A STUDY OF

FIVE SETTLEMENT SCHEMES PRIOR TO IRRIGATION MODERNIZATION

Vol. IV- Vavunikulam

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PRIOR TO

IRRIGATION MODERNIZATION

Volume IV - Vavunikulam Scheme

Research Study No. 42 *October 1980*

AGRARIAN RESEARCH & TRAINING INSTITUTE
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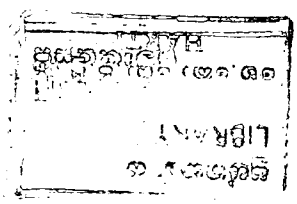

FOREWARD

Vavunikulam is one of the five settlement schemes selected for modernization under the World Bank funded Tank Irrigation Modernization Project. This report is the result of the study conducted by the Agrarian Research and Training Institute to assess the pre-investment conditions of the scheme and it forms the fourth in the series.

For the study, data were collected in the field in 1978. Mrs. J Ranmuthugala, Research and Training Officer was responsible for designing the questionnaires and the collection of data in the field. With her departure in early 1979 to accept an appointment in an international organization, the completion of the project became the responsibility of the other members of the team, namely, Messrs. A.S. Ranatunga and W.A.T. Abeysekera. Mrs. A.C.K. Sepala, Research and Training Officer, who was co-opted to the team was responsible for the tabulation of the data and the preparation of the preliminary draft. However, the final report which is being published now was prepared by Mr. A.S. Ranatunga who was the Co-ordinator of the team, assisted by Mrs. Sepala and Mr. Abeysekera.

The finalization of the report was somewhat delayed due to circumstances beyond our control. As the settlers of this scheme, largely consisted of Tamil speaking persons, the questionnaires were in that language. With the departure of Mrs. Ranmuthugala there was no other Tamil speaking officer in the team and therefore before the final tabulations were done the schedules had to be translated into English Language. This was unfortunately a laborious and time consuming exercise.

It is hoped that this study would prove useful as the bench mark of the Vavunikulam Settlement Scheme, particularly for the purpose of assessing the impact of the irrigation modernization programme. I wish also to express my appreciation for the assistance given by the Officers of the Institute as well as other Departments such as the Agriculture, Irrigation and Land Commissioner to make this study possible.

T.B. Subasinghe

Director

AGRARIAN RESEARCH & TRAINING INSTITUTE

A C K N O W L E D G E M E N T S

As the Study Coordinator, I wish to place on record the contributions of members of the study team comprising Mrs. J. Ranmutugala, Mrs. A.C.K. Sepala and W.A.T. Abeysekera, who handled this study at various stages. The guidance and advice given in sample selection by our colleague Miss. T. Sanmugam is greatly appreciated. Thanks are also due to a number of other ARTI Research Colleagues - Messrs. P.J. Gunawardena, Fredrick Abeyratne and John Farrington for their helpful comments on an early draft. In addition, a number of Officers of other Departments - Land Commissioner, Irrigation and Agriculture, stationed at Vavunikulam assisted us in undertaking this study. In this regard, special mention has to be made of Mr. A. Sivasamy, District Land Officer, Thunnukkai and his team of Colonization Officers who were very helpful particularly in providing facilities for field data collection.

The services of Investigators as well as a number of other personnel in the Institute who helped to make this publication possible deserve mention. The contribution of Mrs. Indrani Perera and Miss. F.N. Jamaldeen, in typing of all manuscripts are acknowledged.

A.S. Ranatunga
STUDY COORDINATOR.

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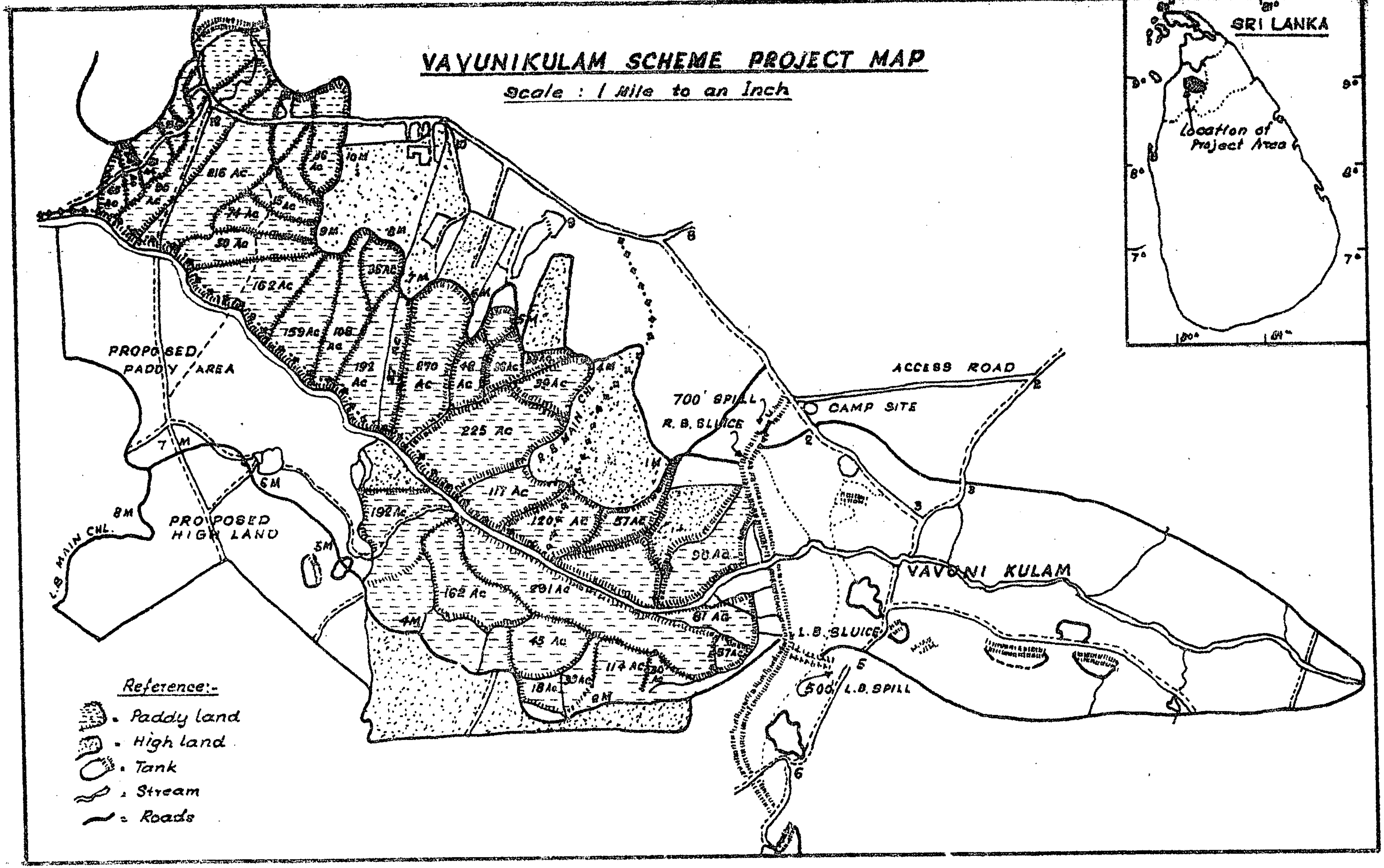

A STUDY OF FIVE SETTLEMENT SCHEMES PRIOR TO IRRIGATION MODERNIZATION

VOLUME IV - VAVUNIKULAM

1. INTRODUCTION

1.1. THE SETTING

This Study on the Vavunikulam Settlement Scheme forms the fourth volume of a series of bench mark investigations undertaken in five settlement schemes prior to irrigation modernization.[1] The bench mark studies referred to here present the situation ex-ante irrigation rehabilitation in five major irrigation schemes - Mahawilachchiya, Mahakandarawa, Pavatkulam, Vavunikulam and Padaviya. The assignments undertaken by the Agrarian Research & Training Institute in this regard are in response to a request of the Ministry of Lands and Land Development and the World Bank, the major funding agency of this rehabilitation programme. The findings presented here cover agronomic, economic and social conditions prevalent in Vavunikulam just prior to initiation of development activities envisaged under the irrigation modernization project.

History of Vavunikulam Tank dates as far back as 161 B.C., to the era of King Dutugemunu. During the early periods this tank was known as Peliwapi and also as Bahavani and remained in a breached condition for several hundred years, until restoration work commenced in 1954.

The tank impounds waters from a seasonal flow river - Pali-aru, which originates in Vavuniya district and traverse westwards into the Mannar sea. The capacity of the tank is 35,300 sq. feet with a

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[1] Volumes I, II, III and V of this series refer to the bench mark studies in Mahawilachchiya, Mahakandarawa, Pavatkulam and Padaviya respectively and these reports have been published already.

water spread of 3150 acres. The catchment area covers about 88 sq. miles and collects water during north east monsoon from October to December. There are five small tanks surrounding Vavunikulam tank namely Kumarikulam, Puwarisankulam, Komburathakulam, Karanpuriyankulam and Padiyankulam.

With initiation of restoration work of the tank in 1954, the settlement process had continued through seven stages from 1956 to 1972. Around 6000 acres of paddy land and about 4300 acres of highland had been alienated to 2156 settlers brought into this scheme. Generally each settler had received three acres of paddy land and two acres of highland except those settled in stage VI.

Vavunikulam Settlement Scheme

Stage	Bank	Total No. of households	Allotted Acreage		Year of Settlement
			Highland (acres)	Lowland (acres)	
I	Right	316	632	948	1958
II	Right	261	522	783	1958
III	Left	350	700	1050	1962
IV	Left	406	812	1012	1964
V	Left	408	816	816	1964
VI	Right	345	678	897	1972 - 74
Centre		68	136	204	1958 - 59
		2154	4296	5710	

Three seperate sluices of the tank serve the allotments in left bank, right bank and the centre. The length of each canal is about 6-8 miles, and the right canal commands the Thunukkai area while the left commands the Padiyankulam.

Agriculture in the area depends entirely upon irrigation water during Yala and largely on rain water during Maha (even in Maha, the uncertain monsoon conditions make the supplementary irrigation necessary). Thus water is a major constraint which affects

agricultural production. The other allied problems identified are[1]:

(1) Insufficient use of Maha rainfall and the wasteful use of stored water in the tank.
(2) Inequitable distribution of irrigation water.
(3) Lack of adequate farm power for timely land preparation.
(4) Poor access roads.
(5) Ineffectiveness of the current agricultural extension services.

The proposed modernization programme envisages the improvement of the living standards of the settlers, mainly through more intensive use of paddy land. The principal components of the envisaged modernization programme are:

(1) Physical improvements to present irrigation conveyance system.
(2) Adoption of better water management practices and enforcement of rotational issues of irrigation water.
(3) Provision of adequate farm equipment for timely field operations.
(4) Cultivation of field crops other than paddy in well drained soils in lowlands during yala.
(5) Strengthening the currently existing agricultural extension service.

1.2. OBJECTIVES OF THE STUDY

The study is designed to serve as a bench mark for evaluating changes in levels of farming and standards of livelihood of the settlers due to project implementation. The specific objectives of the study as given in the original research proposal are :

(1) To ascertain the current status of the project beneficiaries with reference to such criteria as social amenities, employment structure, labour application, agronomic practices, costs of farming enterprises, incomes, credit, marketing and other services.

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1 Appraisal of the Tank Irrigation Modernization Project Report No. 951-CE World Bank.

(2) To identify available institutional support and infrastructural facilities for farming in the study area.

(3) To ascertain the major obstacles that may impede the future expansion of farm production envisaged under the irrigation rehabilitation programme.

(4) To examine the existing patterns of settlement, social organization and community living in the project area.

1.3. SAMPLING

The seven stages of the settlement were used as the sampling strata. A 15% sample was decided by stratified random sampling method. A proportionate random sample was drawn from each stage to enable a representative sample to be investigated. The following table describes the details of the sample.

Table 1.1. Details of the Sample

Bank	Stage	Total No. of Households	Total No. of Households selected.
Right	1	316	48
	2	261	39
	6	345	51
Left	3	350	49
	4	406	57
	5	408	58
	Centre Sluice	68	10
TOTAL		2154	312

1.4. REFERENCE PERIOD

The study data covers two cropping seasons immediately prior to initiation of irrigation modernization activities and includes Maha 77/78 and Yala 78 seasons.

