SHIFTING FARMING - TOWARDS STABILITY

A Study of Four Rainfed Farming Systems in Sri Lanka

Research Study No. 66

February 1986

AGRARIAN RESEARCH AND TRAINING INSTITUTE,
114, Wijerama Mawatha, Colombo 7.

SRI LANKA

SHIFTING FARMING : TOWARDS STABILITY

A Study
of
Four Rainfed Farming Systems
in Sri Lanka

Fredrick Abeyratne
H.P.M. Gunasena
D. Tennakoon

Research Study No. 66 February 1986

Agrarian Research and Training Institute
114, Wijerama Mawatha
Colombo 7
Sri Lanka

FOREWORD

The Chena or 'shifting' (cultivation) has been a predominant form of agriculture in Sri Lanka, especially in the Dry Zone, from time immemorial. The basic feature of this system is the felling of jungle land with an average extent of 2-3 acres per unit and exploiting the natural fertility of the soil for a period of about 3 years to grow a variety of crops. When the land gets impoverished the farmer abandons it and allows it to fallow and clears a similar plot and repeats the same process. Therefore, it is a system of 'land rotation' rather than 'crop rotation' as practised in modern agriculture. The system is characterised by its low input use and risk-avoidance by growing many crops in mixtures. The unsatisfactory elements of this system of farming are the inefficiency of the land use, waste of human labour and the lack of any scientific approach to the production of crops. The most damaging feature of chena farming, of course, is the damage it does to the ecology and environment.

When land was available in abundance and the population pressure was not so high, the chena system of cultivation was accepted by the government and it formed a component of the farming system and a subsidiary occupation for the large number of paddy farmers. The situation changed rapidly since nineteen sixtys due to various reasons. Firstly, with the increase in population the demand for land was so high that it became an unacceptable practice of land utilization.

Secondly, the environmentalists began to highlight the damage done to the ecology and the environment by this form of slash and burn of the jungle. Thirdly, when the imports were restricted due to foreign exchange difficulties and the chena crops, particularly cereals and pulses, emerged as marketable commodities, enterprenuers entered the area of chena farming, cultivating large extents of lands aggravating the problem. Hence the question of restricting the chena system of cultivation and encouraging a more stabilised form of highland cultivation received the attention of the government in the last decade.

In late 1980, a proposal was received from the Centre for South Asian Studies of the Cambridge University, Great Britain requesting our assistance to carry out a study on sociological aspects of chena cultivation in Sri Lanka. As agronomic and economic potentials of chena cultivation are also very important inter-related areas for policy formulation, we discussed the matter further with Cambridge University and came out with a joint proposal to carry out a study integrating the social, economic and agronomic aspects of chena cultivation. This report is the result of that study. Unfortunately, the report covers only the agronomic and economic aspects as the sociologist who was nominated by the University of Cambridge preferred to carry out his own study without much collaboration and interaction with the agronomist and economist. However, his findings have been reported as a separate document under the title "Policy Dilemmas for Unirrigated Agriculture in Southeastern Sri Lanka" by the Centre for South Asian Studies.

The study was carried out by Dr.H.P.M.Gunasena, Professor of Crop Science and Dean of Agriculture in the Faculty of Agriculture of the University of Peradeniya and Mr.Fredrick Abeyratne and Mr.D.Tennekoon Research & Training Officers of ARTI. In this report the authors have discussed the system as prevalent in the Moneragala and the Hambantota districts and made certain recommendations for the benefit of the policy makers. Their recommendations especially with regard to the appropriate farming systems, extension, farm power and marketing aspects of chena cultivation are worthwhile considering when attempting to stabilise chena farming. My thanks are due to the two researchers for their very valuable effort. I also wish to express my deep gratitude to Dr.B.H.Farmer, Director, Centre for South Asian Studies, University of Cambridge for initiating this study and the constant interest he showed during the course of the investigations.

The ARTI component of this study was funded by the grant received from Swedish Agency for Research Cooperation with Developing Countries (SAREC). The Cambridge component was funded by the grant received from the Overseas Development Administration. Our thanks are due to these Agencies for their generous support to make the study possible.

T.B.Subasinghe
DIRECTOR - A.R.T.I.

ACKNOWLEDGEMENT

We take this opportunity to express our gratitude and appreciation to all those who contributed in various ways to the accomplishment of this research programme successfully. Some of them, in particular, need special mention. A special word of appreciation to both Mr. T.B. Subasinghe, Director of Agrarian Research and Training Institute-Sri Lanka; Dr. B.H. Farmer, Director of the Centre for South Asian Studies, University of Cambridge for their encouragement and support given from the inception of the project up to its completion.

Regional officials of the Dept. of Agriculture, Dept. of Agrarian Services, and Grama Sevaka Officers with the official authority in the study area, extended their fullest co-operation throughout the study programme. We should extend our thanks to the farming community in the study area, for their patience and hospitability extended to the research team about one year, in the field.

We also wish to acknowledge the ARTI research staff: Dr. R.D. Wanigaratne, Deputy Director-Research, APE Division, Mr. A.S. Widanapathirana, R&TO and Miss. T. Sanmugam-Deputy Director, Information Centre, for offering valuable suggestions in the sample selection, information, reporting, etc., Dr.C.R. Panabokke gave some valuable comments on the final report. We should mention the name of Mr. Wilfred Ranasinghe, Librarian-ARTI, for editing the final draft of the report. Mr. S.B.K. Bandara, Information & Publication Officer-ARTI, deserving a special word of appreciation for copy editing the final draft.

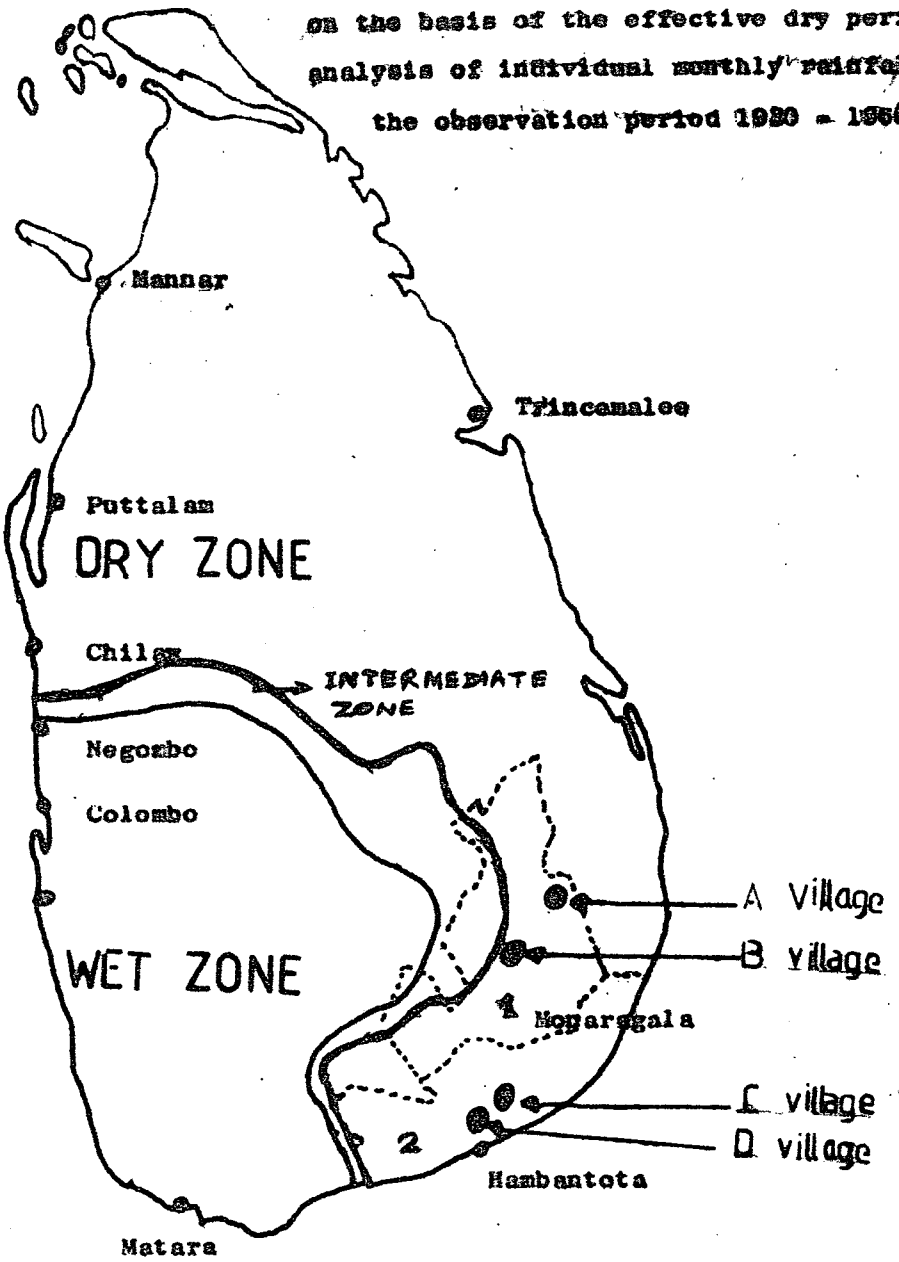
Our thanks are also due to Mrs. Bawa for typing the draft and to Mr. Palitha Gunaratne for preparing the script for publication.

Fredrick Abeyratne
D. Tennakoon — Production Economics and Extension Division/ARTI

Prof. H.P.M. Gunasena - Faculty of Agriculture, University of Peradeniya.

CONTENTS

The division of Ceylon into Wet Zone and Dry Zone on the basis of the effective dry period and by the analysis of individual monthly rainfall totals for the observation period 1930 - 1960.



1. Monaragala District

2. Hambantota District

Map No. 1.
MAP OF SRI LANKA SHOWING STUDY DISTRICTS AND AGRO CLIMATIC ZONES

Source: Adoptpd from Manfred Domres, The Agroclimate of Ceylon.

Chapter One

INTRODUCTION

I.I TERMINOLOGY

In order to understand the implications of this study, one should have a clear idea about the terminology used in this report. Irrigated agriculture in this country is almost synonymous with paddy cultivation and often paddy cultivation is identified as a lowland activity. The clear distinction in this particular type of farming is that paddy is grown under inundated conditions, where water is supplied to the crop by gravity irrigation.

The other type of cultivation we are mostly concerned with in this study, is highland farming, ie. cropping that is entirely dependent on natural rainfall. Whereas the earlier type of agriculture is practised mostly in ill-drained soils like low humic gleys, highland farming is in well-drained soils like reddish brown earths, immature brown loams,etc.

The type of cultivation practised under highland conditions could be classified again giving consideration to a very distinct character, namely the fallow period (ie. length of period the land remains uncultivated). This aspect is fundamental to the whole study and would be discussed at length at a later stage. This fallow period is connected with a type of cultivation involving the rotation of land which is commonly termed as "shifting cultivation" or "chena cultivation" (Ruthenburg, I976). In this type of cultivation the length of the fallow may well range from a minimum of one cultivation season to as much as I5-20 years or more, depending on the pressure for land.

The second type of highland cultivation takes place where there is no rotation of land. Under this situation any permanent cultivation of less than ½ (half) an acre which has a permanent dwelling house may be classified as a

home garden. Large extents which range from more than ½ acre to about IO acres may be classified as permanent highland farms. Home gardens may consist of mainly perennial tree crops. A diagrammatic presentation of various systems of farming is given in Fig. I.

Larger holdings which may or may not have a permanent dwelling house on it, may consist of perennial tree crops as well as annual crops. In the case of larger holdings, the classification tends to get complicated when the ownership of land is also considered. When the farmer holds the title deeds of the land, it is deemed to be an owned highland farm. But more often than not, in case of fairly large extents of holdings, the farmers have no ownership rights at all. In fact, they are owned by the government. Technically to cultivate these lands one needs a permit. Yet, such lands are cultivated without permits. In most instances, these holdings have, at one time, been under chena cultivation, and for reasons that will be outlined later, they have become stable agricultural holdings without being fallowed. Nevertheless, though it is a misnomer, farmers still tend to identify such holdings as "chena farms". For the purpose of this study, however, unless otherwise mentioned, this type of farms will be called stabilized highland farms.

The need to obtain permits becomes important in the case of chena farming as it involves clearing of jungle. The law allows cultivators to clear only shrubs of less than 6 feet in height and only two acres per household. As a result of this law, certain farmers cultivate with permits as well as without permits, under the chena system of farming.

I.2 ISSUES

Having identified the different systems of highland farming, the next section would concentrate on a literature review which will highlight the important issues involved in the present study.

