerous widely dispersed small-scale producers and the inherent seasonality of production. With a perishable commodity and import constraints, this necessarily implies relatively high collection-transportation costs and seasonal price fluctuations.

At the same time, government-inspired institutional developments have achieved only modest success as countervailing agencies to the private sector trade. In the case of the Marketing Department, this is probably inevitable because of its twin commitments to assist both the consumer and the producer. The Marketing Department generally operates at a loss. With respect to the Cooperatives (including MARKFED), resource constraints discourage total vertical integration of the vegetable marketing operation.

Neither the Marketing Department nor the Cooperatives buy large volumes at the producer level. Farmers generally dislike these organizations because of allegedly lower prices, incorrect weights, complicated grading systems, delayed payment, and container losses. Consequently, marketing margins remain relatively large and large seasonal price fluctuations persist.

9.4.3 - Performance Criteria

Looking at each marketing function independently, the operational (physical) and pricing inefficiencies of the existing vegetable market in Sri Lanka become more apparent.

Price Formation

Prices are largely determined by the private trade. No existing countervailing agency has any measurable impact on prices. Prices fluctuate according to day-to-day supply and demand conditions.

Storage and Transportation

Existing storage facilities are wholly inadequate. Aside from the facilities owned by the Marketing Department, storage facilities for vegetables are virtually nonexistent. An estimated 25 percent of the consumer price is attributable to wastage.

Transportation is both difficult and relatively expensive. Most vegetable farms are not directly accessible by motor vehicle. Roadside pickup by assembly agents costs about 5 percent of the consumer price. Produce usually takes at least 1 day to reach a retail market outlet.

Standardization and Financing

Formal or informal grading, sorting, cleaning, and packing is common, but modest price incentives discourage concerted efforts to improve the quality of the existing produce.

At the same time, institutional credit for the vegetable sector has actually been declining in recent years. Private loans frequently tie the farmers to a specific market outlet, which reduces his bargaining power substantially. Institutional credit is a prerequisite for any major vegetable marketing improvements in Sri Lanka.

Risk Bearing and Market Information

Some market information filters through to producers via the radio and newspapers. However, because of the strong bargaining position of traders, the absence of alternative outlets, the perishable nature of vegetables, and the traditional socioeconomic relationship between producers and traders, this information is a weak bargaining tool. Farm prices are discounted by traders to allow for risk and uncertainty in the marketplace.

The general outcome with respect to marketing margins is predictable. On average, the consumer price for vegetables in Sri Lanka is made up of the following.

	Percent
Producer price	44
Marketing costs	
Transport and handling	18
Wastage	25
Other	13
TOTAL	100

9.4.4 - Project Implications

In the light of the above assessment, the implications for the project are readily apparent.

No major vegetable production should be established in the project area without a complementary commitment to a wholly integrated market delivery system. This system would be producer-controlled, would buy directly from the farmer, and would have adequate physical facilities at all levels of the

marketing chain. In addition, it would be closely coordinated with a workable institutional farm credit system with adequate funds for both vegetable production and marketing. Specific proposals would logically try to secure the support of MARKFED and the local MPCS.