1.5. DATA COLLECTION

A detailed structured questionnaire was used to obtain the required information from settlers on demographic features, cropping patterns, farming practices, employment, income levels, land holding, labour utilization and social amenities etc. Secondary information on infrastructural facilities and other relevant aspects were obtained from the District Land Office at Thunnukkai and other officers working in the settlement scheme. Fifteen field investigators were deployed for data collection for two months during the two cropping seasons under the direct supervision of the researchers. The bulk of data gathered is on economic, agronomic and sociological aspects of farm units included in the sample.

The response from the farmers was very satisfactory except in stages IV and V where few of the sample farmers who were non residents in the scheme could not be located.

1.6. DATA PROCESSING

Data processing was taken in hand in July 1979 and was completed in January 1980.

II. FARM FACILITIES, SETTLEMENT FEATURES & LABOUR FORCE

Some of the more important socio economic characteristics of settler population - their origin, family size, educational attainments and employment etc. are examined in this chapter. In addition, infrastructural facilities and other physical and social utilities available in the settlement are also briefly reviewed.

2.1. ADMINISTRATION

A resident District Land Officer is in overall charge of the administration of the settlement scheme. He is assisted by three Colonization Officers and five Overseers at the field level. Their duties are largely concerned with land administration matters mainly settlement work. Of the cadre of six Colonization Officers assigned to this scheme, three posts remained vacant at the time of survey. An agricultural Instructor resident in the scheme is responsible for agricultural extension work. Of the cadre of five village level workers (K.V.S.) available to this settlement scheme, only thre posts were occupied at the time of field interviews. Irrigation water distribution along with maintenance of the channel system is the responsibility of a resident Engineer assisted by two Technical Assistants. The Assistant Government Agent, Thunnukkai functions from an Office located within the settlement scheme itself.

2.2. ORIGIN OF SETTLERS

The study area had been sparsely populated prior to the initiation of the Vavunikulam settlement. The allottees, mostly landless peasants drawn mainly from Jaffna (90%) (a few from Mulativu and Mannar) had been settled over an unduly long period of nearly fifteen years. The settlers are mostly Tamil Hindus. A majority of the chief of the households in the settlement belong to the first generation of settlers.

2.3. PHYSICAL INFRASTRUCTURE

The settlement scheme is provided with much of the basic facilities and services and the inhabitabts are better off than those living in the neighbouring dry zone villages. Vavunikulam is relatively well served by road communications. From Mankulam to Thunnukkai, the road network is well maintained, but the condition of this road deteriorates as one travels further on. The feeder roads are narrow sandy tracks and are very poorly maintained. During rainy weather many of the feeder roads be come impassable and the settlers have to use much longer routes. Currently three buses ply daily from Thunnukkai to Jaffna and two buses to and from Padiyankulam. This facility serve mainly the needs of the settlers in stages I, II, III and VI. Transport facilities available to those residing in stages IV and V are not adequate.

At Thunnukkai several small shops as well as sub offices of the district administration (A.G.A.), Post Office and Dispensary are located at the far end of the scheme. Padiyankulam is served with a separate A.G.A. Office, together a chain of similar services as in Thunnukkai. Electricity supplies are available at present only to the official bungalows at Thunnukkai.
Two dispensaries and a rural hospital with a resident Medical Officer serve the medical needs of the residents in the study area. Malaria still continues to be a major health concern among settlers. Among sample households there had been ten deaths due to malaria during the past three years. Consequently malaria eradication programmes are being continued.

Common to other dry zone settlement schemes, scarcity of water is a major problem. There is an acute shortage of water during Yala season not only for cultivation but even for domestic use. Water for domestic purposes is obtained mostly from public wells. Around two hundred community wells in the area were reported and almost one half of households rely on such wells for domestic uses.

Bicycles and carts are the popular mode of transport. Of the sample households, 10% and 2% own bicycles and carts respectively. No one in the sample owns a car but eight hiring cars and five lorries are available within the settlement scheme. At the time of the survey, 8% of the farmers reported owning tractors and the sample reflected the availability of four two-wheel and twenty one four-wheel tractors within the scheme.

2.4. HOUSING AND OTHER AMENITIES

The allottees settled in the early phases of the scheme, in stages I, II, III and under the centre sluice had been provided with permanent two roomed cottages by the State. Besides, the early settlers had received substantial State assistance in the way of grants for land development and construction of large wells - food production wells. In contrast, the more recent settlers had not received either permanent cottages or most of the other financial assistance provided in the early phases due to curtailment of capital expenditure. As a result, many of the allottees in stages IV and V and some in VI lack permanent houses. A majority of them continue to have their permanent interests largely in villages of their origin and take up residence in their allotments mainly in Maha when paddy cultivation is in progress. Their dwellings in the settlement consist of temperory huts. Families of such operators often do not reside in allotted lands even in Maha season.

Among the important household items in possession of the sample farmers were: Transister Radio - (45%), Sewing Machine - (27%), Pressure Lanterns - (23%) and Wall Clocks - (7%). Basic implements such as mammoties were available in all households. One quarter of the sample farmers owned portable water pumps as well as animal drawn ploughs. 15% owned sprayers and another ten sprayers and eight tillers owned by co-operative societies were also available to the settlers.

2.5. POPULATION CHARACTERISTICS

The total population in the Vavunikulam settlement is estimated around 12,500 of which 56% are males. The male, female ratio is 1 : 0.9. A classification of the composition of population according to age and sex is given below

Table 2.1. Percentage Composition of Population According to Age and Sex

Age Group (years)	Males %	Females %	Total %
Upto 10 yrs	28	30	29.0
10 - 13	10	10	10.0
14 - 20	14	16	15.0
21 - 25	10	8	9.0
26 - 30	9	10	9.5
31 - 40	10	10	10.0
41 - 50	7	8	7.5
51 - 65	10	7	8.5
66 and above	2	1	1.5
	100	100	100.0

The demographic data represent a predominant youth group with 63% of the total household members being under 25 years of age. Children (under 14 years) constitute almost 40% of the population, indicating a high dependency rate with all attendant implications of the need for heavy investments on social overheads for education and health etc. Besides, the demographic characteristics seen here pose problems with regard to future development of the settlements. With the passage of time, the fixed land allotments hardly offer any scope for economic betterment of the settler families within the agricultural sector. The provision of proper irrigation facilities alone would hardly ameliorate the second generation problems that are likely to arise here. Thus introduction of non farm employment generation activities have to assume considerable importance in the future development programmes.

The average size of a farm family is 5.9. Half the households (55%) comprised of 5-8 members and incidence of larger families with nine or more members are seen in one sixth of the farm units sampled.

Table 2.2. Size Distribution of Households

Family size	No. of households
2 and less	15.0
3 and 4	15.0
5 and 6	29.0
7 and 8	24.0
9 and 10	11.0
11 and 12	4.0
13 and 14	1.5
15 and above	0.5
All	100.0

Eighty two percent of the farm families are nuclear families and one quarter of them have less than two children. Households with more than ten members, invariably extended families are confined mostly to stages I, II and III, the first settlements established. Thus the family size data points to the beginning of the extended family system in the settlements established in the first phase.

2.6. FAMILY LABOUR COMPOSITION

The available work force per family for full time farm work is presented below -

Table 2.3. Family Labour Composition

	No.	%
Average family size	5.9	100
Number of persons engaged in full time farm work -		
Males	1.2	20
Females	.6	10
	1.8	30

The work force per family averages to 1.8 members. On an average, 30% of the members of households reported full time work on their own farms, while another 20 - 30% responded as working part time. (This figure is perhaps an understatement, on account of the non-reporting of a high proportion of part time child labour working on their own farms).

2.7. EDUCATION

The literacy standard of the settlers seen here is relatively high when compared with many of the traditional dry zone villages. The easy access to schools within the settlement scheme could have contributed to the high overall literacy rate of 90%, with even higher literacy levels among young people.

Table 2.4. Educational Attainments of the Farm Family - members above 6 years

Level of Education	Male %	Female %	Total %
No schooling	5.0	10.0	7.00
Up to Grade II	21.0	20.0	21.00
Grade III - VI	20.0	20.0	20.00
Grade VII- VIII	29.0	28.0	28.00
Grade IX - X	23.0	20.0	22.00
Passed G.C.E. (O.L.)	2.0	2.0	2.00
Total	100.0	100.0	100.00

Further analysis of educational attainment data shows 91% of the family heads are able to read and write their mother tongue - Tamil.

Table 2.5. a Educational Attainments of heads of households

School Level	%
No schooling	9
Grades I - V	40
Grades VI - X	50
XI and above	1
	100

Those with no formal education are mainly confined to stages I and II settled in 1958.

The student teacher population in the settlement area are as follows -

Table 2.5. b Student Teacher Population of Schools within the Settlement Scheme

Stage	Particulars of Schools					
	Maha Vidyalaya			Primary & Secondary*		
	No. of			No. of		
	Schools	Teachers	Students	Schools	Teachers	Students
I	1	14	350	1	11	350
II	-	-	-	2	19	550
					2	70
III	-	-	-	1	8	293
Centre	-	-	-	1	1	37
IV	-	-	-	2	2	50
V	-	-	-	-	-	-
VI	-	-	-	1	2	85

* Up to Grade 10

A higher drop out rate is seen as children proceed in grade. However, all small children attend school up to about 4 or 5 years at the primary level although less than 50% of them continue their education up to secondary levels.

This high rate of dropout observed here could be attributed partly to closer involvement of children with farm work, particularly highland crop production under lift irrigation. Due to shortages of labour some of the children of school going age start working as farm helpers in their own farms and eventually drop out from school. According to school authorities, nearly a tenth of the students cease to attend school every season. Around one half of the students are said to miss regular school attendance during peak periods of cultivation, such as land preparations, harvesting etc. Most children, (school drop outs as

well as those school going) assist their parents in farm work during such peak periods.

The children presently in the scheme have attended school at least up to grade 3. However around 15% of those between 10 - 14 years of age do not attend school at present. As for aspirations of farmers for education of their children, nearly two thirds preferred higher education for their sons as well as daughters. Preferred form of employment for girls was as school teachers. Only about 2% of the farmers desired their daughters to have a University education. The relatively better-off farmers - those with high incomes (about 15 - 20%) send their children (especially males) to Jaffna for further education and one third of the farmers preferred their sons to be employed outside the settlement area. Of them, 62% wanted their sons to work outside agriculture.

2.8. EMPLOYMENT & LABOUR FORCE

The labour force which includes individuals within the age group 14 - 65 years excluding students, invalids and disable constitute 61% of the farm population. Agriculture is the main economic activity in the project area and 82% of the males in the labour force are actively engaged in farming for their subsistence. In the case of females the relevant figure is considerably smaller (24%). Six percent of the male labour are exclusively engaged in hiring out their labour mainly in agriculture.

Table 2.6. Sexwise breakdown of Labour Force according to primary activity

Type of primary activities	Males %	Females %	All %
Self employment in agriculture	82	24	53
Hired Labour in agriculture	6	5	5
Household work	-	65	33
Wage Labour outside agriculture	1	-	1
Traders	1	-	1
Self employed outside agriculture	3	-	2
Unemployed (excluding housewives)	7	6	6
	100	100	100

Six percent of the labour reported as being unemployed and actively seeking work. The unemployed as presented above does not include the under employed. Substantial amount of under employment is certain to exist here, due to the marked seasonality of agricultural activities in this scheme. Paddy cultivation does not provide regular work throughout the year and in times of water scarcity - in Yala season, a majority of the allottees are under employed particularly those in stages IV, V and VI. Settlers in stages I, II and III with some access to lift irrigation water are reasonably well employed even during Yala season.

Hiring out labour for agricultural activities is an important means of secondary employment. Around one fourth of the household members have participated in such employment. This proportion does not include students and housewives who work in the farms (especially highland) during peak cultivation periods.

Alternative avenues of employment like carpentry, smithery and tailoring are hardly found in the settlement area. This may be due to the fact that a majority of the allottees chosen with farming backgrounds had not attempted to acquire the skills necessary perhaps due to the lower demand for such skills.

2.9. LIFT IRRIGATION FACILITIES

State has provided lift irrigation facilities over the years to settlers in stages I, II, III and parts of VI for field crop production mainly during Yala season. The stages I, II and VI are in the right bank and have better access to water for lifting. The stages III and IV and V are in the left bank. Of them only stage III has ready access to water and accordingly the allotments here too had been brought under the lift irrigation. The stages IV and V located far away from the tank have very poor access to water sources and have been excluded from this programme. A stage wise breakdown of the lift irrigation facilities is presented in table 2.7.