What is most important, as far as the chena farming is concerned, revolves round two major factors:

I. Rate of deforestration under human influences,
2. Rate of reforestration under natural conditions (long fallows).

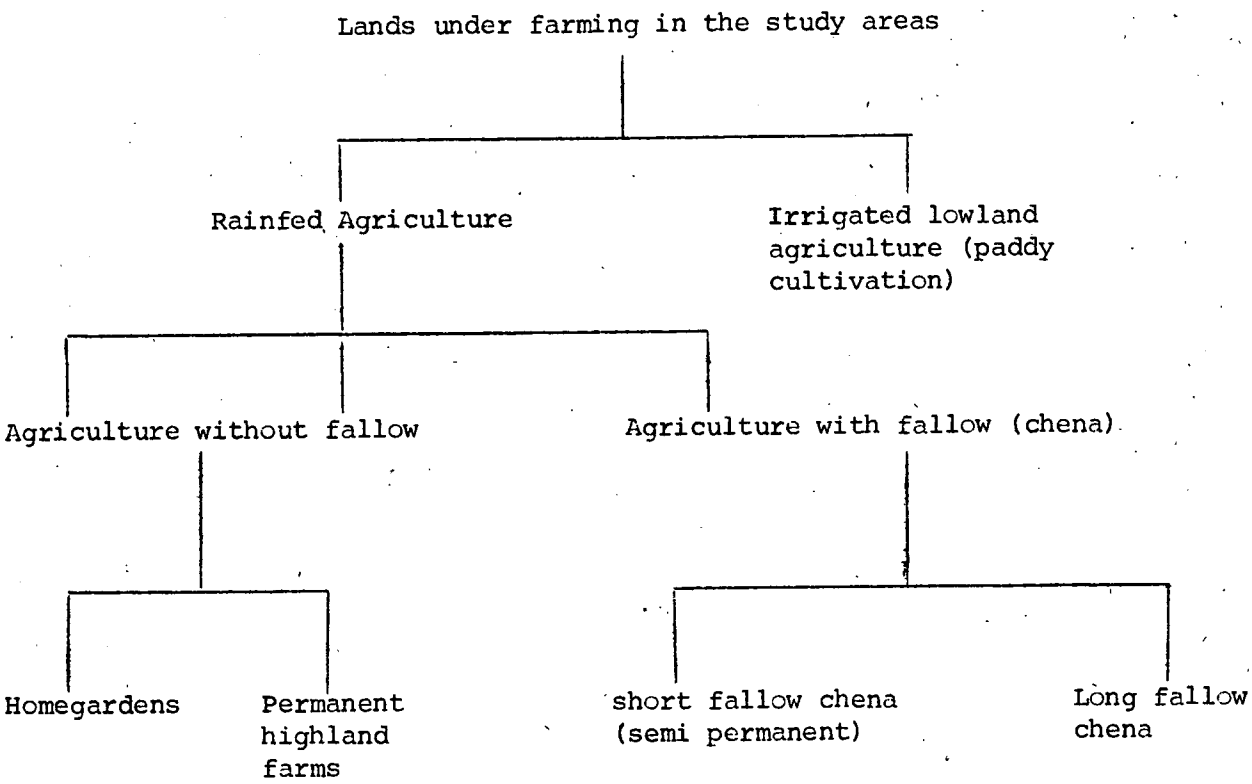


Fig. 1 : Systems of Land Use in the Study Area

These two main issues are very important since we are constrained by the unavailability of jungle land and the increase of population.

It is difficult to calculate exactly the forest land area that is periodically cleared for cultivation. A recent World Bank Circular (1979) has indicated that there are about 2.5 million acres of land under shifting cultivation in Sri Lanka. It is hard to say whether this acreage represents the annual rate of jungle clearing as it may well include a portion, which though identified as 'chena' farms, remains under stable agriculture and such lands which are under fallow.

Taking the availability of land as the most important variable, it is reported that the total forest area in the country is just about 25 percent of its total area (Sri Lanka Swiss Satellite Image Project Survey-1981) and this figure is just sufficient to maintain the balance in the eco-system. However, this has to be viewed with due regard to the fact that only a decade ago, the forest cover was 40 percent of the total area and it is predicted that by 1990, the forest cover would decline to about 10 percent if the present rate of forest clearing and reforestration continues. Hence, clearing of forests for highland cultivation and its implications constitute the central theme of the present study.

Having identified the approximate extents of land clearing taken up by this particular type of annual cropping, it is important to understand the contribution of this sector to the national economy and its implications.

For this reason, the ensuing discussion will focus more on aspects of chena farming or situations where jungle is cleared on a shifting basis for purposes of cultivation. In the present Sri Lanka systems of agriculture, apart from paddy farming and home gardening in small extents of lands, the other leading form of agriculture in the dry zone is chena farming. In this type of farming, jungles are cleared during the months of June and July and burnt after about a month, i.e. September. Once the land is cleared of any unburnt parts of trees, the field is ready for sowing in mid September with the first showers of the North East monsoonal rains (Maha or wet season). This piece of land is cultivated for two or three seasons and is then abandoned for a period ranging from 2 years to 15-20 years, depending on the extent of pressure for land.

This form of shifting agriculture has been existing in Sri Lanka for centuries and even today it plays a leading role in the Sri Lankan economy. In the past, it was a form of agriculture looked upon as one which met the subsistence needs of farming families. There was no danger in this system as there were no immediate implications from the point of view of economic use of land. For example, chena farming as practiced in ancient Sri Lanka, was part of an integral system since the farmer was dependent on all categories of land under cultivation for his subsistence needs (Abeyratne,1956). The forest was shared by the village and clearing of forest land took place with mutual understanding. Since the pressure on land was minimal, ample time was allowed for fallowing and regeneration of the forest. Therefore, questions relating to the maintenance of soil fertility, weed control, environmental preservation,etc. did not arise. Chena farming was done only for subsistence needs and it was in perfect harmony with the eco-system. It was also a socially acceptable practice.

However, this harmless situation changed over the years. Population pressure was growing gradually harder in the dry zone. As a measure to ease this pressure since late 1930s settlement schemes were started whereby peasants from the wet zone were resettled in the less inhabited dry zone. This process naturally increased the pressure for land. With the introduction of the Crown Land Ordinance of 1840, the forest land hitherto freely shared by the village, became the property of the Crown. Thus, the physical unity was lost (Abeyratne, 1956). This resulted in haphazard clearing of jungle land. Added to this situation, with the country facing food shortages and foreign exchange limitations in 1960s and 1970s, the government embarked on food production campaigns and consequently most of the food crops were grown in the highlands under chena cultivation. Taking advantage of this situation, many middle class businessmen exploited the land in the dry zone by clearing vast extents and then abandoning them without paying due consideration to the conditions vital for the regrowth of forests. All these processes have been slowly but surely contributing to the destruction of a vital natural resource of our country, the forests. Such practices eventually have resulted in -

(1) the formation of 'waste land' (Jochim & Kandiah, 1948) with detrimental repercussions on the balance of the ecology as may be observed from the changes in the rainfall pattern (Brohier, 1975), and also in timber shortages and threats to wild life (Gunaratne et al., 1980), and

(2) in migrants more specifically businessmen exploiting the land indiscriminately for commercial purposes rather than in poor peasants within the dry-zone resorting to chena cultivation, often evicting small farmers and creating a class of landless labourers.

Under these circumstances, although one may tend to dismiss chena farming as a wasteful type of agriculture (Yalman, 1967), we have failed to understand that this system of farming has been undergoing a transformation over the years. In fact, one could observe that from a truly shifting system of cultivation, a semi-stable form of highland farming is being evolved under varying conditions. Accordingly, subject to the availability of and the pressure on forest lands, a certain level of stabilization is taking place. Therefore, such issues as the other circumstances that have created this situation and the impact of this situation on the productivity, need to be studied.

The situation gets more complicated when chena farming is practised concurrently with paddy farming, especially in the irrigation settlements created as a recent phenomenon. Many theories exist with regard to competition for labour (Silva, 1977; & Harris, 1977) and the use of resources that could rise when both types of farming are simultaneously practised. This is another major issue that has to be studied in detail. These issues have initiated this study which is detailed in the next section.

1.3 Objectives of the study and methodology

Objectives

This study aims to provide both quantitative data and models for a range of characteristic situations in which highland farming takes place in Sri Lanka today, in order to furnish the necessary information and orientation for those responsible for policy planning. More specifically the study aims to integrate (a) an economic analysis with (b) an agronomic input so as to report on their implications for policy making.

Although we would be discussing a range of situations where highland farming is one component, special emphasis would centre around chena farms, except in one situation where highland farming is practised with a minimal fallow period or none at all.

Thus, more specifically, the objectives of the study are

1. to assess and explain the variations in the standard of living of the population, vegetation use and the economic role of highlands in various types of settlements, according to the degree and the type of dependence on highlands. It would be desirable at this stage to determine the varieties of crops as may be suited for various land classes on a stabilized system of dry land cultivation, in terms of not only the cultivators' perceived economic interest but also of agronomic stability.

2. to specify in these terms the circumstances which might impel an individual household or a community to move from one pattern to another, particularly from truly shifting chena cultivation to a semi-permanent and permanent highland farming, associated with cash cropping.

3. to assess the effects of changes in external and internal conditions such as population increase, immigration, variable harvests, improvement of the market, credit and transport facilities or national pricing policies on these situations.

The agronomic aspect will be investigated with the objective of studying -

(a) cultivation practices in relation to rainfall variability and the effectiveness of the use of rainwater for cropping, the commencement of cultivation and measures taken for soil and water conservation, if any, and efforts towards maintaining soil fertility for continuous cropping in cases where the fallowing period is alredy restricted to a few seasons or none at all. It also aims to study the long-term effects of chena cultivation on soil properties, in relation to soil degradation and regrowth of vegetation on the subsequent crop yields.

(b) the agricultural organisations required for the stabilization of the chena system of agriculture - identifying the type of crop varieties that would perform best in the various agro-climates, and the pattern and system of cropping that will maximise the utilization of all available resources namely capital, labour land and other physical resources.

Methodology

Data collection for the above study covered the two major cultivation seasons, i.e. 1982/83 Maha season and 1983 Yala season. The methodology adopted was as follows:

1. A representative sample from each location was surveyed with the aid of a questionnaire in order to get information on the following aspects:
   (a) Household characteristics
   (b) History of cultivation
   (c) Attitudes on changing of the system
   (d) Attitudes towards the government policy and other environmental changes
   (e) Cropping patterns
   (f) Agronomic calendar and commencement of cropping in different seasons
   (g) Use of rain water, and soil and water conservation aspects
   (h) Crops grown, their yields performance over several seasons and years, and also crop failures
   (i) Use of any agro-technology eg. input use, agronomic practices marketing of produce etc.
   (j) Signs of soil degradation, properties of soils, reinfestations of natural vegetation.
2. A monitoring (farm record keeping) exercise of a selected sample from the initial main sample. Here investigations were carried out to collect the following information. (See Appendix for schedules used).
   (a) Labour use pattern
   (b) Land use and land ownership pattern
   (c) Input/output data

(d) Income/expenditure, savings/debts

(e) Food habits and expenditure on food, etc.

3. Apart from data generated from the questionnaire survey, specific soil testing as well as collection of secondary data from published materials were undertaken for the purpose of the agronomic study.

4. Secondary data from various reports and papers were collectedboth from government officers within study locations as well as from places like the museum and the National Archives Department.

Study locations

Although chena cultivation is widely practised throughout the dry zone, the study team decided to concentrate on the South-east quarter of Sri-Lanka. The main reason for this selection is that these areas have the biggest potential for rainfed highland farming in Sri Lanka. Although chena cultivation is practised extensively in the North Central Province of Sri Lanka, much of it has already come or will come under irrigation schemes in the future. Many studies on various aspects of rainfed highland farming in the North Central Province have been already carried out (Gunaratne et al, 1976). Therefore, a similar study in the South-east Sri Lanka is very important. The fact that there is a great scope for highland farming in the area is also an equally important reason for such an exercise in the present context.

Two districts namely Hambantota and Moneragala on the South-east of Sri Lanka were selected. Hambantota district was specially selected as both lowland paddy and highland farming (under shifting conditions) are practiced there. Moneragala district on the other hand, was exclusively selected to study the highland system at two extremes (this system does not include the paddy component), ie. one which includes the classical type of chena cultivation with long fallows and the other which shows signs of more stability with very short fallows or no fallows. Although Hambantota district is entirely in the dry zone, Moneragala district lies partly within the dry zone and partly within the intermediate zone based on the agro-ecological classification of Sri Lanka. However, both study locations are in the dry zone, though only a part of Moneragala district comes within it. (The agroecology of these two districts will be discussed later).

The criteria used for the selection of villages were two-fold:

(a) Level of stabilization of the highland farms, ie. length of the fallow period.

(b) Level of dependence on the highland farm.

The following villages or schemes within the two districts were selected in order to study specifically the different and contrasting sysems of land use.

1. MONERAGALA DISTRICT

(a) Kahambana : This village practises the classical type chenas, with no irrigated paddy cultivation depicting total dependence on chena for subsistence,

(b) Mahakalugolla : This village practises almost stabilized form of 'chena' (highland) with no irrigated paddy cultivation. However, its nature of stability and better accessibility to markets depict a better level than the mere subsistence level.

2. HAMBANTOTA DISTRICT

(a) Gannoruwa : This is a purana (traditional) village with a small tank, where farmers practise irrigated paddy cultivation as well as chena cultivation. In this system, the farmers are dependent on both paddy and chena for their subsistence. Since paddy cultivation takes place only during Maha (Wet) season, the risks are high due to water shortages, thereby giving a prominent place to chena.

(b) Badagiriya : This is a major irrigation settlement. Although it is classified as such, the Badagiriya tank has a command area of a little more than 200 acres. Yet, there is uncertainty regarding the availability of irrigation water for the Yala (dry) season every year. Therefore, highland cultivation plays a major role in the economy of the people of this settlement. However, as the size of the irrigated allotment is larger than that at Gannoruwa, the dependency on chena is comparatively less. By and large, peasants are more dependent on irrigated paddy cultivation.