9.5 - Fruits

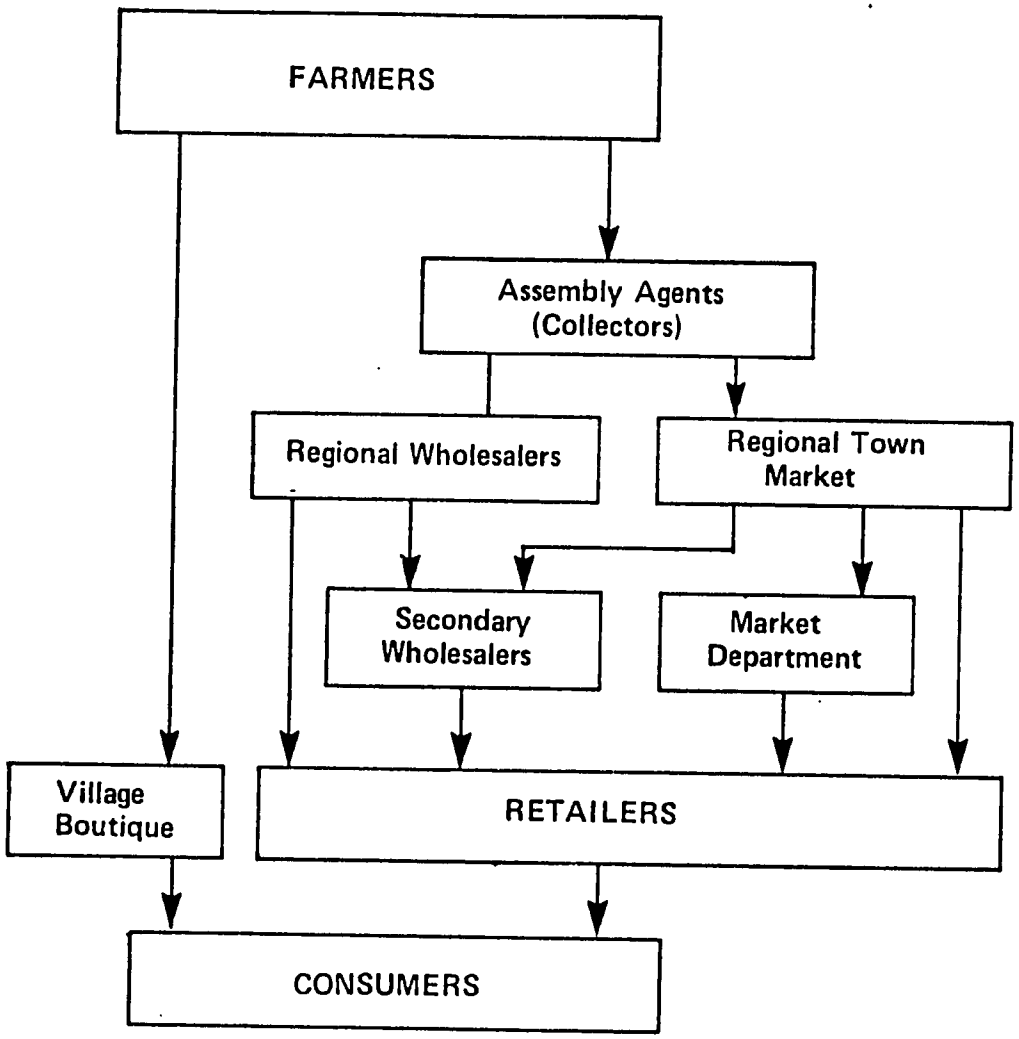
The domestic market for fruit is generally very similar to the vegetable market, as discussed in Section 9.4. Market channels for various fruits are illustrated on page 131.

As with the vegetable market, the fruit market is inefficient --perhaps more so. In this case, however, there have been even fewer efforts to either improve the existing private marketing system or develop countervailing agencies to give the farmers alternative market outlets.

Depending on the fruit (supply, demand, and perishability) gross marketing margins are generally similar to marketing margins for vegetables, i.e. about 50 percent of the consumer price. Predictably, large seasonal price fluctuations are also typical.

In general, the bargaining position of the fruit farmer is extremely weak. Whereas some alternative outlets are available to vegetable producers (private, cooperatives, MARKFED, and the Marketing Department), the fruit farmer can generally only choose between a private trader (collector) and a local boutique. Market information is also imperfect, since it is generally obtained from these same two sources.

MARKET CHANNELS FOR FRUIT, SRI LANKA, 1979



The existing market infrastructure is such that no fruit production initiatives are warranted in the project area until an efficient marketing system can be developed for the products in question. Again (like vegetable market requirements) this wholly integrated marketing system would have the following characteristics

- producer control
- direct farm purchase
- complete vertical integration between producer and consumer
- auxiliary farm services, e.g. credit.

MARKFED and the local MPCS would be best equipped to assist in this area.* Cooperative price pooling should also be considered.

*Along these lines, one pilot project for banana production and marketing is already operating at Didula. Here MARKFED has entered into an agreement with a group of farmers to supply banana suckers, fertilizer, and agricultural implements with interest-free credit, with the proviso that the farmers sell all their produce to MARKFED. For further details see Reference 27.

10 - CREDIT

10.1 - Introduction

Agricultural credit is a prerequisite for successful non-subsistence agriculture. The technology of commercial agriculture is such that more capital is required and farm cash flow requirements increase. Integration (backward and forward linkages) with other sectors of the economy becomes more complete; more transactions which require money are inevitable. This is especially true in a region (such as the project area) where very little physical capital is already in place.