Table 2.7. Stage-wise breakdown of lift irrigation facilities

Stage	Allotments which have lift irrigation facilities		Water Pumps available
	From irrigation channels	From the food production wells[1]	
I	224	60	16
II	201	45	13
III	270	40	15
IV	-	-	1
V	-	-	-
VI	76	30	15
Centre	-	20	3
	771	195	63

Already 771 of the allotments in these three stages are equipped to receive lift irrigation water from the distribution channels. Further 195 allotments draw water from large food production wells available in the area. As mentioned earlier, in the initial years of settlement, a majority of the settlers in the above stages had taken advantage of a government subsidy of Rs.27500/- per well and had constructed the required wells. However over the years with the subsidy remaining almost unaltered, the settler enthusiasm for construction of wells had dwindled largely due to sharp escalation of construction costs. Consequently very few food production wells are found in the more recent allotments located in stages IV, V and VI. In this regard, unavailability of ground water at shallow depths in locations further away from the tank may also be an underlying reason. At present 26 percent of sample farmers own kerosene pumps for lifting water from food production wells. Those with access to lift irrigation water from the channel system are expected to pay a rental charge of Rs. 300/- per season as water dues, but a majority of them are said to be in default of the due payments.

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1 Permanent wells constructed for irrigation purposes with State assistance.

2.10. LIVESTOCK ASSETS

The presence of a large cattle population is a noteworthy feature in Vavunikulam. Of the households investigated, little over one third owned cattle - mostly neat cattle. The cattle population at the time of survey is said to be around 4000 - 5000 heads according to an estimate of the Assistant Government Agent, Thunnukai. Unlike in many of the other settlement schemes in the dry zone, neat cattle are used here instead of buffalo for paddy field work, mainly for second ploughing and levelling. Usually the individual herd sizes vary from 15 - 25 animals. Larger herds are not uncommon. Cattle manure is an important source of supplementary income for settlers as the manure collected in Vavunikulam has a ready market in Jaffna. The price offered for a lorry load of cattle manure in 1979 was Rs. 500/- and middleman from Jaffna visit this settlement regularly to purchase manure.

Currently very little milk is available for sale here. Only about 6% of the households reported any milk production. The existing conditions in this scheme provide considerable scope for livestock development - both milk and draught cattle. The provision of veterinary support for artificial insemination and disease control together with extension programmes to encourage processing of animal feeds using crop by products - such as rice bran, paddy, maize and sorghum stalks, etc, should go a long way to upgrade the quality of cattle over time. Similarly, organization of marketing facilities for milk is certain to provide an impetus to cattle owners to milk their animals. Neglect of draught cattle is another aspect for concern here. With the ever increasing fuel costs, more and more draught animals would be needed for farm work in future. The development programmes of the National Livestock Development Board concentrate largely on problems associated with milk production and consequently the improvement of draught cattle in locations such as Vavunikulam do not appear to receive the desired attention.

III. FARM COMPOSITION, LAND USE AND IRRIGATION

This Chapter focuses attention on the composition of farm holdings, sytems of cultivation, intensity of land use, and some issues related to irrigation.

3.1. PATTERN OF LAND ALIENATION

The total extent of irrigable land under the Vavunikulam Scheme is estimated at 6,000 acres of which 5,700 acres had been allotted in units of 3 and 2 acres to settler families brought into the scheme in seven different stages. In addition to irrigable lands, each settler family had received 2 acres of highland as well. Altogether about 4,200 acres of highland had been alienated in this manner.

The particulars of allotments available in the different stages of the settlement scheme at the time of survey are presented in Table 3.1.

Table 3.1. Stage-wise distribution of land allotments

Stage	Allotment Size		Allotted Acreage		Unallotted Acreage		No. of households
	High land (Ac)	Low land (Ac)	High land (Ac)	Low land (Ac)	High land (Ac)	Low land (Ac)	
I	2	3	632	948	-	-	317
II	2	3	522	783	-	-	261
III	2	3	700	1050	-	-	350
IV	2	3	812	1012	19	19	406
V	2	2	816	816	19	19	408
VI	2 or 1	3 or 2	678	897	-	-	345
Centre	2	3	136	204	-	-	69

About 150 - 200 acres of unalienated land had been reserved for infrastructural development, mainly for roads, buildings as well as to serve as drainage reservations. A further 76 acres remain unallotted due to the presence of rocks etc. At the time of

rehabilitation of the tank, the population in *purana* villages in the vicinity of the tank had been very small and accordingly bulk of the newly developed land had been alienated to landless peasants from Jaffna and Mannar.

3.2. OPERATIONAL HOLDING

As presented in table 3.1., the standard size of allotment is five acres - three acres of lowland and two acres of highland. However ,the size distribution of allotments varies as one moves away from the tank towards the more recent settlements in stages V and VI. The limited availability of land, has compelled the authorities to reduce the allotment size in both these stages to four acres or so. Here, the allotment generally comprise of either two acres each of lowland and highland or three acres of lowland and one acre of highland (See Table 3.2.).

Encroachments are more common in stages I, II and III where highland farming is relatively well developed, but in stages IV and V wit out satisfactory access to irrigation water less of encroachment are seen.

Table 3.2. Average Composition of Operational Land Holding per farm according to stages of settlement

Stage	Lowland		Highland		Total	
	Allotted land (Ac)	Encroach ments (Ac)	Allotted land (Ac)	Encroach ment (Ac)	Allotted land (Ac)	En croach ments (Ac)
I	3.0	0.3	2.0	0.6	5.0	0.9
II	3.0	0.5	2.0	0.8	5.0	1.3
III	3.0	0.3	2.0	0.6	5.0	0.9
IV	3.0	-	2.0	0.2	5.0	0.2
V	2.0	-	2.0	0.1	4.0	0.1
VI	2.1	0.1	1.4	0.8	3.5	0.9
Centre	3.0	0.2	2.0	0.5	5.0	0.7
Total	2.7	0.2	1.9	0.5	4.6	0.7

Chena (shifting) cultivation is almost non existent at Vavunikulam unlike in many of the other dry zone settlement schemes. The settlers here, most of whom come from Jaffna Peninsula were very unfamiliar with chena farming in places of their origin. Infact, their previous experiences in farming in Jaffna, if any, were those connected with intensive farming on highlands almost the opposite of what takes place in chena.

The relative success of cash crop farming in Vavunikulam could be partly attributed to the previous farming experiences and background of settlers.

3.3. SYSTEMS OF CULTIVATION

Table 3.3. Classification of farms according to systems of cultivation by season

Type of cultivation	Yala		Maha	
	Farmers reporting	Average Extent cultivated per farm reporting	Farmers Reporting	Average Extent cultivated per farm reporting
	(%)	(Ac)	(%)	(Ac)
No cultivation	72	-	6.0	-
Only lowland	1	0.80	21.0	2.6
Only highland	27	1.4	9.0	1.9
Only chena	-	-	-	-
Lowland + highland	-	-	62.0	4.2
Lowland + chena	-	-	-	-
Highland + chena	-	-	0.8	0.3
Lowland + chena + highland	-	-	0.2	0.8

The main thrust in farm production during Maha season is on irrigated paddy. However farming activities show some diversity during this season, with almost two-thirds of the cases investigated having adopted more than one system of cultivation with both lowland and highland allotments being planted to seasonal crops.

Mono-cropping of paddy in lowlands is seen in about one fifth of the sample farms. A majority of mono crop farms were observed in stages IV and V with less satisfactory water supplies. In such cases, the allottees often do not reside on the lands allotted and the highland plots continue to remain more in a state of neglect. Over the years due to such neglect, some of the highland plots have gone back to scrub jungle. As pointed out earlier, operators of such allotments take up temporary residence on the allotted lands during Maha, mainly for the purpose of cultivating irrigable lands and highlands invariably remain unattended even in Maha. In such circumstances, farm operators apparently are not able to find sufficient time to clear the jungles and bring the highlands back to levels fit for cropping, due to their full time involvement with paddy field work.

According to survey data nearly three fourths of the sample farmers had no cultivation whatsoever during the Yala season under reference. Unavailability of irrigation water is the key explanatory factor for non cultivation reported by such a high proportion of the settlers. The well being of the resident settlers during Yala season is largely dependent on highland cultivation presently undertaken on limited extents of land in stages I, II and III and parts of VI with lift irrigation water.

With regard to crops, paddy is the exclusive crop grown on lowlands and that too only during Maha season. On highlands, chillie , onion , vegetables and pulse crops as well as banana are cultivated both under irrigated and rainfed conditions.

3.4. USE OF HIGHLAND ALLOTMENTS

Table 3.4. Size distribution of cultivated extent per farm in highland allotment - Maha 77/78

Extent cultivated with arable crops (Ac)	Farmers reporting %
None	06
0 - 0.5	21
0.6 - 1.0	30
1.1 - 1.6	35
1.6 - 2.0	8
	100

Highlands carry a variety of seasonal crops in both seasons, with cash crops such as chillie and onion showing dominance. Pulse crops, mainly black gram, green gram and vegetables too are cultivated as supplementary crops. Gingelly is cultivated mainly during Yala. In addition, a multiplicity of tree crops - mango, banana, jak, drumsticks and lime etc. are grown around homesteads. The availability of lift irrigation facilities has contributed largely for successful field crop production in all stages of the scheme except in IV and V. As mentioned earlier, the highland allotments in stages I, II and III in particular have benefitted greatly from lift irrigation facilities. Currently around 966 allotments have access to lift irrigation facilities either from irrigation channels or from food production wells. Here one irrigation pump is available per every three allotments, where as in stages IV and V the corresponding ratio is 1 : 46.

Table 3.5. Availability of Lift Irrigation Facilities and Intensity of cropping on Highland Allotments.

Stage	Extent of highland with irrigation facilities		Extent of highland cultivated*	
	From the channels	From the food production wells	Yala	Maha
	%	%	%	%
I	71	19	75	90
II	77	17	80	95
III	77	11	75	90
IV	-	-	20	45
V	-	-	15	40
VI	22	9	60	90
Centre Sluice	-	29	55	95

* Includes both permanent tree crops as well as seasonal crops

The above data shows that in allotments with access to lift irrigation water, cropping intensity is generally higher, with three fourths of the extent being planted to crops both seasonal and

permanent. However, the same cannot be said of stages IV and V where allotments remain in a very poor state of development. The allottees operating in these two stages having received only very meagre assistance in the way of grants, subsidies and dwelling houses etc. had failed to develop their individual allotments. In fact in stage V, at the time of survey nearly 70 highland allotments continued to remain under scrub jungle.

All in all, Vavunikulam has forged ahead in stabilising highland cropping specially in allotments in stages I, II and III. The highland development programme in Vavunikulam stands well ahead of the other 4 settlement schemes coming within the purview of the tank irrigation modernization project. This scheme infact also has a comparative advantage over the other settlements included in the irrigation modernization programme for promotion of field crop production, as it falls within the main subsidiary food crop production belt in the Northern Province. Besides, the past experiences and background of settlers too would have contributed largely to stabilize highland cropping in this particular settlement. However, the sharp escalation of prices of fuel - diesel and kerosine, witnessed since 1978 is certain to affect the lift irrigation programme adversely in future. The cost of pumping water has shown a phenomenal increase during the past year. As the field surveys were done just prior to this period, the magnitude of such cost increase on fuel cannot be assessed without further investigations.

3.5. USE OF LOWLAND ALLOTMENTS

Marked seasonality of cultivation is observed in lowlands. In Maha, these lands are utilized fully for raising of paddy crops, while in Yala hardly any paddy cultivation is undertaken for want of irrigation water. There had been no regular cultivation of paddy in Vavunikulam during Yala season for almost eight years during the period 1971 - 1978. Infact, the above years constitute a period of prolonged drought conditions in most parts of the northern dry zone.

Table 3.6. Size distribution of lowland operational holdings - Maha 1977/78

Extent cultivated	Farmers reporting %
Nil	06
0.1 - 1.9	28
2.0 - 2.9	64
3.0 - more	2
	100

In Maha, cropping intensity is high - 86% during the reference season. In contrast, during Yala lowlands remain idle in most years. The recent attempts to cultivate field crops requiring less water such as cowpea, black gram, soya beans and gingelly etc. during Yala in the well drained lowlands in stages I, II and III had met with limited success. About 15% of the farms surveyed, reported small areas under such crops in paddy fields during 1978 Yala season. A majority of farmers interviewed expressed reluctance to invest on purchased inputs etc. for field crops in paddy fields during Yala largely due to risks involved.

Table 3.7. Cropping Intensity in Lowlands

Season	Average extent cultivated per farm (Ac.)	Average extent available per farm (Ac.)	Cropping Intensity (%)
Yala	0.8	2.9	27
Maha	2.5	2.9	86
Annual	3.3	2.9	113

An overall cropping intensity of 113% implies extremely limited double cropping of paddy. The lowlands remaining fallow in Yala serve rather a useful purpose in providing grazing grounds for neat cattle. As seen earlier in (section 2.9), rearing of neat cattle in Vavunikulam is an important enterprise.