SAMPLING PROCEDURE

(a) Questionnaire survey :

No attempts were made to stratify the sample as the intention was to explain certain variables that are unique to a particular situation. Given the constraints of availability of funds and manageability, it was decided to limit the total sample to about 200 households within the four villages. Certain weightage was placed on the sampling procedure depending on the total population of each location. However, when the population was very small, for instance less than 50, a total enumeration was conducted and in cases where the populations were large, a 20 percent sample was drawn on a randon basis.

(b) Sample frame :

There was some difficulty in using a uniform sample frame for all the villages. In the Hambantota district, as all the farmers cultivate paddy under irrigation, the paddy lands register maintained by the Department of Agrarian Services covered the total population. Therefore, the paddy lands register was used as the sampling frame for Badagiriya and Gannoruwa with the assumption that all the paddy farmers cultivate highlands as well. However, in the Moneragala district very few farmers had paddy lands and, therefore, the paddy lands register was not complete enough to be used as a sample frame. The next available alternative was the highland register. This was possible in the case of Kahambana as it is a 'purana' village where almost all the households owned at least a small piece of highland which is listed in the highland register. But in Mahakalugolla, as the village consisted mainly of migrants from nearby villages, most of them did not own land. Thus, the land register was not a complete record of all the households. Under these circumstances it was decided to use the householders' list maintained by the Grama Sevaka (village worker) attached to the Siyabalanduwa Assistant Government Agent's Office. This list may, however, contain some non-farm households as well. We had to assume that almost 100 percent were farm households, which was factual. However as a precaution a reserve list to exclude any non-farm households from the sample was also prepared.

In Badagiriya, which is a major irrigatlion scheme, we concentrated on the headworks, with the objective of getting a sample assured of irrigation water for cultivation of paddy as compared with the tail enders. Therefore, the paddy lands register of the D 1 Channel farms was used as the sample frame.

On the basis of the above sample frames, the following numbers were selected as random samples. Specifically, farmers who cultivate highlands were selected. In the case of a farmer cultivating paddy with no highland farming, a replacement was found from the reserve list.

TABLE 1 : POPULATION AND SAMPLE NUMBERS SURVEYED

District	Village	Total number of households	Number in the sample enumerated	As a % of the total population
Moneragala	Kahambana	36	36	100
	Mahakalugolla	282	48	17
Hambantota	Badagiriya	298	57	19
	Gannoruwa	104	48	46

From each random sample, 20 households were selected, again on a random basis, for the purpose of the farm record keeping exercise.

Chapter Two

SOCIO-ECONOMIC INDICATORS UNDER VARIOUS TYPES OF HIGHLAND FARMING

This chapter contains particulars with regard to demographic characteristics, educational standards, housing and sanitation, ownership of farm household assets etc. of the four different study locations surveyed namely

(a) Irrigated paddy and mainly chena based farming economy - Gannoruwa
(b) Mainly irrigated paddy and marginally chena based farming economy - Badagiriya
(c) Mainly chena and marginally rainfed paddy upland paddy or (godakumbura) based farming economy - Kahambana, and
(d) Chena and stabilized highland farming based farming economy- Mahakalugolla.

2.1 SYSTEM 1 : Paddy and chena based farming economy (Gannoruwa)

The village which is classified as a purana (traditional) village is located ten miles North-East of Hambantota town. Hambantota is the major administrative-cum-commercial town centre closest to the village. In the past the old Gannoruwa (purana gama) was a village of few farm families (10 to 12) situated within a dense forest area and was linked with Hambantota town by a cart track. Then the village economy was mainly based on chena (hena) as well as on irrigated paddy (kumbura). A tract of 40 acres of paddy lands was cultivated under a village tank (mostly only Maha season was cropped) and about 60 acres of chena lands were annually cultivated by clearing the forest near the village.

Purana gama - traditional village
Chena or hena - Fields where shifting cultivation is practised
Kumbura - Paddy field

Due to low population densities it was feasible to practise long fallows of about 15 years or more. Paddy was mainly produced for home consumption. Chena crops such as gingelly and mustard were produced for the market while others like kurakkan, maize, meneri etc. were produced for both consumption and marketing. Sometimes the surplus of these crops was stored in an atuwa (local granary) until the prices in the market became more favourable. Each family had at least three separate granaries constructed for cereals such as kurakkan, maize (badairingu) and paddy (vee). The storehouses constructed for kurakkan and maize were made of wood and paddy straw (piduru) or cadjan (pol-atu) or palm fronds (thalatu).

The building of grain storehouses and maintaining them had been an integral part of the family labour activities, because each family was responsible for maintaining grains in quantities essential to feed a family until the next seasons crop is harvested. Generally some chena crops such as mustard and gingelly were not stored; they were sold to traders who came to the village or to shops in the town. When there were enough quantities of grains which could be marketed, a group of farmers would get together and organize bullock carts to transport the goods to the nearest town. Before selling the farmer would check the prevailing price and would sell to the highest bidder. They usually buy cloths, salt, soap, dry fish and other essential needs from the towns. This traditional system of peasant life in a purana village, as briefly described above, was almost self-sufficient. However, during the last two to three decades there have been rapid changes towards urbanization due to government involvements.

Although the rehabilitation of the village tank as well as the introduction of new technologies had a big impact on paddy production, very often failure of rains resulted in the loss of the paddy crops. Hence, produce from chena farming played a major role in meeting the farmers' essential requirements. The cart track from Hambantota town to this village was tarred 15 years ago and now public transport is available. A primary school was established in this village about 30 years ago, which was upgraded to secondary level about 15 years back. A co-operative shop had also been established in the village at about the same time. The village has a sub-post office too. The infrastructural development has resulted in the village becoming so exposed to the outside world

that the farmers are now growing crops such as chillies, ground nuts, cowpea and green gram which have commercial status.

2.1.1 Demographic characteristics

The village has 104 farm households with an average size of 5.68 persons. Of the total families, about one fifth comprised of seven members or more while 8 percent were small families of four or less. The majority of the families, considered as families of medium size (between four and seven members), accounted for about 74 percent of the total number of households. Almost all the households were engaged in agriculture for their livelihood.

2.1.2 Age and sex distribution

The age-sex composition of the sample households shows no difference compared with the other rural areas of the country. As much as 42.9 percent of the total population is under 14 years of age. The active population (15-65 years) is 53 percent of the total.

The masculinity ratio (male-female ratio) shows a slight male dominance where the number of males per 100 females in the village is 104.3. This figure is similar to the findings of the survey carried out in 1981 in Hambantota district (Dept. of Census and Statistics, 1980/82). The lower percentage of females in the higher groups reveals a fall in the longetivity of females in these dry zone regions. Similar findings are reported in other studies (Central Bank of Ceylon, 1975: 35-36).

2.1.3 Literacy and education

Table 2 : EDUCATIONAL LEVEL OF THE POPULATION ABOVE 5 YEARS OF AGE

Type of education	Male		Female		Total	
	No.	%	No.	%	No.	%
No education	06	4.5	13	10.5	19	7.4
Upto Grade 5	68	51.5	59	47.9	127	49.8
Grade 5-GCE O/L	45	34.1	37	30.1	82	32.1
GCE O/L & above	13	9.8	13	10.5	26	10.2
Professional or technical training	-	-	01	0.8	01	0.3
Literate	126	95.4	110	89.4	236	92.5
Total :	132	100.0	123	100.0	255	100.0

The population under five years of age is 10.2 percent of the total in the survey sample. Of the population over five years age, about 92 percent could read and write. Of the 7.4 percent illiterate population, females have a higher illiteracy rate (10.5 percent) compared with that of males (4.5 percent). Nearly a half of this population received only primary education upto Grade 5. Of the child population of school going ages, especifically between 5-14 years, nearly 10 percent have not attended school due to various reasons. Sexwise, the proportion of female children not attending school is very high (13.5 percent) compared with that of males (6 percent). It was observed that children over 14 years of age avoid school largely because of (a) poverty, (b) long distance to commute for secondary education, and (c) since the majority of farmers are dependent on family labour, they are in much demand for farm work. During the peak seasons of activity in lowlands and chena farms, even children between the ages of 10-14 years abstain from school for long periods to help in farming activities.

2.1.4 Labour force and employment

(1) Labour force

In the active population, as categorized between 15-65 age, the crude dependent population was 46.4 percent of the total. Even in the active group nearly a fifth was between the ages of 15-25 years. This trend is seen in other areas of the country as well (Central Bank of Ceylon, 1975: 30-32 and Dept. of Census and Statistics, 1972 - 5-11). This marked youthfulness could create a heavy demand on land for both cultivation and residence. This high proportion of youth population is the key parameter which decides the availability of labour for farming operations. However, a substantial proportion of this (50 percent) come under the school going population.

Of the female labour force, approximately two thirds were students, housewives and household workers and their contribution to farming was confined only to the peak season activities.

(2) Employment

Agriculture is the major economic activity in this village cluster. About 50 percent of the population was engaged in agriculture on full time basis and a similar proportion engaged in both agriculture and non-agricultural enterprises.

Table 2.2 : THE CLASSIFICATIONS OF HOUSEHOLDS BY THE SOURCE OF INVOLVEMENT

Source of income	No. of household	Percentage
Agriculture only*	24	50.00
Agriculture & non-agriculture**	23	47.09
Non-agriculture**	01	2.01
Total	48	100.0

* Including agric-labourers

** Including non agric-labourers, self employers, traders (part time) etc.

Some of the salient characteristics of the employment pattern in any rural village in Sri Lanka are also shown in the village, eg. (a) the majority of youth of schooling age (between 14-20 years old) participate in economic activities, to a considerable degree, (b) the pattern of employment in farming shows marked seasonal variations in labour use. Underemployment is widely experienced during the lean seasons, (c) though the majority of housewives participate in economic activities as well, they are considered as non-income earners, because their contribution to the household income cannot be gauged in monetory terms.

The potential labour force in the age group of 15-65 years, are under two sub-categories, namely (a) economically, active and (b) economically non-active, as given in Table 2.3. The composition of the active labour force presented below includes all adults (15-65 years of age) excluding students, disabled persons and the like. The active labour force of the population includes employment both on full time and part time basis and also family helpers.

The key terms used in this discussion (for the analysis of the labour force) are illustrated as follows:

LABOUR FORCE (ACTIVITYWISE)

(i) Economically Active	(ii) Economically Non-Active
(i) Economically Active -	(a) Employed
	(b) Unemployed
(ii) Economically Non-Active -	(c) Housewives
	(d) Students
	(e) People not seeking work
	(f) Disabled and too old

$$\text{Economic Dependency Ratio (as a percentage)} = \frac{b + c + d + e + f}{\text{Total Employed ie. (a)}} \times 100$$

Table 2.3 : ECONOMICALLY ACTIVE AND NON-ACTIVE PERSONS OF SAMPLE HOUSEHOLDS

Category or Activity	Total		Male		Female	
	No.	%	No.	%	No.	%
Economically Active						
Income earners	92	53.8	67	74.4	25	30.8
Non-income earners and unemployed	42	24.6	06	6.7	36	44.4
Economically Non-Active						
Students	26	15.2	10	11.1	16	19.8
Disabled persons	11	6.4	7	7.8	4	5.0
Total	171	100.0	90	100.0	81	100.0
Active labour force	134	47.2	73	50.3	61	44.0
Total Population (All age groups)	284	100.0	145	100.0	139	100.0

The first group or activity (economically active labour force) comprised all persons between 15-65 years of age who were employed, underemployed and unpaid family workers. This formed the manpower resources which could be deployed for the production processes and services in this village. The second group or activity (economically non-active category) includes students disabled persons and unemployed due to illness etc. If facilities are available, the disabled persons of this category too could be deployed in some kind of production process and services which may suit their physical and mental conditions. A noteworthy feature of income earners category in the area is that they are predominantly males- 74.4 percent of males compared to 30.8 percent of the females. The low rate of economic activity of the female population in rural Sri Lanka is a typical feature, as women are mainly employed as housewives and family helpers.

2.1.5 Levels of living and amenities

This section considers three household characteristics indicative of socio-economic conditions in the village, i.e. (a) housing conditions, (b) accessibility to service centres, and (c) ownership of assets.

All the farmers have their own homes for dwelling, of which a majority (64.6 percent) are semi-permanent, made of wattle and daub with thatched roofs. About 2.1 percent are temporary structures made of cadjan. Only 33.3 percent of dwellings come within the permanent type of houses which are made of bricks and roofed with tiles. In assessing the housing facilities, about 50 percent of all dwellings are two-roomed houses while a third had three rooms. There is no electricity supply. Sanitary facilities were also not satisfactory since almost 50 percent of the houses did not have lavatories. The village tank and wells are the major sources of water supply, where 83.3 percent of the houses obtain their drinking water from wells, and nearly 95 percent of houses use tank and river water for bathing purposes. The village is connected with the nearest township (Hambantota town) by a tarred road (12 miles).

Of the major capital goods that are owned by the households, radios are most common (62.5 percent), followed by bicycles (47.9 percent), sewing machines (43.7 percent), petromax lamps (25 percent), and carts (6.6 percent). There were four 2-wheel tractors in the whole village but almost every household had three mammoties each; other agricultural equipments are almost absent.