The assessment below focuses on unique structural characteristics of the existing rural credit system in Sri Lanka, implications for the project and projected capital requirements for farmers in the project area.

10.2 - Background

Existing institutional credit to the agricultural sector flows through three principal channels

(a) People's Bank to MPCS and Cooperative members,

(b) People's Bank to MPCS Rural Bank branches and Cooperative members, and

(c) Bank of Ceylon to farmers through Agricultural Service Centre suboffices. The People's Bank and the Bank of Ceylon are both state-owned commercial banks.

Typically, crop cultivation loans account for some 80 percent of total institutional credit to the agricultural sector. Up to two-thirds of all credit goes to paddy producers. Most of the remainder goes to subsidiary crops, with very small amounts going to livestock enterprises. Other important credit items include housing, electrification and wells.

Nevertheless, despite repeated efforts to improve the rural credit system in Sri Lanka, four problems continue to plague the banks

- low-level penetration
- defaults
- misuse of loans by borrowers
- misuse of loan repayments by the MPCS.

The "penetration problem" has two components: the first is one of limited total penetration; the second relates to the potential borrowers who are actually reached. Total penetration is limited, amounting to perhaps 25 percent of total rural credit. This is suggested by the survey data in Table G-10.1. According to these statistics, compiled in 1969, about one-half of all rural credit still came from friends and relatives, and professional money lenders. Thus, although the role of institutional credit is increasing with the passage of time, it is obvious that it is still very small. In addition, the institutional credit which is actually disbursed generally reaches only the higher-income farmers. It trickles down through a status/class hierarchy, and very little reaches the lower income classes.

TABLE G-10.1

SOURCES OF RURAL CREDIT, 1967 and 1969

Source	1967 (percent)	1969 (percent)
Institutional		
Government	2.6	6.9
Commercial banks	1.1	9.2
Cooperatives	4.1	2.7
Subtotal	7.8	18.8
Noninstitutional		
Friends and relatives	44.2	25.4
Professional money lenders	15.5	24.0
Boutiques/trade credit	11.5	4.3
Landlords	8.0	0.5
Other	13.0	27.0
GRAND TOTALS	100.0	100.0

Source: Reference 28.

The "default problem" is a second major concern. This is an old problem which, on occasion, has reached chronic proportions and actually threatened the very foundation of the rural credit system in Sri Lanka. Table G-10.2 is illustrative.

A number of surveys have been conducted to determine why the default rate is so high and numerous reasons have been suggested. A typical list,(28) the overall validity of which has been reconfirmed in other surveys, is as follows.

Reason for Default	Percentage
Crop failure	66
Lack of extension work	7
Investing in other activities	8
Considered loans to be Government aid	6
Other high-priority debts	7
Other reasons	6
TOTAL	100

In an irrigation scheme with a reliable water supply, the loan recovery rate should be higher than the national figures given in Table G-10.2, due to a reduced incidence of crop failures. Any successful credit program must, however, address the other causes of defaults to increase the recovery rate to a satisfactory level.

TABLE G-10.2

SMALL FARMER LOANS
AND RECOVERIES, 1947 TO 1976

Period	Loans Granted (Rs x 10^6)	Recoveries (Rs x 10^6)	Rate of Recovery (percent)
Paddy Loans			
1947/48-1952/53	45.56	27.23	59.8
1953/54-1962/63	147.53	141.01	95.6
1963/64-1966/67	122.59	68.87	56.2
1967/68-1969/70	180.09	127.96	71.0
1970/71-1976/77	444.18	223.20	50.2
Subtotal	939.95	588.27	62.6
Other Food Crops			
1967-1970	19.47	15.43	79.2
1971-1977	132.76	63.64	47.9
Subtotal	152.23	79.07	51.9

Source: Reference 29.

10.3 - Interest Rates

Crop loans under the new Agricultural Credit and Comprehensive Rural Credit Scheme, which form the bulk of rural credit, carry an interest rate of 9 percent for the farmers and are available for paddy and 17 other field crops. Loans are repayable within 30 days of the harvest. Personal security (2 members in the case of Cooperatives and personal guarantee in the case of direct loans) is accepted. The Central Bank provides a guarantee of 75 percent on defaults and extends refinancing facilities at a service charge of 1.5 percent. Another 0.5 percent is charged as the guarantee fee. The Bank of Ceylon thus enjoys an interest spread of 7 percent, whereas the People's Bank charges 5 percent interest from cooperatives if loans are repaid in time or 8 percent if repayment is delayed, leaving an interest spread of 3 percent. The Cooperatives enjoy an interest spread of 4 percent on these loans.