With regard to irrigation facilities for lowlands in Maha, the position as stated by sample farmers is one of satisfaction. In seasons of good rainfall, over 90 percent of the farmers reported adequate water supplies in Maha. However, lowland allotments towards the tail end of the scheme appeared to have irrigation problems in most Maha seasons. Nearly one half of such problems were reported to be due to defects in the channel system. Lack of proper maintenance and timely repair of channels were indicated as some of the main irrigation deficiencies as perceived by farmers. Arising from such deficiencies tail end farmers experience insufficient flow of irrigation water.

Illicit tapping of water by allottees up stream is another common problem raised by nearly one quarter of the farmers. Among other irrigation issues raised were lack of proper water control devices and insufficient water in the tank in some of the years. The crop losses due to short fall in water supply had been rather low in Maha seasons, and according to farmer responses such losses could be assessed as around 8 - 10%. In contrast, the situation in Yala is quite disturbing, in that almost two thirds of the very limited extents of paddy planted had suffered severe losses. Failure of farmers to adhere to stipulated cultivation calendars in Maha results in staggard sowing which in turn aggrevates water problems still further.

3.6 . FARMER ATTITUDES TOWARDS PROPOSED IRRIGATION CHANGES

Farmers are quite reluctant to introduce other field crops to paddy fields in Yala as envisaged under the irrigation modernization programme. The discussions with farmers as well as their families during the survey made it clear that the settlers are very keen on cultivating paddy during Yala season. The main reason for bias towards paddy is the great desire to be self sufficient in paddy requirements for consumption. About a fifth of the farmers felt that paddy cultivation is more suitable as this crop require less labour as well as cash for purchase of inputs.

Table 3.8. Major constraints for introduction of other field crops to paddy fields during Yala as perceived by farmers

Constraints	Farmers reporting %
Water shortages	46
Problems of marketing	22
Lack of money	16
Pest and disease problem	10
Poor drainage	4
Poor soil conditions	2
	100

Of the above constraints, the problems with regard to availability of water are likely to diminish with the implementation of irrigation modernization programmes. However, more positive steps are needed to solve problems of marketing and pests and disease control. The State Agencies handling such aspects should concentrate more in studying such problems faced by farmers in order to strengthen the field crop production programmes.

With regard to rotational issues, a majority agree that the issue of water on a rotational basis is a step in the right direction. Farmers suggested improvement of conveyance system as very basic, for timely deliveries and proper control of water issues. Their view is that prior to introduction of rotational issues of water on a regular basis, the conveyance system should undergo substantial improvements. In this regard, the installation of proper locking devices which cannot be readily tampered with, along the water conveyance system was raised as an important issue for efficient water allocations.

IV. FARM PRACTICES, CROPPING PATTERNS & OUT PUT

The discussion here covers mainly the cultivation practices adopted in lowlands as adequate details on farming practices on highlands were not available in the survey data.

4.1. FARM POWER USE

Four-wheel tractor and neat cattle are the principal forms of farm power used for paddy field work. Around one half of the settlers rely solely on tractor and about a third on cattle for land preparation. Tractors are also used for threshing of paddy crops and for highland preparation. Rather extensive use of neat cattle for ploughing of lowlands observed here is of interest as buffalo is the traditional animal power used in most other settlement schemes in the dry zone. Ready availability of neat cattle in the area, has made this possible. Normally, 4-wheel tractors equipped with tyne tillers are used for first ploughing and neat cattle for second ploughing. A light wooden plough is used with animals.

Currently, bulk of the tractor needs of settlers, both for tillage and threshing are hired from sources outside their farms. Three fourths of the tractor users had hired their requirements during the Maha season under reference. Of those using animal power only a third had hired the required cattle. At the time of the field interviews, inadequate tractor supplies were reported. However since then, the supply situation had improved considerably, with the addition of about 41 tractors under the Tank Irrigation Modernization Programme during 1978 - 79. Despite the increase availability of tractors in the recent past, the tractor hire charges continue to rise (Table 4.1.).

Table 4.1. Farm Power Hire Charges
1978 - 1980

Field Operation	Tractor Hire Charges Rs. per acre			Neat Cattle Hire Charges* Rs. per acre		
	1978 Rs.	1980 Rs.	Increase %	1978 Rs.	1980 Rs.	Increase %
Mud Ploughing	175	250	43	100	200	100
Threshing	40	60	50	30	60	100

* Inclusive of wages of labour used for driving animals.

The increase in hire rates of tractors is largely a reflection of the upward movement of the price of fuel and spare parts. The present concentration of ownership of tractors in the hands of an affluent group in the area may provide a partial explanation for the relatively high rates of tractor hire observed above. In this regard, the operation of local monopolies is a possibility. Following increases in tractor rates, hire charges for neat cattle for land preparation had shown a more steep rise from Rs. 100 to Rs. 200 per acre. The high labour component in the use of animal power is a major reason for the unduly high increases recorded in animal hire costs. On the question of farmer preferences for draught power, around two thirds of those investigated showed a preference for 4-wheel tractors for paddy field work. The speediness of field operations with tractors is the main advantage as perceived by farmers. On the other hand, the one third showing a preference for animal power stressed the ready availability of animals in times of need as the main advantage. Lower cash costs is another advantage raised by the animal users. Infact,it is not uncommon for family labour to get involved with ploughing work using hired animals. In such cases, the cash cost are relatively less - only hire charges of animals.

4.2. VARIETAL ADOPTION

At the time of survey old high yielding varieties, particularly H-4 was widely cultivated during Maha season. This particular

variety had been originally introduced to Vavunikulam in late 50's with the initiation of the first settlements. Over the years, H-4 had continued to maintain a pre-eminent position in this scheme due to its ability to withstant moisture stresses. Thus, despite the advent of very high yielding varieties of the Bg series in the early 70's, H-4 remains the choice of nearly two thirds of the settlers in Maha season. In this regard, the dominance of this variety is most evident in stages IV and V with the poorest water supply conditions. The very new varieties - Bg 34 - 8 and Bg 11 - 11 with very high yield potential are seen mostly in stages I, II, and III under stable water supply conditions. Broadly, the pattern of varietal adoption observed here is indicative of a conscious attempt on the part of farmers to fit varieties suited to differentials in water supply conditions.

4.3. PLANTING METHODS

Broadcast sowing of germinated paddy under wet conditions is the principle form of planting. (Table 4.2.)

Table 4.2. Percentage Distribution of Farmers by Method of Planting - Maha 77/78

Method of Planting	Farmers adopting %
Broadcast sowing	73
Dry Sowing (Kekulan)	19
Transplanting	08
Row sowing	-
	100

Dry sowing is lot more popular here, unlike in the cases of the four settlement schemes studied earlier. Around a fifth of the farmers had sown paddy under dry conditions during the reference Maha season. Dry cultivation is seen mostly in stages IV and V, where water supply is poor. Transplanting has not caught on primarily due to problems associated with irrigation water supplies.

On investigating farmer preferences for different planting methods, around, one half of the settlers showed a response for broadcast sowing under mud conditions as the most suitable planting method under the existing water supply situation at Vavunikulam. Another one third indicated a preference for transplanting. Their preferences were based largely on easy control of weeds and possible higher yields under transplanted conditions. However, the non adoption of transplanting by those showing a preference for this method is said to be due to irregular water supply, lack of labour at the required time and high cash costs of hired labour. With regard to dry sowing - an important component in the package of farm practices envisaged under the irrigation modernization programme, the farmer response is not very encouraging except in stages IV and V. At Vavunikulam, the settlers perceive dry sowing as a suitable alternative sowing practice when irrigation water supply is not properly organized. Infact, in stages IV and V, the water conveyance system has many deficiencies and consequently the settlers are not in a position to get their requirements of irrigation water at the desired times, particularly in the early part of the Maha season. Under such conditions, dry sowing of paddy is rather common in Maha season.

4.4. FERTILIZER USE

A high proportion of farmers seem to recognise the benefits of fertilizer use for paddy crops. Three fourths of sample farmers had used some form of fertilizer in their lowlands during Maha. The average quantity applied amounts to 1.4 cwt. per acre which is less than half the recommended dosage. In all stages of the scheme, varying quantities of nitrogenous fertilizer is used widely for top dressing, mostly at tillering stage. Urea is the popular nitrogenous fertilizer used. Fertilizer use data disaggregated on the basis of stages of settlement show a rather close relationship between fertilizer use and availability of water in different stages of the scheme. Under assured water supply conditions in stage I, II and III, over three fourths had used chemical fertilizer. On the other hand, in stages IV and V with many water supply problems, the number

applying fertilizer is low, roughly about a third of the farmers.

Table 4.3. Farmers applying fertilizer according to stages of settlement - Maha 77/78

Stage	Water Supply conditions*	Farmers applying some form of fertilizer
		%
I	good	81
II	good	97
III	good	77
IV	poor	30
V	poor	35
VI	poor	76
Centre Sluice	good	72

* Water supply conditions as perceived by the settlers

The above data demonstrates clearly the farmer reluctance to invest on costly inputs such as fertilizer under uncertain production conditions. In high risk situations as found in stages IV and V, the settlers with meagre resources tend to reduce cash costs. The low level of fertilizer usage seen in this instance could be explained largely on this reasoning. Similarly, applications of complete fertilizer mixtures which include basal dressings - V-1 as well as TDM (Top Dressing Mixture) are found mostly in stages I, II and III. Around four fifths of those using fertilizer in the above stages, had used even a limited quantity of basal mixture and or TDM in addition to Urea. In this regard, the pattern of fertilizer use in stages IV and V provides a contrast, with a large majority of fertilizer users having applied only Urea.

The survey data is indicative of a general awareness of the benefits of fertilizer use among sample farmers. However there is considerable scope for improvement of their knowledge on specific aspects of fertilizer use - the need for timing as well as correct combinations of different kinds of fertilizer. Non-availability of required fertilizer at the desired times at retail

outlets is another aspect raised by farmers. This is an organizational problem that deserves attention.

4.5. WEED CONTROL

The general standard of weed control on this settlement scheme is not very impressive except in stage II, even though all the sample farmers reported as having attempted weed control in varying degrees during the season under reference. Use of chemical weedicides is the principle form of combating weeds at present. Taking the scheme as a whole, two thirds of the allottees had used chemical weed killers. Higher usage of weedicides is seen particularly in stage II - 93% of those who had used weed control measures had relied on chemicals. Hand weeding is more pronounced in stages IV and V where two thirds of those reporting weeding had adopted this method. In hand weeding, attention is concentrated mostly on patches where weed growth is found to be excessive. In consequence, the paddy fields as a whole do not benefit much from the type of hand weeding practiced at present. Due to the rising costs of weedicides some farmers tend to use lower concentration of chemicals than the amounts stipulated in order to accommodate cost increases faced by them. This perhaps may be one of the underlying reasons for the somewhat poor control of weeds observed despite the extensive usage of chemicals at Vavunikulam. It is worthwhile for the agronomists to investigate this observation further.

4.6. PEST AND DISEASE CONTROL

The most common paddy pests reported were paddy leaf roller, stem borer and paddy bug. Use of insecticides is quite common and farmers adhere rather closely to recommended control measures whenever pest outbreaks occur unlike in the case of weedicides.

4.7. YIELDS

The reported paddy yields averaged to 43 bushels per acre in Maha 77/78.

The distribution of farmers according to different yield categories is given below.

Table 4.4. Percentage distribution of farmers according to paddy yields reported - Maha 77/78

Yield Category (bu. per ac.)	No. of farmers reporting	
	No.	%
Less than 20	11	5
20 - 29	27	12
30 - 39	46	20
40 - 49	79	34
50 - 59	50	22
Over 60	18	7
	231	100

The reported acre yields computed on the basis of the stages of settlement exhibit marked variations. The data in Table 4.5. reflects largely the impact of the differentials in water supply conditions on paddy yields at Vavunikulam

Table 4.5. Paddy yields according to stages of settlement Maha 1977/78

Settlement Stage	Water supply* Conditions	No. of farmers Reporting	Yield per acre (bushels)
I	Good	46	54
II	Good	39	56
III	Good	46	51
IV	Poor	34	22
V	Poor	13	20
VI	Good	44	47
Centre	Good	11	48

* Water Supply conditions as perceived by farmers

Highest yields are seen in stages I, II and III, with average yields of over 50 bushels per acre in Maha. These settlement have the benefit of good water supply conditions. Higher rates of adoption of improved cultivation practices particularly fertilizer use and transplanting were seen earlier in the above three stages. The settlements with generally poor water supply conditions in stages IV and V have recorded lowest average yields around 20 bushels per acre. Thus the importance of water as a production input is very striking in this instance.