2.2 System 2 : Mainly paddy and marginally chena-based farming economy (Badagiriya)

Badagiriya in which this system is centred, was settled during 1958 after rehabilitation of the old tank and approximately 2500 acres were aswedduмized under paddy. This settlement is located about four miles off the Hambantota - Tissamaharama main road. The tracts of the settlement are accessible by a gravel road from the Hambantota - Tissa main road. The settlement has facilities such as a sub-post office, a dispensary, schools, shops, co-operative stores, a gram sevaka office etc. Our survey concentrated on the D 1 settlement. Since the settlement comprises allottees selected from various regions of the district, the traditional types of social organization is absent. The village depends entirely on the major tank for their water supply.

2.2.1 The demographic characteristics

As much as 95.5 percent of the settlers are low country Sinhala Buddhist. The rest (4.5 percent) were Muslims. The average household size was 7.7 persons. This is higher than the average household size of 5.9 persons for the dry zone rural sector. The model family size was between 4-7 (63.7 percent). Nearly 16 percent of the households have more than seven members while a fifth has small families of less than four members.

2.2.2 Age-sex distribution

The percentage of the population below 14 years was 22.2, which corresponds with 1981 census data (Census of Population 1981). This shows that the population is much younger compared to Gannoruwa. The population over 65 years of age was 3.8 percent. The entire dependent population (both young and old) was 26.0 percent of the total population. The proportion of working ages (eg. 15 to 65 years) was 74.0 percent of the total population. This proportion of labour force (between 15-65 years) is mostly due to heavy migration from neighbouring villages.

2.2.3 Literacy & education

In the analysis of literacy and educational level in this settlement a higher literacy rate is evident (87.7 percent). Of those who have obtained formal (school) education, nearly a half had only primary education, upto grade 5. The educational level of the population above five years of age is shown in the Table 2.4.

Table 2.4 EDUCATIONAL LEVEL OF THE POPULATION ABOVE 5 YEARS AGE

Type of Education	Male		Female		Total	
	No.	%	No.	%	No.	%
No education	16	7.69	31	17.81	47	12.30
Upto Grade 5	101	48.55	67	38.50	168	43.97
Grade 5 - GCE O/L	74	35.57	52	29.88	126	32.98
GCE O/L and above	16	7.69	23	13.21	39	10.20
Professional/Technical Training	01	0.48	01	0.57	02	0.52
Total	208	100.0	174	100.0	382	100.0

2.2.4 Labour force and employment

(1) Labour force

The crude dependant population in this village was 26 percent of the total population. The crude labour force was 74 percent (15-65 years). This consists of a higher proportion of migratory labour as well.

Another important observation was that nearly a third (more than in Gannoruwa) of the total population ranged between the ages of 15-25 years.

(2) Employment

As for employment, agriculture is the major economic source of income (see Table 2.5). This picture is similar to that of Gannoruwa.

Table 2.5 THE CLASSIFICATION OF HOUSEHOLDS BY THE SOURCE OF INCOME

Source of income	No. of households	Percentage
Agriculture only*	26	48.14
Agriculture and non-Agriculture**	26	48.14
Non-Agriculture only**	02	3.72
Total	54	100.00

* Including Agric-labourers, self employees, traders etc.

** Including non-agric labourers too

A breakdown of the labour force, to the level of activity is given in the Table 2.6. The standard definition followed is given in the first part of this chapter. The active labour force of the population includes employment both on full-time and part-time basis (including all housewives, family helpers etc.).

Table 2.6 ECONOMICALLY ACTIVE & NON-ACTIVE PERSONS OF SAMPLE HOUSEHOLDS

Category Activity	Total	Male & Female	Male		Female	
	No.	%	No.	%	No.	%
a. Economically Active						
Income earners	129	40.95	108	63.52	21	14.42
Non-income earners & unemployed	142	45.07	37	21.76	105	72.41
b. Economically Non-Active						
Students	33	10.47	21	12.35	12	2.27
Disabled persons	11	3.49	4	2.35	07	4.82
Total	315	100.00	170	100.00	145	100.00
Active labour force	271	64.83	145	64.44	126	65.28
Total population (All age groups)	418	100.00	225	100.00	193	100.00

The percentage of income earners of the economically active group among the female category was very low (14.4 percent) in this colonization scheme compared with the other three locations of the study. Among males, 63.5 percent were involved in income earning while 21.7 percent consisted of non-income earning family helpers, housewives and the unemployed. The students and the disabled persons amounted to only 13.8 percent which is a very low percentage compared to Gannoruwa (21.6 percent).

2.2.5 Levels of living and amenities

The status of housing, accessibility to service centres, and ownership of assets are indicative of socio-economic conditions of the farming community. The colonization scheme is characterised by the presence of a large proportion of two-roomed colony houses constructed by the Department of Lands and Land Development. These houses are made of bricks and roofed with tiles. This type of houses, considered as permanent, accounted for 91.1 percent of the total houses in the study area. The rest of the dwellings were of traditional types- wattle and daub and thatched with paddy straw. These are the dwellings of the second generation and the migrants. All were occupied houses (taking into consideration the government-built houses and those erected by the farmers themselves on State land which they consider as their own properties). Nearly 74.1 percent of the dwellings are one or two-roomed houses while 25.9 percent of dwellings had three or more rooms.

Approximately 91 percent of the households obtained their drinking water from wells. The main sources of water for washing and bathing were tanks (reservoirs) and streams or irrigation canals. The dwellings of this village were significantly better than those at Gannoruwa. Regarding the availability of toilet facilities, about 84 percent of the households in this village had lavatories. The accessibility of households to basic infrastructural facilities is also an important indicator. In fact, most of the services like schools (Primary and Secondary), co-operatives, public transport, temple, village bazaar, post office etc. are available within 3 km.

Other major services like administrative, judicial, health, bank, bazaar and shops etc, were available at the main town of Hambantota, 20 km away from the village. The village was provided with public as well as private sector transport. The accessibility to service centres and other facilities in this village can be considered as satisfactory compared to other villages of the survey.

Approximately one third of the households of this settlement owned radios, petromax lamps, and sewing machines with a similarity in ownership of such goods in other villages. About 74 percent of farm houses owned bicycles. The most common farm equipment in this village also was the mammoty with 83 percent farm families owning two or more mammoties. Only 2 percent of the farm families owned two-wheel tractors, trailors, mud wheels, winnowing fans, sprayers etc. No farm householder owned a four-wheel tractor or related equipment.

2.3 System 3 : Mainly chena (Hena) and Marginally Rainfed Paddy farming - Kahambana

This village cluster is made up of a number of purana villages, ie. Kahambana, Marawa and Ambagolla etc. However it is very different from the other dry zone purana type of villages which are tank-based settlements. But these villages are solely dependent on non-irrigated agriculture.

Kinship ties are still very strong and they play a major role in social activities such as marriages, ceremonies and even in farming activities. Co-operation among the villagers is also present in various activities such as agricultural (Kaiya), house building, hunting, etc.

Kahambana which is central to our study (Gangoda), consists of 36 housholds. The village road is connected to the main bus route at Wedikumbura (seven miles from Kahambana). The farm houses are located on either side of the village road (cart road). The large tracts of privately owned lands (Sinnakkara idam) are located around the cluster of home gardens (gammadda). Parts of these lands (highland) are seasonally cleared by the owners for chena type of farming. Relations too are allowed to cultivate these lands without payment of any rent. The surrounding area of the village consists of shrubs and jungles (crown lands) which are exclusively used for chena cultivation, logging and hunting. Chena plays the dominant role in the village economy.

2.3.1. The Demographic characteristics

All the householders in the village are Sinhala Buddhists. The basic unit of investigation in the study was the 'household'. Sometimes a household would comprise a number of farm families who have common cooking arrangements and cultivate lands jointly with their parents. The average size of a household in this location is 6.4 while the average family size was 5.5 as compared with the other villages. With a similarity to other locations, medium size families (between four to seven members) accounted for 61.9 percent of the total number of families in the village. The large families (more than seven members) amounted to 21.4 percent. A large family is considered as an aaset as chena farming is mostly dependent on family labour.

2.3.2 Age-Sex Composition

The population structure of the village is such that approximately 45.4 percent of the population is below 14 years of age, which is the highest among the study locations. About16.7 percent of the population are young and below four years of age. However, the population above 65 years was very low (2.15 percent) compared to other locations.

The male-female ratio in this village was 104 males to 100 females, which is similar to that of Gannoruwa.

2.3.3 Literacy and education

Table 2.7 below indicates the literacy and educational level of the population above five years of age. The literacy rate of the population of over five years of age was 82.8 percent (84.8 percent and 80.8 percent among males and females respectively) which is low compared with Systems 1 and 2. However, in the middle age group (25-54 years) illiteracy rates were much higher (about 19.0 percent). The majority of the population (45 percent) has studied only upto the 5th Grade. Although this village is considered to be backward, a fair percentage (4.4) has studied above the GCE (O/L).

Table 2.7 : EDUCATIONAL LEVEL OF THE POPULATION ABOVE 5 YEARS OF AGE

Type of Education	Male		Female		Total	
	No.	%	No.	%	No.	%
No education	14	15.2	19	19.2	33	17.3
Upto Grade 5	36	39.2	50	50.5	86	45.0
Grade 5 to GCE O/L	35	38.1	29	29.3	64	33.5
GCE O/L and above	7	7.5	01	1.0	08	4.2
Professional or technical training	-	-	-	-	-	-
Literacy	78	84.8	80	80.8	158	82.8
Total	92	100.0	99	100.0	191	100.0

2.3.4 Labour force and employment

The present dependent population which accounts for 47.6 percent (between 0-15 years and over 65 years) in this village cluster, is higher than that of the other village clusters discussed earlier. Sex-wise marked variations in the labour force in all age groups are not observed in this village as in the other three villages surveyed, but the proportion of younger people between 14-24 years is high among females (26.9 percent) compared with males (16.7 percent).

Table 2.8 : THE CLASSIFICATION OF HOUSEHOLDS BY THE SOURCE OF INCOME

Source of income	No. of households	Percentage
Agriculture only*	30	83.4
Agriculture and Non-Agriculture**	06	16.6
Non-Agriculrure only**	-	-

* Including agricultural labourers
** Including non-agricultural labourers self employed, traders,etc. (part time).

More than four-fifths of the households in this village are dependent on agriculture, including forestry. Only 16.6 percent of the households were involved in non-agricultural work eg. gemming, logging, etc. in addition to the agricultural activities. In contrast to the other locations, no household was dependent totally on non-agricultural activity.

This again signifies the non-availability of non-agricultural pursuits due to the isolation of the village. In analysing the pattern of employment, the work force (labour force) could be principally divided into two categories viz. (a) active, and (b) inactive. The key terms used in this discussion were discussed in an earlier section.

Table 2.9 : ECONOMICALLY ACTIVE AND NON-ACTIVE PERSONS OF SAMPLE HOUSEHOLDS

Category/Activity	Total Males & Female No.	%
Economically Active		
a) Income earners	54	43.9
b) Non-income earners & unemployed	55	44.7
Economically Non-Active		
c) Students	11	9.0
d) Disabled persons	03	2.4
Total (14-64 years age)	123	100.0
Active labour force (a + b)	109	46.8
Total population (All age group)	232	100.0
Economic Dependency Ratio % $\frac{(b+c+d}{a}$ X 100)	127.7%	

The village is characterised by a high economic dependency ratio of 127.7 percent which is common in Sri Lanken traditional villages. The total labour force participation rate in the project area, as indicated by the active labour force (active labour force = crude activity rate percentage, which is calculated as;

$$\frac{\text{Income earners + family helpers + unemployed X 100}}{\text{Total in the sample}}$$

is about 46.8 percent and is higher than for the rest of the rural sector (32 percent) (Survey of Sri Lanka Consumer Finances, 1973). The net activity rate of the active labour force

$$\text{(net activity Rate \% = } \frac{\text{income earners + family helpers and unemployed X 100)}}{\text{15-64 years old in the sample}}$$

accounts for about 54.0 percent which is very high among male labour force (79.0 percent). The student category of the economically non-active labour force is very low (9.0 percent) compared with the situation in System 2.

2.3.4 Levels of living and amenities

As is common in traditional villages, each farm family in Kahambana too live in their own houses. The survey data indicate that about 86.0 percent of the houses in the village are of the traditional type made of wattle and daub, thatched with paddy straw or cadjan. Generally housing conditions in this village were much poorer than those in the systems 1 and 2. About 6 percent of the dwellings were one-roomed. Health and sanitary facilities in the village were unsatisfactory. Nearly two-thirds of the farm houses had no toilet facilities. River water was used for drinking, bathing and washing purposes by 92.0 percent of the farm households in the village. Only 8.0 percent used well water for drinking and washing. The accessibility to services ie. post primary education, medical facilities, the bazaar etc. were very poor as farmers had to commute above 12 km for a bus that plies to Moneragala town.

Radios (68 percent household owned radios) and bicycles (62.5 percent owned bicycles) were the most popular items owned by the farmers. Mammoties were the common farm implements possessed by the farm families. Bullock cart was the most popular and common vehicle used for transport of products as well as passengers. About 38 percent farm houses possessed bullock carts.