Outside the Cultivation Loans, higher interest rates and strict standards of security are applied. The Bank of Ceylon, for example, charges interest at the rate of 10 percent under the IDA Dairy Development Loans, 14.5 percent for dairy and poultry farming, 13 to 16.5 percent for the purchase of agricultural machinery and equipment, tractors, pumps, sprayers, etc. Similarly, the People's Bank charges an interest rate of 14 percent on agri-business and short-term crop loans.

Details on the terms of loans are given in Appendices I and II.

10.4 - Project Implications

A rural credit program for System B will undoubtedly be part of the prevailing national scheme. Nevertheless, it is still useful to outline some of the principal elements of a successful program

(a) All settlers must be credit-worthy and willing to accept institutional credit. To reduce the bureaucratic "red-tape" associated with loan applications, agro-identity cards should be issued and loan procedures should be simplified.*

(b) To ensure repayment levels, a number of principles should be followed

(i) Credit allocation on the basis of the farmers' repayment capacity;

(ii) Clarification of government policy to emphasize that credit is not a grant;

(iii) Proper field supervision;

(iv) Proper audit and inspection;

(v) Systematic and vigorous recovery questions.

*For more details, see Reference 29.

Perhaps most important is the need to strengthen the "banker-client" relationship. Field staff must visit the farmer to determine accurately his credit needs and repayment capacity. This would logically be achieved by further reinforcing the People's Bank-MPCS-extension system.

10.5 - Credit Requirements

There are a number of reasons for believing that the farm credit requirements in System B will exceed the "typical" loan now provided to farmers in other parts of Sri Lanka. Firstly, most settlers will not have much capital prior to their arrival in the project area. Secondly, most will not have a nearby informal credit network (friends and relatives) on which they can rely. And thirdly, the proposed farm technology assumes a higher capital input than the national average. Thus, substantial institutional credit will be virtually mandatory.

To provide a general indication of credit requirements in System B, approximate estimates are provided in Table G-10.3 (for Scenario A). Included are intermediate credit requirements which are for buffalo cow purchases and short-term production credit requirements. The latter are calculated at Rs 1,000/lowland farm/season and Rs 1,200/upland farm/season. Intermediate credit requirements could be substantially higher if farmers decide to purchase tractors for their own use and/or for hire.

TABLE G-10.3

INTERMEDIATE AND SHORT-TERM FARM CREDIT REQUIREMENTS IN SYSTEM B[1]
(million Rs)

Year (Post-Construction)	Intermediate[2]	Short-Term Production[3]
1 (1984)	4.8	9.0
2 (1985)	6.0	20.3
3 (1986)	4.2	29.3
4 (1987)	3.2	35.3
5-over	-	35.3

Notes:

[1]The staging of the credit requirements is based on Scenario A.

[2]Cow = Rs 2,112, costing Rs 180/farmer/yr.

[3]Lowland farm = Rs 1,000/crop, costing Rs 90/yr.
Upland farm = Rs 1,200/crop, costing Rs 108/yr.

The above calculations indicate the large size of the total credit requirements for System B. To put them in perspective, total institutional loans to the rural sector of Sri Lanka in 1976 totaled Rs 162 million. Clearly, a considerable amount of advance planning will be required to make possible the effective administration of this large a credit program.

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APPENDIX I

TERMS OF LOANS FOR DIFFERENT TYPES OF RURAL CREDIT - BANK OF CEYLON

APPENDIX I

TERMS OF LOANS FOR DIFFERENT TYPES OF RURAL CREDIT - BANK OF CEYLON

Types of Loans	Repayment Period	Grace Period	Repayment Installment	Interest Rate	Security Required	Maximum Amount Per Loan
Short-term Crops						
Paddy & other subsidiary food crops as per list attached	Seasonal settlement in full at end of season	-	-	· %	Granted under comprehensive rural Credit Scheme. Govt. Guarantee of 75% and Central Bank refinance.	As per annexture
Consumption						
Social functions Debt. Redemption household requirements	36-60 months	-	monthly	17.5%	Personal Guarantee of third parties, fixed deposits surrender value of life insurance policies.	Depending on the repayment capacity of the borrower
Agro-business						
Animal husbandry IDA Dairy Development Scheme	36-84 months	one year	monthly	10%	Under IDA Project Oriented lending	Depending on generated income & 90% of total cost of Project
Dairy farming	36-60 months	3 months	monthly	14.5%	Personal Guarantee of third parties, fixed deposits surrender value of life insurance policies.	Depending on borrowers repayment capacity
Poultry farming	36 months	6 months	monthly	14.5%	Personal Guarantee of third parties, fixed deposits surrender value of life insurance policies.	Depending on borrowers repayment capacity