4.8. PRODUCTION ON HIGHLANDS

As discussed in section 3.4., cropping on highland allotments is relatively well established in this settlement scheme. In this regard, the principle reason underlying the progress achieved so far is the availability of lift irrigation facilities. Such facilities have provided a great impetus to farmers particularly in stages I, II, and III to develop stable cropping systems on their highland allotments. The main constraint for expansion of highland cropping in Yala is the limitation in the water supply.

The principle crops cultivated during the two reference seasons are presented in Table 4.6.

Table 4.6. Cropping pattern on highland allotments

Crops	Extent cultivated as a percentage of the total	
	Yala %	Maha %
Chillies	48	55
Onion	21	20
Black Gram	10	10
Gingelly	8	9
Vegetables	8	4
Green Gram	2	1
Paddy	2	-
Cowpea	1	1
Total	100	100

Large scale cultivation of chillie and onion is seen throughout the settlement scheme. However, intensive cultivation of these two crops is found most in allotments with lift irrigation facilities. Application of agro-chemicals for pest and disease control as well as artificial fertilizer for above crops is common. In stages IV and V without such facilities,crops such as black gram and gingelly are grown more widely under rainfed conditions. The yields of some of the principle highland crops as reported by farmers are presented in Table 4.7.

Table 4.7. Yields of Highland Crops

Crop	Unit	Reported yield per acre
Chillie	cwt.	10
Onion	cwt.	74
Black Gram	bu.	9
Gingelly	bu.	5
Green Gram	bu.	4
Cowpea	bu.	7
Paddy	bu.	25
Vegetables(mixed)	lb.	980

The average yields of highland crops given here should be taken as approximations as precise estimates of extents of highlands cultivated were not available unlike in the case of paddy.

V. LABOUR UTILIZATION

Feasible cropping patterns at Vavunikulam are an important determinant of both the level and the pattern of labour use, as they influence the overall demand for labour. In contrast to the other four settlement schemes included in the Irrigation Modernization Programme, the relatively well established highland cropping activities provide an important avenue of employment for the settlers here during most part of the year. This is particularly so, for those living in stages I II and III where subsidiary food crops are grown in both seasons On the other hand, cultivation of lowland paddy provides a contrast in terms of labour application. In lowlands, with cultivation being restricted only to Maha season in most years, the employment opportunities available to settler families in paddy cultivation is limited.

With regard to labour supply, the demographic features observed in chapter II are of relevance. The youthful population with 40% of household members being under 14 years of age, naturally restricts the amount of man power available for farm work. Further more, with two thirds of the adult females in this settlement being engaged in household work as the primary economic activity, the overall participation rate in farming activities has got reduced further. Under such conditions, hired labour assume a great deal of importance particularly in the case of crops such as paddy which exhibit a marked seasonality in agricultural operations.

Labour application at Vavunikulam in Maha season classified by source of labour and type of cultivation are presented in Table 5.1.

Table 5.1. Labour application classified by source of labour and type of cultivation - Maha 1977/78

Production Unit	Mandays per farm			Man days Per acre			Man days Percentage	
	Family	Hired	Total	Family	Hired	Total	Family %	Hired %
Highland	112	69	181	66	41	107	62	38
Lowland	43	102	145	17	41	58	29	71
All	155	171	326	83	82	165	47	53

The nature as well as the level of labour input reported in respect of highlands and lowlands show variation. In highlands, planted mostly with cash crops such as chillie and onion, bulk of the labour input has come from the farm family. The predominance of family labour on highland allotments may partly be attributed to the greater after care necessary for raising some of the cash crops. Crops such as chillie, onion and vegetables require regular tending as a matter of routine particularly for earthing up plants, weeding, irrigation, spraying and harvesting for which family labour is largely utilised. On the other hand, in the case of paddy crops ,the high seasonality of agricultural operations makes unusually heavy demands on the stock of labour during specific peak periods. Such labour peak demands cannot be met from the limited family labour available. In such instances ,outside labour is hired for short spells to complete operations such as land preparation and harvesting.

With regard to levels of labour used per unit area of land, highland allotments stand prominent as absorbing nearly twice the amount of labour per acre during the Maha season compared to the labour used on lowlands.

5.1. PATTERN OF LABOUR USE IN LOWLANDS

The total labour applied for paddy cultivation in Maha season averages to 145 man days per farm with a cultivated extent of 2.5. acres - around 58 man days per acre. This level of labour

inputs is in line with the intensity of labour use generally found in the Jaffna District.[1]

Table 5.2 Labour application in paddy cultivation by tasks - Maha 1977/78

Operation	Mandays per farm			Mandays per acre			%
	Family	Hired	Total	Family	Hired	Total	
Land preparation	7.5	37.5	45.0	3	15	18	31
Sowing	5.0	10.0	15.0	2	4	6	11
Crop Care							
Pest Control	2.5	2.5	5.0	1	1	2	3
Fertilizer application	2.5	2.5	5.0	1	1	2	3
Weeding	7.5	10.0	17.5	3	4	7	12
Harvesting	10.0	25.0	35.0	4	10	14	25
Threshing & Transport	7.5	15.0	22.5	3	6	9	15
	42.5	102.5	145.0	17	41	58	100

Labour input for paddy cultivation in Maha season presented in Table 5.2. show the two usual peaks normally associated with paddy cultivation. The highest peak is during harvesting and threshing; the second highest is during land preparation. Almost 70% of the total labour input is used for the above two operations. Bulk of the hired labour is largely utilized to accomplish work related to time specific operations associated with land preparation and harvesting. Besides, as mentioned earlier, family labour is heavily involved in tasks relating to highland cropping in Maha season. Thus the farmers are compelled to use more of hired labour for lowland paddy cultivation.

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1 The Department of Agriculture estimates the average number of mandays used for cultivation of paddy in Jaffna in Maha 1978/79 as 63.3 per acre - Agricultural economic study No. 28 - September 1979.

Further analysis of labour data in lowlands show an increasing trend in the level of labour use with improvement in water supply conditions (Table 5.3.)

Table 5.3. Intensity of labour use in lowlands according to stages of settlement

Stage	Water Supply Conditions	Labour Days per acre	Index of Labour Use*
I	Good	64	97
II	Good	66	100
III	Good	60	91
IV	Poor	54	81
V	Poor	52	78
VI	Good	56	84
Centre	Good	58	87
Total Average		58	

* The highest labour use recorded - 66 mandays/acre = 100

It is clear that with relatively more assured irrigation water supply conditions, the level of labour use per unit area of land is relatively high. In contrast, under poor water supply conditions, less labour is applied - almost 20% less than under assured water supplies. The differences in some of the farming practices adopted as discussed in Chapter IV are helpful in understanding such differences in labour use.

5.2. LABOUR USE IN HIGHLANDS

Labour use data in respect of individual highland crops are not available from the farm survey. However, the limited information available on labour application on highlands is presented below, mainly to illustrate the broad labour use pattern on such lands during Maha season.

Table 5.4 Labour application per acre on highland allotments Maha 1977/78

	MAN DAYS					
	Family	%	Hired	%	Total	%
Land Preparation	23	61	15	39	38	36
Sowing and planting	06	75	02	25	08	07
Crop Care	22	79	06	21	28	26
Harvesting	15	45	18	55	33	31
Total	66	62	41	38	107	100

As seen earlier, highlands provide the most amount of farm work to settlers at present. The introduction of lift irrigation, calls for new operations in water control, which includes provision of irrigation ditches, bunding of land and so on. Also, the availability of water has enabled the farmers to shift from traditional less labour demanding pulse crops to more labour intensive cash crops such as chillie and onion. Lastly such facilities also have made double cropping possible on some of the highlands mainly in stages I, II and III. Consequently the overall demand for labour has increased. The total labour input of 107 mandays per acre comes largely from the farm family. The more important reasons for the dominance of family labour in highlands were discussed in the proceeding section. In general, hired labour on highlands assume some importance mainly during harvesting of seasonal crops.

At the time of survey, the modal daily wage payment for hired labour in this settlement scheme was around Rs. 15/- for a male, Rs. 12/- for a female and Rs. 8/- for a child exclusive of meals. In case meals being provided, a sum of Rs. 5/- was deducted for a male and a proportionate amount from females and children. The above wage rates are applicable to hired labour used on both lowlands as well as highlands.

VI. COSTS AND RETURNS

Costs and returns associated with both lowland and highland farming in the Vavunikulam settlement during Maha 1977/78 and Yala 1978 seasons are analysed in this chapter.

A. PRODUCTION COSTS

6.1. TOTAL PRODUCTION COSTS

The annual gross production costs given in table 6.1. approximates to Rs. 12987/- per farm. This figure include both the cost of purchased inputs as well as the imputed values of farmer's own resources other than land, used in the main farm enterprises during the two reference seasons.

Table 6.1. Average Production Costs per Farm, Classified by Cash and Non Cash Costs - Maha 77/78 & Yala 78

	Maha 77/78			Yala 78		
	Cash Costs (Rs.)	Non Cash Costs (Rs.)	Total Costs (Rs.)	Cash Costs (Rs.)	Non Cash Costs (Rs.)	Total Costs (Rs.)
Low land	3422	1038	4460	896	416	1312
High land	2559	2334	4893	1188	1134	2322
Whole Farm	5981	3372	9353	2084	1550	3634

As far as production costs are concerned, highlands figure prominently in Vavunikulam compared to paddy and provides a contrast to the situation seen earlier at the other four study locations. Here, slightly over one half of the total annual production costs incurred per farm had been in respect of crops grown on highlands, where as in Pavatkulam the position was quite the reverse with only one tenth of total costs being on this account. The higher production costs on highland is largely a reflection of the intensive cash cropping undertaken on such lands with lift irrigation water. The intensiveness of production costs in lowlands and highlands are better seen when cost data are presented on a per acre basis. (Table 6.2.)

Table 6.2. Production Costs per Acre in Terms of Cash and Non Cash Costs - Maha 77/78

	Cash Costs		Non Cash Costs		Total Cost	
	Rs.	%	Rs.	%	Rs.	%
Lowland	1369	77	415	23	1784	100
Highland	1421	52	1297	48	2718	100
	2790		1712		4502	

On a per acre basis also, the gross costs incurred on highland allotments are considerably higher compared to those reported from lowlands. This differential arises mainly from the more intensive application of labour on highlands (See Table 5.1). The marked differences in cost structure between highland and lowland allotments are due to the degree of involvement of family labour in cultivation activities. Non cash costs are higher for highlands than for lowlands. This is because, as discussed earlier, family labour figure prominently on highlands as compared to lowlands. The marked prominence of cash costs in lowlands as compared to non cash costs is due to the greater use of hired labour and hired tractors (see table 5.2).

6.2. CASH PRODUCTION COSTS

Table 6.3 Percentage Distribution of Cash Production Expenses Classified by Inputs - Maha 77/78

Input Item	Maha Season	
	Paddy	Highland
	%	%
Hired labour	49	33
Tractor hire charges	35	40*
Cattle hire charges	2	2
Fertilizer	9	8
Seed & planting material	2	5
Agro chemicals	1	9
Others	2	3
	100	100
Rs. per farm	(3422)	(2559)

* includes some of the cost of lifting water. Seperate cost figures of pumping water were not available.

On a percentage basis, cash production costs incurred per farm show that the payments for hired labour and draught power as the two most important items. In lowland paddy, nearly one-half of cash costs had been spent on hired labour and a further one-third on account of tractor hire charges. Payments for material inputs such as fertilizer is not very high, representing only 9% of the total. In the case of highland crops, cost of lifting water, hiring of tractors as well as labour together account for about three-fourths of the cash costs. Agro-chemicals and fertilizer figure next in importance in the cash cost structure.

Cost data relating to hired labour was further tabulated according to important field operations.

Table 6.4. Hired Labour Costs Classified by Field Operations - Maha 1977/78

Field Operation	Lowland	Highland
	%	%
Pre Sowing operations	36	38
Sowing/planting	9	8
After care	13	13
Harvesting	26	32
Post Harvest operations	16	9
Total (%)	100	100
(Rs. per farm)	(1688)	(1247)

It is observed that field operations prior to sowing had absorbed one-third of hired labour costs. The other important operations taking a higher proportion of total hired labour costs were harvesting and processing of farm produce. These two tasks together had absorbed almost two-fifths of the total hired labour costs.

6.3. NON CASH PRODUCTION COSTS

The non cash production costs refer to the imputed values of

owned inputs used in production activities. A rental value for land used for production purposes was not computed.