2.4 System 4 : A Stabilized highland farming economy - Mahakalugolla

The village is located 42 km South-East of Moneragala town, on the Moneragala-Pottuvil trunk road, Moneragala is the nearest administrative-cum-service centre for the village. The settlers are mostly migrants from the nearby villages as well as from far away places. The village is a cluster, comprising several yayas (tracts) established by migrants themselves. The tracts are named after the original village they migrated from, eg. Kegalle yaya indicates the settlers who had migrated from Kegalle. There are four major tracts (yayas) viz. (a) Irrigation Handiya yaya, (b) Kegalu yaya, (c) Bibile yaya, and (d) Pallegama yaya.

The village cluster is divided into four tracts which is accessible by cart. Each tract is divided into village compounds (gammadda) where the farm houses are located in a dispersed manner unlike in purana villages. The village which comprises home gardens and highlands is surrounded by the forest, which has become very thin over the years due to chena farming. As the migrants in a particular yaya identify them as coming from one area, kinship ties are very strong as in purana villages. Hence, cooperation among the settlers too is high for social as well as agricultural activities.

2.4.1 The demographic characteristics

The number of farm houses in a yaya (small village) of this village cluster varies from 90 to 125. The village cluster has about 300 farm households where the total population comprises all Sinhala Buddhists (about 88.5 percent are Kandyan Sinhalese and 11.5 percent low country Sinhalese). The average household size is 6.4 persons with an average family size of 5.6. In these villages the average household size is larger than the national average because many adult relatives have migrated (mostly between the age of 14-25 years) from their original villages and are helping in agricultural activities. The medium size of families (four to seven members) are predominant (66.6 percent) while 22.9 percent of the families have more than seven members. The proportion of small families is comparatively low(10.4 percent) compared with Systems 1,2 and 3.

2.4.2 Age Sex compostion

The population data shows that nearly 39.0 percent of the total population is below 14 years. Infant population (four years) is very low (7.2 percent) compared with System 1,2 and 3. The adul' population (15-65 years) is very high as adult relatives are continuously migrating to the region. They tend to live with the relations till they find a suitable piece of crown land to settle down.

The population over 65 years of age is very low (1.0 percent). The male and female ratio is skewed towards males (88 females to 100 males). This is mostly due to the migrant male population helping in farming operations.

2.4.3 Literacy and education

In analysing the literacy and educational level, there does not appear to be much of a difference in the educational achievement in the study area compared with the educational achievement in the other Dry Zone rural areas of Sri Lanka.

Table 2.10 : EDUCATIONAL LEVEL OF THE POPULATION ABOVE 5 YEARS OF AGE

Type of education	Male		Female		Total	
	No.	%	No.	%	No.	%
No education	14	9.5	20	16.0	34	12.5
Upto Grade 5	72	49.0	69	55.2	141	51.8
Grade 5 - GCE	54	36.7	29	23.2	83	30.5
GCE and above	06	4.1	07	5.6	13	4.8
Professional or technical training	01	0.7	-	-	01	0.4
Literacy	133	90.5	105	84.0	238	87.5
Total	147	100.0	125	100.0	272	100.0

Nearly 12.5 percent of the total population above five years of age have had no education (unable to read and write; females 16.0 percent and males 9.5 percent and only 35.7 percent of the older population have had schooling over Grade 5 level (males 41.5 percent and female 28.8 percent). About 4.8 percent of the total population (over five years age) had passed the GCE (O/L Examination). Only about 1 percent has had any professional training.

2.4.4 Labour force and employment

This section focusses attention primarily on the following parameters of the labour force, ie. age and sex-wise composition in employment and the occupational structure among the population of sample households.

The data revealed that the dependent population was 40.0 percent of the total population. Of the rest, nearly 30 percent came under the age category of 14-25 years. These statistics are identical with the three other survey locations as well as with the situation elsewhere in the country, especially in rural areas (Dept. of Census and Statistics,(1981).

Agriculture is the major economic activity in the village. In addition to dire involvement in farming, agro-industries like sugar cane extracting and lumbering too have reated employment opportunities. Table 2.11 below gives a classification of households by the source of income.

Table 2.11 : THE CLASSIFICATION OF HOUSEHOLDS BY THE SOURCE OF INCOME

Source of income	No. of households	Percentage
Agriculture only*	35	72.9
Agriculture and non-agriculture**	11	22.9
Non-agriculture only**	02	4.1
Total	48	100.0

* Farming in own farms, hired labour for farming etc.

** Non-agricultural - casual labourers in sundry works, traders, self-employed etc.

About 73.0 percent of the households earn their income entirely from agriculture. The non-agricultural sources of income included daily wage labour in jaggery making, sugar cane extracting, lumbering etc. Following the general employment pattern in agriculture in Sri Lanka, a marked seasonal variation in labour use in farming is observed in this village.

Females in all the locations constitute a high proportion of non-income earners. This is obvious as housewives and adult females in a farm house involve themselves only in specific operations such as weeding, transplanting,harvesting etc. The potential labour force is shown in Table 2.12.

Table 2.12 ECONOMICALLY ACTIVE AND NON-ACTIVE PERSONS OF SAMPLE HOUSEHOLDS

Category/Activity	Total male & female		Male		Female	
	No.	%	No.	%	No.	%
(a) Economically Active Income earners	98	50.8	80	76.9	18	2o.2
NOn-income earners & unemployed	52	26.9	o2	1.9	5o	56.2
(b) Economically Non-Active students	38	19.7	19	18.3	19	21.4
Disabled persons	5	2.6	o3	2.9	o2	2.2
Total	193	100.0	104	100.0	89	100.0
Active labour force	150	49.1	82	5o.6	68	4o.6
Total population (All ages)	3o5	100.0	162	100.0	143	100.0

According to the survey data, out of the employed population (full time workers in agricultural and non-agricultural activities, and part time workers in agriculture and casually employed in other activities) more than 80 percent were engaged in agriculture comprising mainly chena farming.

Activities were of three types, viz. (a) full time agricultural workers who have encroached and developed land by themselves, (b) workers who are privately engaged in agriculture but engaged in non-agricultural pursuits until they are in a position to encroach on a piece of crown land for chena farming, and (c) part time workers, ie. family helpers (adults school going or seeking employment though they are partly engaged (in farming) and housewives who help in the farms when time permits).

2.4.5 Levels of living and amenities

Unlike in the other locations, a very small percentage (2.1 percent of farm families live in houses belonging to their relatives without rent. About 87.5 percent of houses are of traditional type (wattle and daub). Only 10.4 percent of houses have permanent structures (which have walls made of either stone or brick, and plastered and roofed with either tile, asbestoes or metal sheets).

About 81.2 percent of the dwellings have more than three rooms as against the other locations where the proportion of three-roomed houses is very low. Sanitary facilities are not very satisfactory. Only 44 percent of the dwellings had lavatories. Wells and streams are the major sorrces of water supply for domestic use such as drinking, bathing, and washing. Almost all the farm houses use well water for drinking, services such as education, religious, agrarian services, agricultural, bazaar and marketing facilities are available within 6 km. from the village. Higher administrative, judicial, medical and wholesale services are located in the Moneragala town, which is about 25 miles from the village. Generally visiting traders come to the village to buy produce during the harvesting season.

The availability of household amenities is rather poor as in other locations. Although most of farm houses do not own basic items of furniture like chairs and beds, items such as bicycles, sewing machines and radios are very common. The majority owned bicycles (62,8 percent) and radios (48.9percent).

Bullock cart forms the principal mode of transport for farm produce and inputs. On the average, 38.0 percent of the farm households owned a bullock cart. It also helps in passenger transport along with the bicycles. Equipment such as water pumps, seeders, rotary weeders, dusting machines and sprayers are hardly owned by the sample farm households.Common farm implements owned were mammoties and kattys. While every farm household had at least two mammoties, very few households owned a plough. It was reported that there was a single 4-wheel tractor and one/ 2 wheel tractor in the village. These tractors are used for farming operations as well as for transport. It was observed that tractors with trailors are also used for passenger transport.

Chapter Three

MAJOR AGRO-ECONOMIC PARAMETERS IN DIFFERENT FARMING SYSTEMS

The central theme of this Chapter is the agro-economic role of chena cultivation in order to identify the key parameters important from the view point of a changing system. Chena cultivation has to be studied in relation to the other components of the farming system. Given that chena is only one component of the farmers' economy and that they are dependent on all the land types they cultivate (Abeyratne, 1956), this approach seems to be the most appropriate. Thus, the following major items would be discussed under this theme.

3.1 How central the chena component is, in the total farming system

(a) Different components of the system

The diversity and the extent of land use constitute a good indicator of the resource endowments of a locality. If different types of lands are cultivated to complement one another, due to uncertainties and/or risks involved, it reflects the resource endowments of an individual farm as well. In fact our selection of locations in this study was based on these principles ie. the level of dependence of the farmers on a particular component of the farming system. Table 3.1 reflects these facts.

When chena farming is concurrently practised with paddy farming, to what extent one could depend on the availability of water for paddy farming will decide the extents that are cultivated under each component. It also reflects the risk in each type of cultivation. Of course there are different arguments regarding this particular aspect, ie. the nature of risk (Silva 1977). Our data clearly indicate that in instances where irrigation water is assured, as in major irrigation schemes, the dependency is more on the paddy component of the system. Under other circumstances they are dependent

mostly on the highland component. This again reiterates the fact that farmers have rationally allocated their resources to a very great extent to achieve a certain level of living, not necessarily to maximise profits. For example, in Badagiriya, which is located in a major irrigation scheme where water is assured for both Maha and Yala, about 2.5 acres of paddy were cultivated and the chena component was less than two acres. In Gannoruwa which is located in a purana minor irrigation scheme, where water is never available for Yala, and the acreage that could be cultivated during Maha too is limited as the command area is rather small, the total area under lowlands is little more than one acre per household whereas the chena component consists of more than three acres. This same picture emerges in the other two villages where total dependency is on highlands (except for a very limited extent of lowlands in Kahambana). In Kahambana where the classical type of chena cultivation is practised, due to high productivity under long fallows, including the other highlands (this will be expanded later), the acreag under highlands (3.9 acres) is lower than at Mahakalugolla (4.8 acres). Here the highlands are stabilized as cultivation takes place with very short fallows or no fallow at all.

One salient feature in Kahambana is that despite the existence of 10 acres of state-vested Crown land (Sinnakkara Land) for permanent highland cultivation for each household, less than one acre has been made use of. This reflects rather the tendency of the people to practise chena in these lands than permanent cultivation as plenty of jungle land is available. This argument particularly refutes the idea that farmers are not inclined to develop the land to cultivate permanently due to the lack of land rights. In fact, the major variable in chena cultivation appears to be the availability of forest land. In Mahakalugolla, since permanent cultivation takes place on the highlands, there was no identified entity called homestead, whereas in all the other three locations this category was present.

This indicates that the importance of the highland component varies according to the circumstances, particularly when its "dependency" criteria are considered. However, at this stage, we have not considered important components like soil fertility, type of crops, marketing channels etc. These will be discussed at a later stage.

Table 3.1 LAND DISTRIBUTION (CULTIVATED) AMONG LOCATIONS BY SEASONS (AVERAGE FARM SIZE IN ACRES)

Location	Location							
	Kahambana		Mahakalugolla		Badagiriya		Gannoruwa	
	Maha	Yala	Maha	Yala	Maha	Yala	Maha	Yala
Land type								
Owned or alloted lowlands	-	-	-	-	2.32	2.42	1.06	-
Rented or leased in lowlands	-	-	-	-	0.12	-	-	-
Encroached lowlands	-	-	-	-	0.08	0.11	0.45	0.15
Other lowland	0.27	-	-	-	0.24	0.15	-	-
Chena with permits	-	-	-	-	-	-	3.16	1.13
Chena without permits	2.72	1.96	-	-	1.75	-	-	1.96
Stabilized highland on Crown land	0.10	-	4.79	0.02	-	-	-	0.07
Land given on Sinnakkara for highland cultivation	0.90	0.54	-	-	-	-	-	0.54
Homesteads	0.24	0.08	-	-	0.28	-	0.06	0.08

Another important aspect which comes up is the type of 'tenancy' found in chena cultivation, ie. whether chena farming is practised on Crown land after obtaining permits or not. Until the Crown Lands Ordinance (1840) came into effect, the forests were owned by the village and its clearing for cultivation was decided by the villagers themselves. However, after this Ordinance, the forests were vested with the State and there were restrictions on the area to be cultivated and rents had to be paid to the State for cultivation rights.

However, in the 1960s and 1970s with emphasis being placed on food production programmes, clearing of jungles was intensified with almost permanent damage to the forests. As a result, stringent measures were taken in 1979 to curtail forest clearing. Forest clearing was totally banned and permits were restricted to a maximum of two acres per household per season to clear shrub land for cultivation, ie. trees or shrubs less than 6 ft. in height. This particular type of shrub lands was selectd by the officers of the Forest Department and the Wild Life Department. Although these laws are still in existence, their implementation varies depending on how active the law enforcement officers are, the degree of accessibility to certain localities, and the risky nature of cultivation.