APPENDIX II

TERMS OF LOANS FOR DIFFERNET TYPES OF RURAL CREDIT - PEOPLE'S BANK

APPENDIX II (page 1 of 5)

TERMS OF LOANS FOR DIFFERENT TYPES OF RURAL CREDIT - PEOPLE'S BANK

BANK'S DIRECT LENDINGS

Types of Loans	Repayment Period	Grace Period	Repayment Installment	Interest Rate	Security Required	Maximum Amount Per Loan
CONSUMPTION						
1. Any purpose	36 months	-	-	18%	a) Securities acceptable to the Bank.	
					b) Guarantee of 2 ISA holders of equal or higher income who have contributed for minimum of 6 months.	Rs. 500/-
2. Any purpose	24 months	-	-	18%	Securities acceptable to Bank. Person who has borrowed previously from Bank and repaid such sum satisfactorily may submit same securities.	Rs. 1000/-
3. Any purpose	36 months	-	-	18%	a) Guarantee of ISA holders who have contributed for at least one year.	Rs. 1000/-
					b) Securities acceptable to the Bank.	
4. Any purpose	36 months	-	-	18%	a) Securities acceptable to the Bank OR	
					b) Two ISA holders who have contributed for at least 1 1/2 years.	Rs. 2000/-
5. Purchase of land	36 months or 60 months (Mortgage of property)	-	-	18%	Securities acceptable to the Bank.	Rs. 5000/-
6. House repairs	36 months or 60 months (Mortgage of property)	-	-	16%	Securities acceptable to the Bank	Rs. 5000/-
7. Redemption of mortgages & conditional transfers	60 months	-	-	16%	Mortgage of property to be redeemed or other property. Not to exceed 50% value of property mortgaged.	Rs. 10000/-

APPENDIX II (page 2 of 5)

Types of Loans	Repayment Period	Grace Period	Repayment of Installment	Interest Rate	Security Required	Maximum Amount Per Loan
AGRO-BUSINESS						
8. Purchase of two wheeled tractors	36 months	-	-	14%	Securities acceptable to Bank.	Rs. 4000/-
DAIRY FARMING						
9. a) IDA (Selected areas)	8 years	2 years	Pattern of income	14%	Up to 10,000/- personal guarantors	On the recommendation of the project unit.
b) Given under normal banking policies	5 years	2 years	Pattern of income	14%	Mortgage of property or personal guarantors	
SHORT-TERM CROPS						
10. Agriculture & industry (tobacco loans)	10 months	-	-	14%	a) Guarantee of two Bank owners who have had satisfactory records with People's Bank OR b) Securities acceptable to Bank.	Rs. 6000/-
11. Coffee	5 years	-	Pattern of income	14%	a) Guarantee of two Bank owners who have had satisfactory records with People's Bank OR b) Securities acceptable to Bank.	Rs. 1000/- per acre
12. Cardamom) cocoa) oil palm)	5 years	5 years	-do-	14%	-do-	Rs. 900/- per acre
13. Cloves & nutmeg	5 years	7 years	-do-	14%	-do-	Rs. 800/- per acre
14. Pepper	5 years	4 years	-do-	14%	-do-	Rs. 1200/- per acre
15. Cashew	5 years	4 years	-do-	14%	-do-	Rs. 800/- per acre
16. Papaw	5 years	1 year	-do-	14%	-do-	Rs. 300/- per acre
17. Mulberry	3 years	2 years	-do-	14%	Securities acceptable to Bank.	Rs. 600/- per acre
18. Lime & orange	3 years	1 year	-do-	14%	-do-	Rs. 2500/-