Table 6.5 Non Cash Production Costs Classified by Types of Inputs - Maha 1977/78

	Maha 77/78	
	Lowland	Highland
	%	%
Family labour	57	80.0
Own seed material	18	02.5
Own cattle services	20	08.0
Own tractor services	01	00.5
Organic Manure	04	09.0
	100	100.0
Rs. per farm	(1038)	(2334)

The value of family labour used in the farms, forms the single most important item constituting non cash production costs. In lowland paddy, slightly over one-half of non cash costs arise from family labour used, whereas in highland- four-fifths of such costs had come from family labour applied for cultivation purposes. Value of owned seed material, and cattle used for field work are two other important items constituting this category of costs. Costwise, another important input applied on highland is the organic manure produced in the farms.

B. INCOME

6.4. GROSS INCOME

The average annual gross income realized in this settlement scheme is substantially high. During the crop year under consideration, the household gross income averaged to around Rs. 20,000/- per annum. This is almost thrice the average annual gross income realized by those in the Pavatkulam settlement during the same reference period.[1]

The per capita gross income of sample households amounts to about Rs. 3518 and is much higher than the national figure of Rs. 2827/- in 1978.[2] Among the five settlement schemes included in the Irrigation Modernization Project, it is only at Vavunikulam that the per capita gross income had exceeded the national figure. Due to the availability of lift irrigation facilities for systematic cultivation of crops on highland allotments, the conditions for field crop production here in both seasons are far better than those found in the other schemes. In this regard, specific mention may be made of the Yala season, when farm allotments remain fallow in some of the other settlement schemes such as Pavatkulam, many of the farmers in Vavunikulam are in a position to raise cash crops on highlands even on a limited scale. This situation has led to a better distribution of income over the two seasons here. Income from non-agricultural pursuits is extremely small - 3% of the annual income.

Table 6.6 Annual Gross Income per farm classified by season and source

	Maha 77/78		Yala 78		Annual	
	Rs.	%	Rs.	%	Rs.	%
Agriculture	14328	96	5761	98	20089	97
Non-agriculture	528	4	141	2	669	3
Total	14856	100	5902	100	20758	100

1 Vol. III - Pavatkulam - ARTI Research Study No. 38
2 Central Bank Annual Report, 1978

Seasonal income from farming vary rather widely, though not to the same degree as was the case in Pavatkulam. Around 72% of the reported agricultural income had been earned in Maha when both lowlands as well as highlands were cultivated. Though on a proportionate basis, the Yala incomes are rather low, the situation found at Vavunikulam is much more satisfactory, with households reporting an average income of about Rs. 5700/-. Infact, Yala income figures stand out very prominently here compared to the meagre incomes of Rs.379/- recorded in Pavatkulam households during the same season. As stated earlier, the availability of lift irrigation facilities has boosted the Yala cropping activities and this has resulted in high incomes during the dry season as well.

Table 6.7 Composition of Gross Income per farm from Agriculture

	Maha 1977/78		Yala 1978		Annual	
	Rs.	%	Rs.	%	Rs.	%
Lowland	5019	35	663	12	5682	28
Highland	9042	63	5011	86	14053	70
Livestock	267	2	88	2	355	2
Total	14328	100	5762	100	20090	100

The disaggregated data on agricultural income show the importance of highlands as a source of farm income. In this instance, it is around 70%. Lowlands are of much lesser importance in generating income, quite in contrast to the situation found in the other four settlement schemes studied earlier.

6.5. CASH INCOMES

The cash incomes as reported by sample farmers are presented in Table 6.8.

Table 6.8 Composition of Cash Incomes

	Maha 1977/78		Yala 1978		Annual	
	Rs.	%	Rs.	%	Rs.	%
Lowland	3213	27	217	04	3430	20.5
Highland	7957	67	4610	93	12567	75.0
Livestock	63	1.5	21	0.5	84	0.5
Wage Labour	368	3	121	02	489	3.0
Others	160	1.5	20	0.5	180	1.0
Total	11761	100.0	4989	100.0	16750	100.0

The average cash income realized per farm is about Rs. 16,750 per annum. This accounts roughly for 80% of the gross income. Highland allotments stand out again prominently having contributed to around three-fourths of the total. In Yala, the role of highlands is more striking with 93% of the cash incomes originating thereon. In contrast, the study on Pavatkulam showed that the settlers there have to eke out a living more by hiring out their labour during Yala, outside the settlement scheme.

Table 6.9 Cash Incomes Derived from Highland Allotments by type of Crops and Seasons

	Maha 77/78		Yala 78	
	Farmers reporting	Average cash income per farm reporting	Farmers reporting	Average cash incomes per farm reporting
	(%)	(Rs.)	(%)	(Rs.)
Chillie	54	9468	49	4063
Onion	19	2697	21	2299
Black gram	09	268	09	129
Gingelly	07	120	07	348
Tree crops	06	171	04	323
Vegetables	03	41	07	32
Green gram	01	--	01	14
Paddy	--	--	01	28
Cow pea	01	14	01	32

During the two seasons considered, chillie is seen as the premier cash crop grown on highlands. Around one half of cash incomes reported had been earned from chillie cultivation. Onion forms the second most important cash crop grown in both seasons and has contributed to one-sixth of the total cash income. Black gram and gingelly are minor contributors to cash income. Tree crops such as banana and mango too serve as a supplementory source of cash.

The income generating intensity of highlands and lowlands under the existing conditions is better seen when income data are presented on a per acre basis.

Table 6.10 Income per acre of Land Cultivated

	Lowland		Highland	
	Gross* Income	Cash Income	Gross Income	Cash Income
Maha 77/78	2007	1285	5023	4420
Yala 78	265	87	2783	2561

* Includes income derived from crops, other than paddy grown on lowlands

The gross incomes per acre for the two seasons also point out the relative stability of cropping on highlands. This is best seen in Yala when little or no lowland cultivation is undertaken. Even in Maha season, highlands had generated nearly four times the cash income reported from lowlands. Cash incomes from lowlands are low due to rather heavy home retentions of paddy for consumption within farm households (see 7.6). On the other hand, almost the entire harvest of chillie and onion enter the market for sale, thus boosting up the cash incomes from highlands.

6.6. NET RETURNS

The inadequate data base relating to costs and returns associated with individual crops grown under lift irrigation hardly permits a complete analysis of the relative profitability of paddy and other highland crops grown at Vavunikulam. However, in order to assess

the attractiveness of paddy vis-a-vis highland crops to settlers, a broad comparison of net returns to paddy and other crops grown on highlands is attempted here.

For this purpose, the net returns are defined as the gross value of output minus the cost of purchased or hired inputs, but not labour.

Table 6.11 Returns to Labour and Land from Paddy and Other Crops - Maha 77/78

	Lowland Rs.	Highland Rs.
Gross Income per acre	2007	5023
Cost of purchased or hired inputs per acre	698	952
Net Returns per acre	1309	4071
Total Labour Inputs per acre (days)	58	107
Net Returns per labour day (Rs.)	22.58	38.03

The average returns per labour day both in lowlands as well as in highlands are higher than actual wage returns prevalent in the area - Rs. 15/- per day. This suggests that, even if deductions were to be made for the notional returns to land, irrigation water and capital, farming on highlands at Vavunikulam would remain attractive by comparison with the alternative of wage-labour. Under the existing conditions - with restricted access to lift irrigation water, returns to labour and land from highland crops are extremely high compared to paddy. With very remunerative cash crops such as chillie and onion dominating, the returns to labour from an acre of highland crops is very nearly twice the amount realized from an acre of lowland paddy. The higher returns per labour day from highland crops can be attributed largely to the provision of lift irrigation facilities which have enhanced the productivity of both land and labour. This particular scheme has a comparative advantage for cash crop production due to a number of physical and environmental factors. Consequently, in such a

location , the availability of lift irrigation facilities to part of the scheme places farmers in a greatly advantageous position in promoting upland crop production. It is worth emphasising that, in order to realize such high returns farmers have to work much harder. With upland crops, the per acre labour input observed earlier was almost twice as high as was the case in paddy.

6.7. INCOME DISTRIBUTION

The distribution of annual cash income among settlers during the reference year is presented in Table 6.12.

Table 6.12 Distribution of annual cash income among project farmers - Maha 77/78 and Yala 78

Annual Cash Income per farm (Rs.)	% of farmers	Cumulative percentage	% of income	Cumulative percentage
0 - 1000	1	1	0	0
1001 - 2000	1	2	0	0
2001 - 3000	3	5	1	1
3001 - 4000	2	7	1	2
4001 - 5000	7	14	3	5
5001 - 6000	3	17	2	7
6001 - 7000	7	24	5	12
7001 - 8000	15	39	13	25
8001 - 9000	13	52	12	37
9001 - 10000	11	63	11	48
10001 - 11000	10	73	12	60
11001 - 12000	7	80	9	69
12001 - 13000	2	82	3	72
13001 - 14000	7	89	10	82
14001 - 15000	7	96	11	93
15001 -	4	100	7	100

With regard to income distribution, a redeaming feature in Vavunikulam is the absence of very low levels of income as was the case in Pavatkulam. The reported income data points to the

fact that four-fifths of the farm households studied had earned cash incomes of over Rs. 6000/- per annum and three-fifths had reported annual incomes of over Rs. 8000/-. Much higher incomes of over Rs. 12000/- per annum were seen in about one-fifths of the sample farms.

In concluding this discussion, the dynamic role of highland allotments in generating very high levels of income needs to be re-iterated. As repeatedly pointed out in the proceeding sections, the availability of lift irrigation facilities in this settlement scheme has made all the difference in generating very high income levels. Though limited in scope at present, the expansion of such facilities together with the improvements to be effected to the irrigation conveyance system under the modernization programme should make a lasting impact on the well being of the settlers in Vavunikulam. In this regard, stages IV and V of this settlement deserve priority consideration in future, as the settlers in them do not have satisfactory access to irrigation facilities at present.

VII. FARM SUPPORTING SERVICES

Facilities available at Vavunikulam for the supply of farm production inputs, particularly seeds, credit, fertilizer and irrigation water along with existing arrangements for agricultural extension and marketing of farm produce are presented in this chapter.

7.1. SUPPLY OF MATERIAL INPUTS

Two Cooperative Societies supported by six branches located within the settlement scheme handle the supply of principle production inputs such as seed, fertilizer and agro-chemicals to farmers. In the case of seed paddy, certified seed production is a responsibility of the Department of Agriculture. The farmer needs of seeds are channelled by the extension service mostly through the branch cooperative societies. According to data, farmer dependence on certified seed paddy is not very high as less than a fourth of the settlers had purchased such seed material during the Maha season under reference. Infact, farmers show a general disinterest for certified paddy seed. This is largely an outcome of poor quality of some of the seed supplied in the past. In this regard, a common complaint of Vavunikulam farmers is the presence of too many weed seeds in certified seed paddy issued to them. Other short comings raised by them were low germination and the presence of high percentage of inert matter in seeds supplied. This has resulted in a majority of settlers using their own seeds. Use of seed obtained on exchange from fellow farmers is also common. The rather thin spread of new high yielding varieties observed earlier (in section 4.2) may partly be associated with deficiencies in the certified seed paddy distribution programme as reported by farmers. Qualitative upgrading of certified seed paddy distributed in the area is an aspect that deserves attention for raising paddy yields.

Subsidized fertilizer for paddy is made available for purchase

through the two cooperative societies. Presently, the two fertilizer stores available within the scheme have a storage capacity of 1000 cwts. The storage space is inadequate to meet future demand. The unavailability of fertilizer at the branch cooperatives at the time required by farmers is a common complaint. Undue delays in indenting for fertilizer by branch cooperatives is often the cause for some of the delays. According to farmers, cooperatives had even resorted to some sort of rationing of fertilizer during the reference season due to their inability to meet the demand. As the season under consideration was not one of general fertilizer scarcity in the country, corrective measures at the level of the cooperative have to be considered for timely supply of this vital input.

Agro-chemicals, both weedicides and pesticides, are available in the cooperatives as well as in private shops in the area. Appliances necessary for spraying of chemicals were in short supply at the time of survey. The serviceable sprayers numbering only 35 available with individual farmers and 8 with cooperative societies are quite inadequate to meet the farmer needs, particularly in view of the stable cropping seen on some of the highlands.