Our survey provides evidence to this effect. In Kahambana, chena cultivation is practised without obtaining permits, so is it in Badagiriya too. However, in Gannoruwa, all the chena cultivators have obtained permits though the extents under cultivation may be much bigger than stipulated in the permits. If reasons for this scenario are analysed, our earlier hypothesis is clearly proved. Gannoruwa farmers being relatively worse off as far as irrigation facilities are concerned, their dependency on chena is greater compared with Badagiriya farmers. Therefore, they cannot risk their crop in the event of being produced before a Court of Law, for unlawful clearing and use of Crown Land. Also, frequent visits by state officers to the adjacent reforestration scheme made the Gannoruwa farmers more liable for prosecution. Hence, they are compelled to obtain permits for cultivating of Crown Land, whereas the Badagiriya farmers are better assured of their paddy crop and the chance of losing the chena crop due to confiscation by government officials is less. Kahambana village is situated in a very isolated locality, where the last seven miles to the village is not motorable by any kind of vehicle. As a result, hardly any officers visit this area. Therefore, clearing of thick jungle for chena cultivation is taking place unabated.

(b) Qualitative reasons for dependence

In the preceeding section we made the point that chena is an integral part of the system and that highland farming is practised under stabilized situations as in Mahakalugolla, primarily because of the lack of other types of land classes or forest land.

Given this fact, it may be appropriate to understand qualitatively the circumstances under which chena is practised within the system. Some of the more important related aspects may be listed and discussed as follows:

1. How stable is chena within the system?
2. Under what circumstances is it practised?
3. Prospects for the future?

1. How stable is chena within the system?

This may be viewed from different angles, although they are interrelated:

(a) Existence of permanent structures, the distance from the dewllings etc.

(b) Length of fallow (See the section on agro-technology (3.3))

Permanent housing is a very good indicator of stability of a particular system of farming and if the house is located in the farm itself it serves as a pointer to the stable nature of farming as well. Conditions of housing were discussed in Chapter 2.

However, one significant feature in Kahambana is that although the farmers have permanent houses in the village, all the chena farmers have dwellings in their chenas. Although the construction is temporary, the whole family lives in the house that is situated in the chena, for most part of the year, with all their valuable belongings (radio etc). They even have their livestock there. The house in the village is unused during the greater part of the the year. One obvious inference is that, since the farmers are solely dependent on this particular farming component, they exericise much eare to look after their produce. It is also because most of the chenas are located at a considerable distance from the village. However, in Mahakalugalla the permanent house is in the farm itself as continuous cultivation is practised. This clearly shows that the highland component is very stable in the system. Where paddy is an integral component in the system, only temporary watch huts are found in the chenas.

This aspect becomes very clear when one considers the distance to the 'permanent house' from the chena farm and the number of seasons the same piece of land is cultivated. In Kahambana, due to continuous clearing of jungle for chena cultivation, the jungle has got thinned. Still thick jungle is available for chena farming within a perameter of two miles from the centre of the village. More enterprising farmers go 4-5 miles from deeper into the jungle to do farming in what may be called wheel chenas (See Leach, 1961 for more details). This distance accounts for the reasons that make them concentrate on constructing houses within the chena to live for long periods of the year. When the length of the fallow is considered, in Kahambana more than 90 percent of the farmers have cultivated the present piece of land only one to two seasons and, of the total number of farms, a half was under fallow for more than five years; about 20 percent of farms have been fallowed for more than 10 years. When this is contrasted with Mahakalugulla, where there is more stable agriculture, more than 55 percent of the total sample have cultivated the same field for four or more seasons (See Table 3.2). Responses regarding the length of fallow were very poor presumably because the fallowing is a rare phenomenon in this location.

Table 3.2 NO. OF SEASONS UNDER CONTINUOUS CROPPING
(PERCENTAGE OF THE RESPONDENTS)

No. of seasons	Village			
	Kahambana	Mahakalu-golla	Badagiriya	Gannoruwa
1	83.3	27.0	46.3	75.0
2	8.3	6.3	16.7	10.4
3	2.7	10.4	16.7	4.2
4	2.7	14.6	9.2	2.1
Continuous	-	41.7	11.1	8.3
Not responded	2.7			

The response to this aspect of the questionnaire was similar in Mahakalugolla as to how many more seasons the present plot of land would be cultivated. In contrast at Kahambana nearly 83 percent of farmers hope to cultivate only two to three seasons before their plots would be allowed to fallow. Despite the fact that forest land is still available to a greater extent in Kahambana than in the other locations, farmers were of the view that the fallow period had decreased over the years. This is attrubuted to the diminishing extents of forest land (68.7 percent) and to the population pressure (29.2 percent) as the more important reasons. However, apart from the depletion of forest resources, the major reason in Mahakalugolla for the reduction in the fallow period has been strict enforcement of the law, making it it necessary to abandon the clearing of jungle. The difference with regard to the degree of enforcement of the law in these two villages is accessibility. As was mentioned earlier, Kahambana is an isolated village where accessibility is very poor. This explains why the enforcement of the law is not a barrier to the change in the fallow period in Kahambana. Conversely Mahakalugolla being closer to the Moneragala-Pottuvil main road, is frequented by the forest conservation officers, who supervise the government reforestation programme going on in the adjacent areas. These activities naturally restrict the clearing of even the available shrubland.

In Badagiriya and Gannoruwa where chena cultivation is integrated with lowland cultivation, the responses of the farmers regarding the continuity of chena was similar to that of Kahambana (See Table 3.2). Here the majority of them have been cultivating the present plot of land only one to two seasons. In Gannoruwa the percentage was much higher (85.4 percent). In both instances they do not intend to cultivate the same piece of land for longer periods. Here again the response was skewed at Gannotuwa with a tendency to lay the fields fallow, with a minimum of cultivation seasons. As in Kahambana, Gannoruwa farmers are more dependent on chenas as paddy cultivation is very risky. This is due to the uncertainty of water availability, being a minor irrigation scheme. No Yala paddy cultivation is possible and even the Maha season gets delayed during the early part of the season, partly due to the paddy tracts getting flooded thereby forcing the farmers to delay cultivation. As a result, instances occur where the paddy crop is lost due to inadeguate water availability in the tank, during the tail end of the season. In fact, no rain water is used for the crop, but a vast amount of water from the tank is used for land preparation.

Although the Gannoruwa farmers perceive this as the main reason for the delay in paddy cultivation, there is a more apparent reason. According to our observations and the discussions held with field officers and farmer leaders, paddy plots are smaller; there is only one season of paddy cultivation and even in this, crop loss is heavy. Thus, under these circumstances, farmers are more dependent on their chenas. Therefore, they tend to delay the paddy cultivation in order to finish the work in the chena using family labour. This aspect would be discussed in detail in a later section. Coming back to our earlier discussion, greater dependency on the chena is the reason why the farmers in Gannoruwa abandon the fields more frequently in order to sustain productivity in the chenas by cultivating fallowed lands.

2. Under which circumstances is it practised?

The chena system of cultivation is commonly identified as a lazy way of farming where once the initial input of labour is incurred, hardly any other type of input is used. This system is also identified as a very unproductive and a destructive system (Yalman, 1967). Although there is a tendency to dismiss the chena system of farming as such, there are many intricate social, economic and agronomic variables which contibute to the system. In fact, it is the factor endowment in a certain locality and the circumstances in which they live that compel them to practise a certain system of farming.

In economic terms, under a given set of circumstances, farmer may practise a certain type of a farming system. Yet, under a different set of circumstances, he may opt for another type of farming system. Thus, rather than treating chena farming as an irrational system, one should consider the prevailing circumstances. The general belief is that where the unavailability of forest land predominates a stable system of agriculture should also exist. Although in general terms this may be true, if the conditions are different, the availability of forest land may not be the sole criterion in deciding the type of farming system.

For example, rights to the land was considered a key variable for not taking steps to develop the land, but have continued to practise chena cultivation. In this section, therefore, an attempt would be made to perceive what farmers may feel in determining the circumstances which compel them to practise chena or change the system.

Table 3.3 REASONS FOR ABANDONING THE CHENA

Reasons	Village (% of Responses)			
	Kahambana	Mahakalugolla*	Badagiriya	Gannoruwa
Weed control	17.7	35.3	34.2	64.7
Drop in soil fertility	46.7	47.1	57.1	29.4
Plenty of forest land available	6.7	17.6	7.1	1.96
Difficulty to cultivate	8.9	-	-	-
Since other farmers let the land fallow	20.0	-	-	-

* Only a third of the farmers abandon even for short fallows.

The main characteristic in the chena system of farming is that after a certain number of seasons the plots are abandoned or allowed to fallow. The main reasons attributable to this situation as widely documented, are to tide over weed control problems and to ensure fertility. In this study too, these two factors emerge as the main reasons. It is interesting to note that the importance of these two factors varies according to the circumstances.

In contrast to the other three locations, in Kahambana, where the classical type of chena cultivation is practised, weed growth is less of a problem as against loss of fertility. This may account for the fact that, in this area, as the availability of forest land is greater than that in the other locations, the number of seasons under continuous cultivation is less.

So, with relatively long fallow periods the incidence of troublesome weeds like Iluk (Imperata cylindrica) is less. One of the notable reasons observed in this particular location was that they let the lands fallow because other farmers did so (20 percent). It shows that in an ancient system of farming as this, which has long history of co-operation (Abeyratne,1956; Leach, 1974) in clearing land and practising 'wheel chenas' etc. farmers tend to follow the lead given by others in the village. Thus, these patterns of social relationships may be considered as one reason for this particular type of system.

Loss in soil fertility is the other major reason adduced to abandoning a particular piece of land. The rate of loss of fertility is analysed in agronomic terms giving due consideration to a number of important factors, such as length of fallow, cropping pattern and soil depth, all at different operations. The ensuing sections will briefly look at these technical aspects.

Variation in soil fertility

The natural fertility of the lands subjected to cropping at various stages, adjoining virgin jungles, formed part of the present study. The objective was to determine any changes in fertility due to chena cultivation. The soil samples were collected from lands at random after the first crop removal and one year of fallow. In Mahakalugolla it was done immediately after burning as such a site was available during the study. Sixteen soil samples were collected from each village, digging the profile to the required depth of 24 inches in order to observe changes in fertility levels and any relationship between cropping lands with reference to soil erosion. The nutrient analysis carried out consisted of Nitrogen (Micro Khjeldhal method), Pottasium (Ammonium acetate), Phosphorus (Olson method), Cation exchange capacity, CEC (Na as indicator ion) organic matter and soil pH (1:2.5N, Kcl).

Although the total N content does not directly indicate the available N, the results indicate its fluctuation due to the different systems of vegetation and also according to the depth of the soil. Generally, in all locations except at Badagiriya, the surface soil layer in jungle lands contained the highest total N, ranging from 0.14 to 0.2 percent. This probably is associated with humification processes resulting from the decomposition of plant residues.

The N content gradually decreases down the soil profile to values around 0.09 to 0.06 at 24 inches depth. This is a reflection of less organic matter and less microbial activity at lower soil depths. At 6 - 12 inches depth the N content in all jungle soils was about 0.15 percent whereas, in lands cropped for one season, it has been less than 0.1 percent one season's cropping reduces the N content in the top soil as compared with jungle lands, due to both the effects of burning and the nutrient depletion by cropping. This effect, however, was not evident at Badagiriya which may be associated with previous cropping. A period of one year's fallow is hardly sufficient to enhance the N content of the top soil and, as Stockdale (1920) has reported, a longer period may be required to regain the fertility status as that of virgin jungle land. Although rainfall may be one factor that adds N to soils, the primary agent that could increase the N in lands under long fallow would be the decomposition of fallen leaves.

The vast extents of iluk-infested lands in the Moneragala district are subjected to seasonal burning. Their previous history too is unknown. The N content of these soils too is lower than those of jungle lands. As stated earlier, they are subjected to frequent burning and erosion of the top soil layer due to heavy monsoonal rains. Though burning allows the regrowth of iluk, it prevents the regeneration of other plant species and, as a result, vast areas are presently covered with iluk without any secondary forest growth. The moderate amounts of organic matter found in iluk-infested soil may be due to the decay of roots. This may be a pointer towards the possibility of utilizing such naturally renovated lands for stabilized cropping, provided good agro-technology is practised.

The organic matter content of the soil is general, not static and is subject to changes due to factors of the environment. In the present study, the organic matter content appears to be highly location-specific. In the top jungle soils it varied from 7.2 percent at Mahakalugolla to 2.5 per sent at Gannoruwa in the Hambantota district. The mean value of the top soils in the other locations ranged from 2.5 percent to 3.6 percent. As stated earlier, the variation of the organic matter status down the soil profile shows its relationship to total N at different soil depths. The presence of the highest N in the top soil layers is, therefore, due to the high content of organic matter resulting primarily from the decomposition of vegetative matter.

It is well known that burning has a sterilizing effect on the soil and destroys the organic matter particularly in the top layers. Such evidence is available from the site at Mahakalugolla where the organic matter content was reduced to 1.8 percent immediately after burning. This effect was noticeable further down the soil profile. It is interesting to note that a slight variation occurs in the organic matter content of the top soil after the first crop as compared with the jungle lands. This is particularly true of the top 6 inches of the soil or in the root zone depth of annual crops which are usually grown as chena crops. Incorporation of above ground vegetative matter into the root system could enhance the organic matter content of such sites, immediately after harvest. The accumulation of organic matter obviously takes time. Thus, at Gannoruwa where the fallow was over a year organic matter content was 2 percent, while in all other locations it was further decreased. It appears that the lack of crop cover and exposure to heavy rainfall have caused soil erosion thereby reducing the organic matter content of lands in the early fallow period. Besides, burning prior to cropping has already depleted the organic matter as was clearly evident at the Mahakalugolla site.