Types of Loans	Repayment Period	Grace Period	Repayment of Installment	Interest Rate	Security Required	Maximum Amount Per Loan
19. Mango	3 years	1 year	Pattern of income	14%	Securities acceptable to Bank.	Rs. 2500/-
20. Pineapple	3 years	18 months	-do-	14%	-do-	Kew crop Rs. 5500/- Inter crop Rs. 3500/-
21. Passion fruit	4 years	12 months	-do-	14%	-do-	Rs. 3500/-
22. Algamara	12 months	-	-	Commission	No security	Rs. 1000/-
MEDIUM TERM						
23. Small Scale Industries						
In collaboration with the IIB	10 years	18 months or 12 months	-	14%	a) Immovables only. b) Guarantee of two wealthy taxpayers. c) Guarantee of two income tax payers. d) Guarantee of one income tax payor. e) Guarantee of a close relative. f) All business assets employed in the project.	Rs. 400,000/-
NEW AGRICULTURAL CREDIT SCHEME						
SHORT-TERM CROPS						
Paddy	180 days	30 days	At time of harvest	9%	Guarantee of 2 members of the Society.	Rs. 810/- per acre
1. Black Gram	180 days	-do-	-do-	9%	-do-	Rs. 610/- per acre
2. Toor Dhal	180 days		-do-	9%	-do-	Rs. 615/- per acre
3. Cowpea	120 days		-do-	9%	-do-	Rs. 565/- per acre
4. Cotton			-do-	9%	-do-	Rs. 515/- per acre
5. Maize	180 days		-do-	9%	-do-	Rs. 595/- per acre
6. Sorghum	5 months		-do-	9%	-do-	Rs. 585/- per acre

APPENDIX II (page 4 of 5)

Types of Loans	Repayment Period	Grace Period	Repayment of Installment	Interest Rate	Security Required	Maximum Amount Per Loan
7. Chillies	270 days		At time of harvest	9%	Guarantee of 2 members of the Society.	Rs. 1635/- per acre
8. Red onions	180 days		-do-	9%	-do-	Rs. 2320/- per acre
9. B. Onions	180 days		-do-	9%	-do-	Rs. 1180/- per acre
10. Potatoes	180 days		-do-	9%	-do-	Rs. 4740/- per acre
11. Soya beans	5 months		-do-	9%	-do-	Rs. 780/- per acre
12. Ground nuts	180 days		-do-	9%	-do-	Rs. 775/- per acre
13. Green gram	4 months		-do-	9%	-do-	Rs. 575/- per acre
14. Sugar cane						
Plant	18 months		-do-	9%	-do-	Rs. 2275/- per acre
Ratoon	12 months		-do-	9%	-do-	Rs. 2575/- per acre

SCHEME OF RURAL BANKS - 1964/1965

1. Production						
a) Food crops	1 year		Pattern of income.	At discretion of Society.	Two or more personal guarantors.	Rs. 2500/-
b) Commercial crops	2 years		-do-	-do-	-do-	Rs. 2500/-
2. Housing	5 years		-do-	-do-	-do-	Rs. 2500/-
3. Debts	5 years		-do-	-do-	-do-	Rs. 2500/-
4. Consumption	1 year		-do-	-do-	-do-	Rs. 500/-
5. Emergencies	1 year		-do-	-do-	-do-	Rs. 200/-
6. Livestock farming	3 years		-do-	-do-	-do-	Rs. 2500/-

APPENDIX II (page 5 of 5)

Types of Loans	Repayment Period	Grace Period	Repayment of Installment	Interest Rate	Security Required	Maximum Amount Per Loan
COMPREHENSIVE CREDIT SCHEME						
1. Production						
a) Food crops	1 year		Pattern of income.	At discretion of Society.	Two or more personal guarantors.	Rs. 7500/-
b) Commercial crops	2 years		-do-	-do-	-do-	Rs. 7500/-
2. Housing	5 years		-do-	-do-	-do-	Rs. 7500/-
3. Debts	5 years		-do-	-do-	-do-	Rs. 5000/-
4. Consumption	1 year		-do-	-do-	-do-	Rs. 1000/-
5. Emergencies	1 year		-do-	-do-	-do-	Rs. 200/-
6. Electrification	1 year		-do-	-do-	-do-	Rs. 1000/-
7. Livestock farming	3 years		-do-	-do-	-do-	Rs. 7500/-
8. Plantation industry	3 years		-do-	-do-	-do-	Rs. 7500/-
9. Fisheries	2 years		-do-	-do-	-do-	Rs. 7500/-
10. Athamaru	1 year		-do-	-do-	No securities.	Rs. 500/-

Source: People's Bank