7.2. SAVINGS AND CREDIT

Short term credit for agricultural production is obtained mainly from institutional sources - cooperatives and the local branch of the Bank of Ceylon. Due to relaxation of the lending criteria of agricultural credit in August 1977, a large majority of the settlers became eligible for production credit during the reference season - Maha 1977/78. Even defaulters of previous loans - 56% of the sample farmers became eligible for further loans. Thus over 85% of the settlers were able to obtain production credit averaging to about Rs. 2500/- per settler. Due to easy availability of institutional credit, non-institutional sources were of minor importance as a source of farm finance during this particular season. Yet for all, almost one fourth of sample farmers reported having borrowed paddy from friends and relatives

mostly for seed purposes. In such instances, repayment rate was reported as 2 bushels of paddy for every bushel borrowed - 100% interest per season.

The saving habit assessed in terms of the number of savings accounts operated is not very impressive. Only one fourth of the farmers reported as having savings accounts with financial institutions as shown below

Savings Accounts

Savings Accounts at:	Farmers reporting %
Rural Bank	16
Post Office	6
Bank of Ceylon	4
	26

7.3. FARM ADVISORY SERVICES

Dissemination of agricultural information to farmers is handled by an Agricultural Instructor and three village level Extension Workers (KVS). Two posts of KVSs remained vacant at the time of survey. The sanctioned cadre of Extension Staff is considered inadequate to provide satisfactory extension coverage here, particularly in view of the scope for development of highland crops. In the past, the limited technical personnel available had directed their attention more to paddy production problems. Extension work in animal husbandry is hardly seen though cattle rearing - mostly for draught purposes is common.

The degree of Extension Worker - farmer contact as reported by sample farmers is presented below

Percentage of farmers reporting as	Extension Personnel KVS (%)	AI (%)
Knew Extension Worker personally	73	8
Closely associated with him	57	52
Visited him regarding problems	63	61
Able to contact him when needed	63	63

Reasonable levels of association between extension workers and farmers is evident from above. However on matters relating to agricultural extension activities, the extension net work does not seem to have a great impact on the farmer. Survey information shows that the farmer awareness and participation in group extension activities such as conduct of training classes, demonstration plots and field days etc. is low. Only about 4% of those in the sample had attended any field demonstrations or group extension activities during the reference season. The print medium - leaflets and agricultural magazines etc. hardly reach the study area. Mass communication techniques - particularly radio programmes on agricultural topics could be more helpful, as almost one half of the sample farmers claimed to be regular listeners to agricultural broadcasts.

7.4. RURAL DEVELOPMENT SOCIETIES

Three Rural Development Societies are reported in Thunnukai and Padiyankulam area. Though nearly two fifths of the sample farmers responded as being members of such societies, a majority of them were quite unaware of the activities of such societies. A limited amount of work had been accomplished on a *Shramadana* basis in repairing minor roads and construction of public wells etc. using the assistance of food aid provided by the World Food Programme.

7.5. IRRIGATION MANAGEMENT

Similar to other irrigation schemes, Irrigation Department handles the distribution of water from the head works up to the field channels. The responsibility of maintaining the field channels lie with the farmers. However, at the time of survey, the maintenance of the entire channel system was in a neglected state and as a result an equitable water distribution system was not possible. The survey findings show, that about 10% of the farmers were not in a position to receive water from the channel system at all, while another 20% complained about inadequate supplies for cultivation of their lowlands. A majority of the farmers who had

severe water problems had their allotments towards the end of the distributory channels. The allotees in stages IV and V were the most seriously affected in this regard.

The normal practices prevalent in this scheme for deciding on the dates of water issues and cultivation operations etc. is through the water meetings held prior to the season. The Irrigation Engineer is charged with the responsibility of convening such meetings before each season. However, these meetings do not seem to be well attended by farmers and the time table agreed upon at such meetings is not strictly adhered to. Some of the farmers on the other hand, feel that water could be obtained when their fields are in need of water, sometimes outside the previously agreed schedule of water issues, if pressure - mostly political and other personal considerations are brought to bear on the correct quarters. This was the situation at the time of field surveys.

Water disputes are common in the Project area. 72% of the sample farmers admitted that they had water disputes in the year under consideration. Most of these disputes are due to the illicit tapping of irrigation water. The improper maintenance of the channel and inefficient water control are also contributory factors to above disputes.

Table 7.1 Nature of the water disputes

Cause of the disputes as reported	Percentage of farmers
	%
Illicit tapping of irrigation water	64
Insufficient irrigation water	20
Neglected maintenance of field channels	14
Other	04

Majority of these disputes are settled by the Colonists themselves, while some are referred to the Colonization Officers.

Water disputes reported to	Percentage of farmers
	%
Colonization Officers	28
Other Project Officers	40
Police	06
Other	04
Not reported	22

Lack of co-ordination among officials in various government departments operating within the project seem to have led to many problems in irrigation management and water distribution. Perhaps it is this reason that has led some farmers even to suggest the appointment of a specific officer to look after irrigation management.

7.6. MARKETING

Surplus farm production in the study area comprises of both paddy and highland produce including subsidiary food crops and fruits such as banana and mango. Substantial quantities of farm produce from highlands enter the market here, in contrast to the situation found in the other four settlement schemes included in the Irrigation Modernization Programme.

PADDY

As lowland cultivation is restricted only to Maha season at present, surplus paddy offered for sale is not large. Besides, due to the unavailability of subsidized rice under the rationing scheme from the end of 1977, the home retentions of paddy have increased and correspondingly sales outside the farms have dwindled. Only about a fourth of the Maha harvest was offered for sale and the average quantity sold amounted to 26 bushels per farm reporting sales.

Table 7.2 Pattern of Paddy Sales Among Settlers

Maha 1977/78

Paddy sales as a % of total farm output	Farmers reporting %	Amount sold per farm reporting (bu.)
No sales	06	-
1 - 19	04	40
20 - 29	08	43
30 - 39	21	36
40 - 49	26	51
50 - 59	12	75
60 - 69	08	88
70 - 79	08	72
80 - 89	03	109
90 - 99	02	114
100	02	159
	100	

The principle marketing channel of paddy is the cooperative net-work. A majority (84%) reporting sales had used mainly cooperative societies to dispose their production surpluses. Private traders as purchasers of paddy is insignificant as only a tenth of those selling paddy had used this channel. However, those making sales to cooperatives were not altogether satisfied with the purchase procedures adopted by these societies. The common complaints were irregularities in grading, mal-practices in weighing and delays in payments of proceeds of sale.

Table 7.3 Mode of Disposal of Paddy - Maha 1977/78

Mode of disposal	Farmers reporting %
Sales :	
Cooperatives	84
Private Trader	5
Payments in kind	8
Home retentions :	
Consumption	100
Seed Paddy	23

HIGHLAND CROPS

Highland produce constitute a large component of the surplus farm production offered for sale. The principle crops marketed are chillie, onion, black gram, green gram, gingelly and tree crop produce such as mango and banana. State Institutions such as Marketing Department, and the Markfed or any other State agencies are not represented in the study area for purchase of such items. The cooperative societies do not participate even in a limited way in the purchase of such produce. Consequently, the private sector handle almost the entire surplus farm produce from highlands. Since the items referred to here are produced over widely scattered farms in a settlement scheme with poor road conditions, the cost of assembling of marketable surplus is high. The high costs in assembling of perishable produce, like fruits and vegetables result in lower prices to growers.

Though limited market information becomes available to producers via radio broadcasts etc. such information can not be utilized to their best advantage mainly due to difficulties associated with transport of produce arising from poor road conditions. In the absence of institutional channels for marketing, the floor prices announced by the State are of limited use to growers in this location. The private traders who operate here appear to have established very close links with the growers over the years. According to growers, cash advances are made by traders during the cultivation season to meet both their production and consumption needs at least partially. Such loans are recovered at the time of harvest of highland crops. Fluctuating prices and short weights and measures applied by the private traders are some of the problems encountered by producers.

Lack of any organised facilities for marketing of milk is a great drawback here.

SUMMARY AND CONCLUSIONS

This report carries the findings of a bench mark investigation on economic, social and agronomic aspects of the Vavunikulam settlement scheme just prior to initiation of irrigation modernization activities in 1978. The study covers a randomly selected sample of 246 farm households in this settlement and refers to both Maha 77/78 and Yala 1978 seasons.

1. The command area of the Vavunikulam tank comprises of around 6,000 acres of lowland and 4,300 acres of highland. The arable lands here had been developed in seven different stages spread over a period of 12 years. Each allotment consists of 3 acres of lowland and 2 acres of highland except in some of the more recent settlements in stage V and VI.

   Agriculture is the main economic activity with over four-fifths of males and one fourth of females in the labour force reporting work in their own farms as the principle means of occupation.

   Within the settlement, the feeder roads are very poorly maintained and during rainy weather many of them become impassable. Existing transport facilities for settlers - particularly the bus service is inadequate. Poor road conditions and inadequate transport facilities have created problems for settlers particularly in marketing their farm produce.

   The settler population is estimated around 12,500 living in 2154 households. They are tamil speaking and a large majority of them (90%) had been drawn from Jaffna. The literacy rate is high with 90% having attended schools. Of the farm operators 91% are able to read and write.

2. Forty percent of the population are children below 14 years of age. The presence of a marked youthful population has direct implications particularly on the farm labour supply situation. Children of school going age were observed to begin working in their own

farms rather early. Besides, the school drop out rate shows an increasing trend as children proceed in grade. According to school authorities, about a tenth of the children enrolled in schools cease schooling almost every season and nearly one half of them miss regular school attendance during peak periods of cultivation.

Heavy investments committed to highland cropping under lift irrigation, is perhaps a major underlying reason for some parents to detain their children of school going ages to help them in their own farm work during school terms. The existing conditions hardly permit the youthful population to make a significant contribution to the economic stability of the settlement. As it is, the fixed land allotments offer very little scope for economic betterment of the members of settler families within the agricultural sphere. In such situations, it is imperative that non farm employment generation activities gain a great deal of importance in the future development programmes.

3. The available infrastructural facilities are unevenly developed across the settlement scheme The settlers in stage I, II and III had received rather liberal State assistance in the way of permanent dwelling houses, generous subsidies both for land development and sinking of food production wells etc. In addition, this category also had benefitted from lift irrigation facilities provided subsequently: Thus,the early settlements with access to both gravity irrigation for lowland paddy and lift irrigation for highland crops are well developed and intensive irrigated farming is seen on them at present. In contrast, the settlements established during later years in IV, V and parts of VI had received considerably less assistance from the State due to prunning down of subsidies and grants for capital work on grounds of economy. Besides, the later settlers being located further away from the tank suffer from many disabilities due to problems associated with supplies of irrigation water. Farmers in such settlement have no access to lift irrigation facilities at all.

Drinking water too is hard to get at these locations during the dry season. Lack of access to basic amenities such as water and housing has resulted in a sizable proportion of settlers in stages IV and V continuing to maintain permanent interests more in their villages of origin. Many such farmers are reported to be in residence on their allotments mainly during Maha when paddy cultivation is in progress. Often their dwellings consist of temperary cadjan huts.
At the time of survey most of the allotments in stages IV and V remained in a very poor state of development - in 70 allotments in stage IV, highlands were under scrub jungle.

Thus in implementing, the irrigation modernization programmes such short comings - lack of access to basic amenities in stages IV and V deserve special consideration.

4. In contrast to other four settlement schemes investigated earlier farming activities here show some diversity, with nearly two-thirds of the farms reporting regular cropping on both lowlands and highlands in Maha season. Chena cultivation is non-existent here.

Vavunikulam is rather unique in that cropping on highlands is well established largely due to the availability of lift irrigation facilities. Particularly in stages I, II and III, nearly 45% of allottees - 945, have access to lift irrigation either from irrigation channels or food production wells. In stages I, II and III, one irrigation pump is available in every third allotment, whereas in stages IV and V the corresponding ratio is 1:46.
A major problem faced at present, by those with lift irrigation facilities is the high cost of fuel. With the rapidly rising prices of both kerosine and diesoline, the cost of lifting water for irrigation of crops is becoming prohibitive. Since fuel prices are certain to record further increases in the future, the lift irrigation programme is faced with a rather uncertain future.

5. The proposal to introduce other field crops to paddy fields in Yala is not viewed with favour by farmers. Their preference is definitely for paddy, mainly in view of the need for rice for home consumption. Relatively low labour requirements for paddy is perhaps another reason favouring this crop. The unavailability of subsidized rice to settlers under the rationing scheme has also increased the demand for home produced paddy. This proposal deserves further examination in view of the intensive field crop production programme already in progress at this location. Any attempts to further expand field crop production in this settlement scheme is very likely to run into labour supply constraints. Even at present settlers experience difficulties in finding the necessary labour at the required times, especially in peak periods. Thus it is more logical to rectify the deficiencies in the available lift irrigation facilities rather than embark on new programmes over which farmer enthusiasm is quite low.