As reported by Joachim and Kandiah (1948), the phosphorus content is highest after burning due to the accumulation of ash. This was the case at Mahakalugolla too. Even after the first crop the phosphorus content remained high in these soils and because of its high ash content, the relatively less uptake by crops, compared with other ions and its less mobile nature in the soil. The phosphorus content in lands infested with iluk was much lower than in those land recently cropped or abandoned. These soils can be expected to contain high contents of phosphorus due to regular burning. Yet, low values indicate impoverishment of such lands due to erosion and other factors. The soils studied seem to be well buffered in phosphorus as there is no clear change in the phosphorus due to different vegetation patterns.

The pottasium content showed differences, and Moneragala soils had more pottasium than those of Hambantota. Except for the reduction of pottasium at Kahambana and Badagiriya after the first year's fallow, the variation in pottasium at other sites was negligible, but in the top 12 inches of the soils the pottasium content appears to be high. As in the case of phosphorus continuous burning may have increased the pottasium level in the surface soil layers. In Moneragala, the soils were moderately acidic to acidic and the pH values ranged from 4.7 to 6.7 and in Hambantota moderately acidic to slightly alkaline (5.0 - 7.7).

The cation exchange capacity was highest in jungle soils in the Moneragala sites which decreased after the first crop and further diminished after one year's fallow. A similar effect was seen in iluk-infested lands. In the Hambantota sites results were conflicting. For instance, the cation exchange capacity (CEC) was higher in lands cropped for one year than in the jungle lands due to the presence of ash on the surface soil. However, in Moneragala, the exchangeable bases were reduced after one year's fallow. The high CEC values of the top soil layers of jungle lands at Kahambana and Badagiriya indicate the absorption sites of the organic matter complex.

From the results discussed above, the following conclusions may be drawn:

The nitrogen content in forest soil remains high compared to cropped lands, and one year's fallow is hardly sufficient to enhance it. The nitrogen content is closely related to the organic matter accumulation and its decomposition. Therefore, the cropped lands contain less nitrogen and organic matter.

The soil phosphorus content is highest following burning due to accumulation of ash and there is a tendency for a decrease in phosphorus in cropped lands. The same trend is shown for potassium.

Joachim and Kandiah (1948) reported losses in organic matter, nitrogen and other mineral nutrients when dry zone uplands were subjected to chena farming. Rosayro (1950) found poor growth of introduced forest tree species on abandoned chena lands compared with adjacent jungle soils. In the present investigation although soil samples were drawn at random from sites whose previous history has not been continuously monitored, there was evidence of loss of nitrogen, organic matter, and other mineral nutrients. Thus, to a certain degree, impoverishment of soils had occured. Therefore, it will be reasonalble to assume that there would be some loss in fertility of land cultivated as chenas. A very interesting feature, however, is that in all locations including those lands under iluk (Mahakalugolla) in the Moneragala district, the reserve nutrients were satisfactory for crop growth. The loss of nutrients is true in all cropped lands including those under improved rotational systems, where seasonal variations in fertility occur due to uptake by crop and losses due to other factors such as erosion and leaching.

Therefore, chena lands do not present an unusual situation in regard to the gradual loss of fertility. A difference exists between the modern system and chena farming. In rotational farming systems attempts are made to renovate the soils for continuous cultivation, while in the chena system long fallows for varying lengths are practised to recuperate soils. These processes are not feasible any more due to the high demand for land and also the population pressure. A point of interest is that soils under chenas are not depleted in fertility to levels which are beyond resurrection. Therefore, appropriate agro-techonology should be incorporated into patterns and cropping systems in such areas. A clear understanding of the environmental factors, farmer resources and the socio-economic factors should play a vital role in the development of systems and in the incorporation of modern technology for continuous cropping in such areas (See Table 3.4-3.7 for details of soil analysis)

3. Prospects for the future

Having considered the circumstances under which chena farming is practised, it is important to conceive changes that are possible. This may be viewed in two ways; (i) if the same conditions prevail in the future or if the respondents feel so, and (ii) to consider what the respondents feel, if the conditions change.

Although farmers would prefer to continue chena cultivation as they have been practising before, the opinion of the majority of the farmers was that the prospect of doing so in the future would be bleak due to various reasons. The responses varied depending on the circumstances under which they lived. That they were aware of the uncertainties was a welcome response. Specially in Gannoruwa and Kahambana (despite the plentiful availability of forest land) almost all the respondents were of this view. However, in Badagiriya, nearly 40 percent felt that there was still some scope to practise chena farming in the future. In the other three locatlions the availability of forest land or shrub land may have influenced those who felt that chena farming would be possible in the future. But in Badagiriya, the majority attributed their responses to questions related to fertility on the assumption that natural fertility could be regained even with short fallows.

Table 3.4 CHEMICAL PROPERTIES OF THE SOIL IN MAHAKALUGOLLA (MONERAGALA DISTRICT)

Place of sampling		Total N %	Org. Matter	Olson-P (ppm)	Exchange K %	CEC me/100g Soil	Soil pH L:2.5 INKcl
Jungle land' Soil depth in	6	0.205	7,8	14.8	280	28,437	4.70
	12	0.086	2.85	16.3	296	18.319	5.00
	18	0.097	2.25	37.0	269	18.027	4.85
	24	0.056	2.05	2.5	254	16.842	5.10
After burned Soil indepth in	6	0.084	1.826	41.1	350	18.943	6.7
	12	0.036	0.958	23.4	168	16.444	6.0
	18	0.022	0.869	28.6	156	13.438	5.6
	24	0.017	0.613	34.5	156	15.547	5.8
After 1st cror Soil depth in	6	0.206	3.35	36.5	304	12.431	5.3
	12	0.095	3.25	10.3	283	12.001	4.7
	18	0.086	2.32	8.5	263	8.473	3.8
	24	0.087	1.20	8.0	236	8.476	3.9
Iluk land Soil depth in	6	0.101	4.3	7.4	359	14.276	5.0
	12	0.086	1.8	1.4	222	12.083	5.05
	18	0.077	1.4	2.4	208	10.427	5.35
	24	0.041	1.4	2.3	238	11.008	5.25

Table 3.5 CHEMICAL PROPERTIES OF THE SOIL IN KAHAMBANA (MONERAGALA DISTRICT)

Place of sampling	Total N %	Org. matter	Olsen-P (PPm)	Exchange.K K(ppm)	CEC Me/100 Soil	Soil pH 1:2.5 INKcl
Jungle land						
Soil depth in 6	0.148	2.9	16.6	194	25.452	5.7
12	0.106	1.035	10.28	122	16.373	5.5
18	0.089	1.062	12.72	122	15.191	5.8
24	0.067	0.948	8.88	128	15.836	6.4
After lst crop						
Soil depth in 6	0.0896	2.524	19.0	111	16.009	5.7
12	0.0896	1.447	17.44	130	12.557	6.0
18	0.0952	1.086	11.0	162	14.748	5.8
24	0.0616	0.996	11.92	154	15.278	5.8
After 1 year fallow						
Soil depth in 6	0.0897	1.622	22.5	88	6.27	6.15
12	0.0952	1.112	16.2	92	8.15	5.85
18	0.0616	0.805	16.9	56	7.78	5.6
24	0.0616	0.664	15.0	52	7.56	5.7

Table 3.6 CHEMICAL PROPERTIES OF THE SOIL IN BADAGIRIYA (HAMBANTOTA DISTRICT)

Place of sampling		Total N %	Org. Matter %	OLSEN-P (ppm)	Exchang.K (ppm)	CEC me/100g Soil	Soil pH 1:2.3 INKcl
Jungle land Soil depth in	6	0.1400	3.633	18.6	218	30.0	6.25
	12	0.1321	5.538	19.5	64	25.3	6.43
	18	0.0752	3.457	20.8	64	23.30	6.9
	24	0.0952	1.498	20.6	48	12.60	6.9
After 1st crop Soil depth in	6	0.2128	3.739	14.6	254	30.2	6.5
	12	0.1904	1.779	20.6	52	14.43	7.1
	18	0.1120	1.571	12.9	52	13.56	7.5
	24	0.0560	1.541	9.6	66	18.3	7.3
After 1 year fallow Soil depth in	6	0.1120	1.670	8.6	76	6.0	6.4
	12	0.1054	1.519	7.5	36	12.08	5.0
	18	0.1288	1.484	12.2	26	14.6	5.4
	24	0.1544	1.372	6.4	20	14.4	6.5

Table 3.7 CHEMICAL PROPERTIES OF THE SOIL- GANNORUWA (HAMBANTOTA DISTRICT)

Place of sampling		Total N %	Org. Matter %	Oslen-P (ppm)	Exchange K %	CEC me/100g Soil	Soli pH 1:2.5 INKcl
Jungle land Soil depth in	6	0.2016	2.254	12.3	208	16.0	6.0
	12	0.1456	1.969	15.7	32	12.08	5.0
	18	0.1120	1.759	15.9	66	14.6	5.4
	24	0.0952	1.581	15.9	72	14.4	5.6
After 1st crop Soil depth in	6	0.1021	1.786	12.5	98.0	19.5	5.7
	12	0.0952	1.686	10.7	60.0	17.9	5.6
	18	0.1904	1.655	10.1	50.0	20.7	6.5
	24	0.2688	1.393	6.2	42.0	20.4	6.2
After 1 year fallow Soil depth in	6	0.1654	2.137	55.6	150	7.65	7.7
	12	0.1120	2.126	13.1	182	11.56	6.0
	18	0.1730	2.021	15.5	64	11.7	6.0
	24	0.1793	2.854	15.6	76	19.4	6.15

This line of reasoning is compatible with our soil analysis which shows that unlike the other three locations, in Badagiriya, the total nitrogen percentage did not drop markedly with cropping. However, one important feature is that, being a colonization scheme, awareness and use of new technology like fertilizers is more, compared with traditional environments. Thus, it would seem that the farmers are aware of the relationship between crop yields and fertilizer application. So, they do not consider the drop in fertility as a big impediment to chena farming with short fallows. They still prefer to shift or rotate the piece of land, even with very short fallows, rather than stabilize it. This raises the question as to why they cannot use fertilizer and sustain productivity on the same piece of land. The possible answer is, that being allottees, they have already been given a piece of highland, and this is one method of cultivating a piece of land without paying much attention to land development etc. As highlighted earlier, they have not made attempts to get permits for these chena land possibly because they feel that, since they already own a piece of highland, it may be difficult to get permits specially if it is for stable agriculture.

Table 3.8 REASON WHY CHENA FARMING IS NOT POSSIBLE IN THE FUTURE AS PERCEIVED BY THE FARMERS (% OF THE RESPONSES)

Reason	Village			
	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
Lack of forest land	55.5	14.3	28.3	38.3
Laws against clearing of lands	4.5	57.1	24.0	11.7
Chena farming by migrants	-	14.3	4.3	15.0
Population increase	4.5	9.5	15.2	26.6
Not oriented towards chena farming	-	4.8	4.3	-
Loss of fertility due to bad management	4.5	-	17.4	1.7
Difficulty in controlling weeds	31.8	-	6.5	1.7
Economic difficulties	-	-	-	5.0

Although availability of forest land is generally regarded as the key variable which decides whether chena cultivation is possible or not, in accordance with our earlier argument, Table 3.8 clearly shows that there are many other reasons depending on the circumstances under which the farmers are placed. One of the non-conventional reasons adduced was the prevailing laws against clearing of land for chena farming. We have tried to correlate the enforcement of laws to the accessibility to a particular location. This is clearly seen in Mahakalugolla where as much as 57 percent of the respondents indicated that chena farming may not be possible in the future due to the prevailing law. Thus, it may well be that in an area where chenas are in a more stabilized nature apparently not due to lack of forest land, (only 14 percent of the respondents thought this to be an important constraint), availability of forest land would not be the deciding factor as regards future developments. It is the outside pressure viz. legal controls. The land constraint is seen in another way as nearly 26 percent of the respondents indicated it to be the population pressure resulting from migrants coming in for chena cultiv ation. At this point however, it must be stated that Mahakalugolla came into being in the late 1950s with outsiders coming to do chena cultivation. It has been so severe as to exhaust in no time the available forest land that could be put under chena cultivation. Population preseure was felt in Badagiriya and Gannoruwa alike, but not in Kahambana probably due to its isolation. In Kahambana, lack of forest land was reported to be the biggest constraint. Paradoxically, this response was despite the fact that the availability of forest land here was the highest compared to the other locations. This may be considered as a case where chena cultivation was practised with long fallows and, over the years, the farmers had to go further into thick jungle, as cultivation of land nearby over long periods (with short fallows) has given rise to weed problems etc. In fact, 32 percent of the responses in Kahambana indicated that controlling of weeds was a major problem restricting chena farming in the future.

In the paddy-based chena situations in the Hambantota district, both migration and population increases were considered as indicators of pressure for land. These reasons, including the lack of forest land were adduced as constraints for future chena farming by nearly 50 percent of the respondents in Badagiriya and 80 percent in Gannoruwa. In Gannoruwa, as was explained earlier, the pressure for land is much more as farmers are more dependent on chenas.