6. As a rule, only one paddy crop is taken on lowlands - in Maha season and during Yala, these lands remain idle. As a consequence, the lowland cropping intensity is low. During the reference year - 113%. In seasons of good rainfall, a majority of the settlers (around 90%) indicated adequate water supplies for paddy cultivation in Maha season. However,about 10% of the sample farmers reported extreme hardships in obtaining water from the channel system even during Maha season. A further 20% or so complained that the water supply was inadequate for lowland paddy cultivation. At the time of survey, the maintenance of the channel system was in a state of neglect and consequently, an equitable water supply could not have been achieved. In this regard, settlers in stages IV, V and parts of VI suffer the most. The illicit tapping of water by farmers upstream in stages I, II and III for cultivation of their highland as well as lowland has resulted in some problems at the tail end. The farmer attendance at water meetings is low. The time table, agreed at such meetings for cultivation operations are not adhered to by farmers at times. Water disputes are common

mainly due to illicit tapping of water. Infact,nearly three fourths of the sample farmers had got involved with such disputes during the year under consideration. Inadequate maintenance of channels and lack of proper water control devices have aggragated these problems.

A majority of settlers are in favour of rotational issues of irrigation water as a means of water conservation. In this regard, improvements to water conveyance system and installation of adequate number of water control devices throughout the distribution net work are considered as pre-requisites by the farming community.

Lack of coordination among officials in various Government Departments operating within the scheme also seems to have led to some of the problems in irrigation water distribution.

7. The principle forms of farm power used are 4 wheel tractors and neat cattle. Nearly one half of farmers rely solely on tractor for land preparation at present. Almost three fourths of tractors used are hired. The supply of tractors is considered adequate at present with the addition of about 41 machines under the Tank Irrigation Modernization Programme. Despite increase availability of tractors in the recent past, hire charges continue to rise. The hire rates for land preparation in 1980 was around Rs. 250/- per acre. Ready availability of neat cattle in the area had encouraged farmers to use more of them for second ploughing and subsequent operations. Even in the case of animal power, around one third of the farmers using animals had hired their requirements.

The settlers in Vavunikulam who are tamil speaking Hindus originating from Jaffna seem to have brought along with them, the tradition of using neat cattle and not buffaloes for farm work. This tradition may be attributed in addition to religious considerations of the Hindu population, the uncongenial surroundings for buffalo rearing particularly due to lack of water for animals to wallow in. With regard to farmer preference for draught power, a majority prefer 4 wheel tractors for field preparation due to the speediness of field operations.

The hire rates for neat cattle too have shown a sharp increase and is around Rs. 200/- per acre for land preparation at present.

8. Broadcast sowing of seed under wet land conditions is the principle form of planting. Dry sowing is lot more popular here, mainly in stages IV and V where the irrigation water supply is more problematic. However, the general preference of farmers is for broadcast sowing under wet conditions. With regard to transplanting, difficulties associated with irregular water supply and securing of required labour for this operation were raised as constraining influences.
An old high yielding variety H-4 is widely cultivated in Maha with nearly two thirds of farmers reporting this variety. Ability to withstand moisture stresses and perform reasonably well, under relatively poor levels of management have no doubt contributed largely to it's popularity. The newer varieties of Bg series particularly Bg 34 - 8 and Bg 11 - 11 are more prominently seen in stages I, II and III, with better water supply conditions. The pattern of varietal adoption observed here is indicative of a conscious attempt on the part of farmers to fit newer varieties more on the basis of the stability in water supply. Survey data also shows that the farmer dependence on certified seed is not high. Among deficiencies of certified seed mentioned were, low germination and presence of high percentage of inert matter in seed supplied in the past. The initiation of a programme to qualititatively upgrade the certified seed to be distributed in this settlement deserves consideration.

9. The benefits of fertilizer use in paddy is generally recognised here, with three fourths of the farmers having used some form of fertilizer in Maha season. The average quantity applied is round 1.4 cwt. per acre reporting, with urea figuring prominently for top dressing at tillering stage. A rather close association between fertilizer use pattern and availability of water is seen. With assured water supply in stages I,

II, and III, 70% of sample farmers had used nitrogenous fertilizers. Besides, many such farmers had used small quantities of basal dressings as well. Farmers in stages IV and V faced with poor water conditions provide a contrast. The proportion using fertilizer here is low, only about 30%. There appears to be scope for improvement of farmer knowledge on specific aspects of fertilizer use such as timing as well as correct combinations of different forms.
On the supply side, the undue delays in indenting for fertilizer by branch cooperatives is a matter for concern. Due to break down in supplies, the cooperatives had even resorted to rationing of fertilizer during the reference season, even though the season concerned was not one in which a fertilizer scarcity was experienced in the country.

10. The general standard of weed control is not very impressive except in Stage II. The principle form of combating weeds is by spraying weedicides - two thirds of sample during the Maha season covered. The rising costs of weedicides, have resulted in farmers using lower concentrations of chemicals than the amounts stipulated largely to accomodate such cost increases. This tendency is said to be a recent occurance and deserves some attention of the Agricultural Extension Staff.
The commonly occuring paddy pests are leaf roller, stem borer and paddy bug. Chemicals are regularly used for controlling them. The spraying equipment available within the scheme appears to be inadequate to adopt timely pest and disease control measures.

11. The extension coverage is inadequate as a number of vacancies in the KVS cadre remained vacant at the time of survey. There is little justification for such posts to remain unfilled in view of heavy investments proposed under the irrigation modernization programme. In general, the farmer participation rates in extension activities is not altogether high. Infact, the farmer awareness of group extension activities - conduct of farmer training classes, demonstration plots and field days

etc is quite low. Print medium - agricultural leaflets etc. do not appear to reach the study area. Animal husbandry extension work is hardly seen here though cattle rearing - mainly for draught purposes is common. Programmes for improvement of draught cattle, provision of facilities for artificial insemination and collection of milk etc appear to be areas needing closer attention.

12. The reported paddy yields had averaged to 43 bushels per acre in Maha season. As expected, the acre yields vary considerably depending on the water supply. Relatively higher yields of over 50 bushels per acre are seen under good water supply conditions in stages I, II and III. In contrast, with poor access to irrigation water in stages IV and V, the reported yields were in the region of 20 bushels per acre.
The availability of lift irrigation facilities has made it possible for farmers to harvest relatively good yields from highland crops. In the case of chillie, the reported yields had averaged to 10 cwt. of dried chillies per acre. Yields of c ion as reported is in he region of arour 1 80 swt. per acre.

13. With two seasons of cropping in a year, highlands are more important in providing employment to available man power, quite in contrast to the situation seen in the other four settlement schemes studied earlier. Besides, levels of labour application are also higher on highlands - 107 man days per acre in Maha. Lowlands provide much less opportunities for work with only one paddy crop in a year. The intensity of labour use on paddy crops is much less - 58 man days per acre in Maha. The Vavunikulam farmers had infact switched away from less labour demanding traditional pulse crops to more labour intensive cash crops such as chillie and onion due to availability of lift irrigation facilities.
Further more, due to double cropping of highlands the employment opportunities for farm labour had increased considerably mainly in stages I, II and III. Bulk of the labour input used

on highlands comes from the farm family, largely due to the need for attending to repetitive field tasks such as - earthing up plants, irrigation and water control, spraying and harvesting etc. On the other hand, in paddy due to high seasonality of agricultural operations, hired labour is used more extensively to meet peak labour demands. The level of labour application for paddy cultivation, appears to be influenced somewhat by the water supply conditions. Less labour has been applied under poor water supply conditions, found in stages IV and V -almost 20% less than the levels of labour use seen in stage II. The labour use differential between the two situations referred to here is about 14 man days per acre.

The modal daily wage payment for hired labour was around Rs. 15/- for a male, Rs. 12/- for female and Rs. 8/- for a child exclusive of meals.

14. Of the annual farm production costs reported (Rs. 12,987 per farm), around 72% had been incurred in Maha season when both lowlands as well as highlands were cultivated. The composition of cost structure in lowlands and highlands shows considerable variation depending on the degree of involvement of family labour for farm work. Non cash costs are relatively higher on highlands - nearly one half of the total, as more of family labour is used on them. Where as in lowlands, due to greater use of wage labour, cash costs are higher - three fourths of the total.

15. Highland farm produce of Vavunikulam enter the market in a big way, in contrast to the situation found in the other four settlement schemes studied earlier. The principle crops marketed are chillie, onion, black gram, green gram, gingelly, mango and banana and all such produce is handled by private traders. The accessibility to markets is handicapped due to very poor road conditions found within the settlement scheme. The growers here, consider the scheme of floor prices announced

by the State as of limited value in the absence of organized marketing arrangements. Fluctuating prices, particularly of fruits and vegetables and short comings in weighing and measuring of produce were the common complaints of producers. Improvement of road accessibility within the settlement scheme may be a partial solution to some of these marketing problems. With regard to sale of paddy, the branch Cooperative Societies serve as the principle marketing channel. Those making sales to Cooperatives were not altogether satisfied with the purchasing procedures adopted. The complaints of farmers refer mainly to irregularities in grading, malpractices in weighing and delays in making payments for paddy sold .

16. The gross incomes realized in this settlement scheme are substantially higher and averaged around Rs. 20,000 per farm per annum. This figure is almost thrice the average gross income per farm reported from Pavatkulam during the same reference year. The per capita gross income here amounts to Rs. 3518/- which is much above the national figure of Rs. 2987/- in 1978. Of the five settlement schemes included under this program, it is only at Vavunikulam that the per capita gross income had exceeded the national figure. Due to double cropping on highlands, income generating is more evenly spread over the year at Vavunikulam unlike in most of the other settlement schemes. This has resulted in a favourable impact on the living levels of farm households compared to Pavatkulam. Bulk of farm income, almost three fourths is generated in Maha season when both lowlands as well as highlands are under crops. Although the incomes earned during Yala are relatively small, when compared with Maha, the situation found at this location is noteworthy, with households surveyed reporting average incomes in the region of Rs. 5100 during the Yala season. In contrast, at Pavatkulam, the incomes are meagre during the corresponding Yala season - Rs. 377 per farm. Around 70% of the annual gross income is derived from highland crops grown under control water supply conditions from lift irrigation. During Yala, in the absence of paddy cultivation

in lowlands, the role of highlands in income generation is more striking with 93% of cash income originating thereon. Chillie is the premier cash crop having contributed one half of the annual cash incomes reported. Onion come next in importance, providing one sixth of the cash earned during the year. Pulse crops such as black gram and fruit crops - mango and banana provide supplementary income. A redeeming feature in the income distribution at Vavunikulam is the absence of very low levels of income as was the case in Pavatkulam. Almost four fifths of the farm households studied reported annual cash incomes of over Rs. 6000/-. In this regard, the dynamic role of highland allotments in generating very high income levels needs to be re-iterated. The availability of lift irrigation facilities in this settlement scheme has contributed to this situation.

As a concluding remark, it has to be emphasized that due to the ever increasing cost of fuel used for lifting water, the prosperity of settlers at Vavunikulam is faced with a great deal of uncertainity. This uncertainity hangs out not only over Vavunikulam but also in other locations in the Dry Zone where similar lift irrigation programmes are in operation. Thus it is of utmost importance to find more economic and appropriate methods of lifting water for crop production. Traditionally, human labour and draught animals have been the power source for water pumping in Jaffna district, but during the last two decades these traditional sources have been replaced by more convenient fuel operated pumps. However with the recent escalation of fuel prices, - both diesel and kerosine, lifting of water using fossil fuelled pumps is becoming uneconomic. Thus alternative energy sources for lifting water is a priority need and renewable sources such as animal and solar power as well as wind power need to be explored.

In recent years, the use of solar energy for lifting water in small farms has received considerable attention particularly

in India and Pakistan. Though solar pumps have a considerably higher capital costs than fossil fueled equivalent size units, their running costs are near zero. Pumping costs using solar pumps vary almost directly with initial costs where as in the case of diesel pumps in addition to installation costs, fuel cost are a significant factor in the unit cost of irrigation water. Both in United Kingdom and United States of America as well as in neighbouring India and Pakistan, the design of low cost solar water pumps has received considerable attention. The solar pumps, currently under tests in Pakistan are said to be specifically geared to requirements of small farmers with holdings of about two acres. In this context, it is worthwhile for the relevant authorities in Sri Lanka to keep a lasting interest on such developments ,as the capital cost of such pumps are expected to fall significantly during the next few years. The limited range of commercially available solar pumps that are being demonstrated with success in India and Pakistan are worth a trial under local conditions as well.