The main purpose of this section is to identify, in qualitative terms, the role of the chena in the village economy. In the preceding paragraphs we tried to show the important variables that play a part in deciding why a certain plot of land would be allowed to fallow in order to practise chena farming. We also tried to identify the important variables as perceived by farmers as to whether this system of farming is feasible in the future. We came up with evidence to support the hypothesis that the future for this type of farming would be rather bleak. The alternative, as suggested by many, would be a more stable system of farming. However, we must not lose sight of the fact that stabilizing the system or farming on the same plot of land is only a partial solution. The alternative is to increase productivity and to sustain it, or at least not to go below the present level of productivity.

3.2 LABOUR UTILIZATION PATTERN IN THE TOTAL SYSTEM

Availability of farm labour and its use is one of the most important variables that decides the successful operation of a particular farming system. Labour use pattern is usually decided by the farmers depending on the relative productivity of the different components of the farming system. Within the labour profile the type of labour is also very important. Specially with heavy operations like land clearing for chena farming, where male labour plays a major role, its availability within the family or in the locality will assume a major role in deciding the extent cleared for chena cultivation. If the required male labour is not available in the household itself, hiring from outside (if available) will again depend on the liquidity position of the farmer. Considering the fact that credit is not available for highland farming on Crown land, this can be a serious impediment. For irrigatad farming, this may not be a big problem if farmers are credit-worthy. However, since it is difficult to control the use pattern of the credit so received, again the farmers' decision on its use would depend on the relative productivity of the different components of the farming system as well as on their subsistence needs. When farmers are not credit-worthy, division of labour will solely depend on the labour available in the household and on the relative productivity and levels of risk of the particular component of the farming system. When farmers depend on non-institutional loans for hiring of labour, the risks involved in farming and the relative productivity of different components of the farming system will be the major determinants of labour use.

Given this complex nature of the system, as far as labour use is concerned, the analysis would concentrate onthe following aspects:

3.2.1 Labour use in terms of type and quantity of labour for each land type within the system;

3.2.2 How labour use may supplement or compete with each other in terms of (a) time, and (b) type of labour.

The analysis can be done on a per acre or per farm basis. On a per acre basis, the comparison becomes difficult as the size of farms varies considerably within the system as well as of the same component within different systems. The advantage here is that it gives us an indication of the intensity of labour use for each component rather than the actual quantity. This becomes complicated when labour displacing or augmenting technologies are used for certain operations. For example, if tractors are used for land preparation, unless this point is considered, the labour use pattern cannot be used for any comparisons. Reported quantities would not always indicate the actual amounts used specially when analysis is done on a per acre basis. However, figures may give some indication of the trend or magnitude involved rather than the actual quantity. As Yala cultivation was not possible in all the study locations, labour use in Maha would be used throughout this section for comparisons.

3.2.1 Labour use in terms of type of labour and quantity of labour

In the calculation of labour use, in terms of man equivalents, the method generallyused is to equate a woman-day to 0.8 of a man-day and a child-day to 0.5 of a man-day. However, due to many reasons, this method was not considered as an appropriate measure. On the one hand, some operations are done exclusively by a single sex. For example, land preparation and forest clearing is exclusively a male job. On the other hand, females are equally efficient or sometimes more efficient than males for certain operations such as harvesting. Thus, certain operations were identified where both males and females are considered to be equally efficient and no coefficients was used to calculate the man equivalents in such instances. However, if females have performed certain operations, more efficiently done by males a coefficient of 0.8 was used to convert the woman-days to man equivalents.

Among the different agricultural operations, nursery preparation, broadcasting, transplanting, dibbling, weeding, harvesting and waiting in the market to sell the produce were considered as operations that could be handled equally by both sexes with the same efficiency.

The analysis of labour use could be done at two levels:

a. Total labour use for the whole system and for each land type,

b. Labour use divided by type of operation for each land type and for the whole system.

Table 3.2.1 TOTAL LABOUR USE FOR 1982/83 MAHA SEASON PER FARM

Village	Type of labour										
	Family		Attam		Casul		Perma-nent		Migra-tory		Total
	Man-days	% of to-tal	Man-days	% of to-tal	Man-days	% of total	Man-days	% of to-tal	Man-days	% of to-tal	Man-days
Kahambana	251.5	77.4	0.3	0.1	66.3	20.4	--	-	6.5	2.0	324.6
Mahakalu-golla	219.7	82.9	24.4	9.2	19.7	7.4	0.1	-	0.3	0.1	264.2
Gannoruwa	284.9	76.9	3.3	0.8	66.0	17.8	12.3	3.3	3.6	0.9	370.1
Badagiriya	254.0	70.2	6.9	1.9	96.5	26.6	-	-	4.1	1.1	362.6

With reference to the total labour use, the main types of labour may be categorised as family labour, casual labour, and in some instances attam labour. The major component being family labour (See Table 3.2.1), the percentage of its use on farming varied from 70 percent in Badagiriya to 83 percent in Mahakalugolla. This variation could be explained when the different land types in the system are considered. An inference may, however, be drawn at a glance to the effect that casual labour component is highest in a system where the major irrigation component is included.

Attam - Mutual exchange of labour.

It is least where highland farming is stabilized indicating a lesser need for casual labour because much of the heavy work like jungle clearing is absent. The use of permanent or migratory labour was almost absent, and attam labour was found to be existing only in Mahakalugolla. This is understandable as almost all the farmers had migrated to Mahakalugolla from specific locations and, as described earlier, people from one area farm a specific tract or Yaya. This social cohesiveness has been a driving force in enlisting labour as attam for cultivation purposes. In Kahambana, although one would expect attam labour, as they are from the same village, it was almost totally absent. In this area what is common is a certain type of labour called kaiya (Gunasinghe, 1976) ie. when a wheel chena is to be cleared, the farmers concerned, would get the help of the others by entertaining them with good food, liquor etc. This is more a casual form of labour than attam. As food is considered a kind of "payment", kaiya" does not give the impression of casual labour, and this is the major difference between the two types. Casual labour can be rather degrading in a traditional society.

The subject of labour use can be better understood if the labour profile is broken into the components of the system. This would be discussed separetely in respect of the two districts.

Monaragala District

(a) Kahambana

In an earlier section it was mentioned that in Kahambana, although farmers had been given ten acres of Crown land each as Sinnakkara land, the cultivated extent of this land was marginal (0.9 ac/farm). This is reflected in the labour use pattern too as nearly 57 percent of the total quantum of labour has been used in the chena lands while only 26 percent was utilized in the Sinnakkara land. However, on a per acre basis, the intensity of labour use has almost equal in both land types, ie. 81.5 and 76.5 mandays/acre for Maha in chena lands and Sinnakkara lands respectively. Although other types of land too were cultivated in Kahambana the labour input was rather small because the extents cultivated were marginal. Of the total labour supply, 11 percent was used on home gardens. In Kahambana there was hardly any Yala cultivation.

(b) Mahakalugolla

As mentioned earlier, of the total labour input on the stabilized chena, the family labour component was highest. Although the total labour use was higher in Kahambana compared with Mahakalugolla, despite the higher acreage under cultivation, the intensity of labour used on a per acre basis too showed the same trend. The discrepancy was very revealing.

For example, in Kahambana where 76.7 man-days were utilized on a per acre basis for Maha cultivation on all the land types, in Mahakalugolla it was only 55.2 man-days per acre. This is quite obvious as operations which require more labour are minimized under stabilized conditions. The use of casual labour on per acre basis was negligible compared with Kahambana where about 24 man-days were utilized for chena operations. The implication of this type of usage pattern is that in a situation where labour is scarce, and in a rising labour wage market, the potential for stabilized agriculture is very high. It has the potential to bring more land under cultivation with the available labour. Similarly the potential to intensify agriculture with the use of new improved techniques involving fertilizer application, soil and water conservation etc. is also high.

Hambantota District

Although the total labour use was almost identical in both these system, the major difference was that more than a quarter of it constituted hired casual labour in Badagiriya whereas in Gannoruwa it was only 13 percent. This discrepancy could be better analysed if the labour use pattern is studied considering the different components of the farming system.

Table 3.2.2 TOTAL LABOUR USE FOR PADDY CULTIVATION AND HIGHLAND CULTIVATION (MAHA, MAN-DAYS)

Gannoruwa	Allotted mudland	Rented in mudland	Encroached mudland	Other mud-lands	Total mud lands	Chena lands
Per acre labour use	99.7	-	51.3	-	75.5	72.5
Per farm labour use	105.6	-	23.1	-	128.7	231.8
Farm size (ac)	1.06	-	0.40	-	1.51	3.16
Badagiriya						
Per acrelabour use	26.5	38.0	38.6	34.4	34.3	162.2
Per farm labour use	61.6	4.5	2.9	8.2	69.0	283.9
Farm size (ac)	2.32	0.12	0.08	0.24	2.52	1.75

Table 3.2.3 PER ACRE EXPENDITURE FOR FARM POWER SOURCES AND THE FARM SIZE

Operation/Charge/ Labour Use (Paddy)	Location			
	Badagiriya		Gannoruwa	
	Per Acre	Per Farm	Per Acre	Per Farm
		F. Size- 2.42		F. Size- 1.24
Operation:				
1. 2 Wt. ploughing-charge (Rs)	-	-	256.11	317.58
Labour used (man-days)	-	-	11.55	14.32
2. 4 Wt. ploughing-charge (Rs)	300 82	728.0	127.97	158.69
Labour used (man-days)	3.92	9.48	3.39	4.2
3. Ploughing by buffalo	-	-	To be paid in kind	
Labour used (man days)	-	-	13.84	17.16
4. Threshing by 4 Wt. charge (Rs)	14.24	22.67	12.70	10.03
Winnowing with 2 Wt.(Rs)	2.53	5.87	20.60	24.23
Total Labour use for both operations:	6.78	16.40	13.84	17.16

According to Table 3.2.3, as we hypothesized earlier, mechanization of farming operations has played a major role in this regard. For example in Badagiirya, costs incurred for land preparation by 4 wheel tractor clearly reflect its implications by means of reduced labour use. In Gannoruwa, land preparation has been mainly performed by using buffaloes and 2 wheel tractors. In an earlier study on Farm Power conducted by the ARTI, it was shown that on an average a farm that hired a 4 wheel tractor for land preparation and threshing used some 12 labour days/acre per season less than a farm using animal draught (Farrington & Abeyratne, 1982). The present study augments this result.

The importance of this analysis is the adjustment of labour use within the system. In Badagiriya, due to better assurance of water for paddy cultivation, greater attention is paid to it. As mentioned earlier, the dependence on the paddy component is high in this location compared with Gannoruwa. Also due to the better economic standing of the farmers in Badagiriya, they resort to mechanization. Whether this is due to labour problems was not investigated. Under these circumstances the Badagiriya farmers are in a position to allocate more of their labour for chena practise. But in Gannoruwa the picture is different as the size of farms is much smaller (1.24 ac paddy) compared with Badagiriya (2.42 ac). The paddy fields in this area have an inherent problem of getting flooded with the onset of rains. It is only with the subsiding of the rains that any land preparation can be attempted. This makes the land too boggy to use heavy 4 WT. On the other hand, if land preparation is delayed, the chance of a successful chena crop is minimized, as it becomes more liable to get caught in a drought during the latter part of the season.

This risk factor precludes the use of heavy expenditure inputs like 4 WT., on smaller uneconomic holdings. Since Yala is almost non-existent in Gannoruwa, it makes the farmers more dependent on the chena component. Hence, due to non-use of mechanical power sources, the higher labour use in Gannoruwa paddy fields look justifiable. Although the labour use pattern in the paddy fields in the two locations may be justifiable on these grounds, difficulties arise with the chena component. As explained earlier, in Badagiriya the size of the chena is smaller (1.75 ac) compared with Gannoruwa (3.16 ac).

Although on a per farm basis the labour input was more or less comparable in both locations, on a per acre basis the intensity of labour use was more than double in Badagiriya (162.2 md/ac) compared to Gannoruwa (72.5 md/ac). This discrepancy can only be explained by considering the cropping pattern and the cultural practices involved. In a later stage it would be shown that the Badagiriya chena farmers do adopt such cultural practices as spraying of agro-chemicals which demands more labour. It may be assumed that due to the small acreage cultivated often without obtaining any permits in order to minimize risks, one can expect a high level of activity to maximize land productivity rather than labour productivity. In fact, the extent of casual labour use in Badagiriya was high as 31.8 md/ac. compared with 9.2 md/ac. in Gannoruwa.

3.2.2

It would be appropriate to discuss briefly the distribution of labour among the different operations. This will give us an indication of the prospect of using labour for certain operations with a view of increasing productivity and also the possibility of shifting the labour from the operation to another, specially thinking in terms of a change in the system. Here again, the discussion will be based mainly on the Maha data as Yala was almost a failure in many locations. The ensuing section will make an attempt to describe these aspects in conjunction with how labour use may supplement or compete with each other in terms of (a) timing, and (b) type of labour.

Although an attempt would be made to discuss these aspects separately, the situation is more complex than it appears as all these factors are interrelated. For example, the use of labour for a certain operation will depend on the availability of different types of labour at a given point of time and also the ability of a farmer to utilize such labour. It becomes quite complex when the same type or different types of operations are time-specific and have to be performed in different types of lands within the system at a given point of time. Thus, labour competition particularly becomes inevitable depending on the priorities set by each farmer on different criteria.

Timing of labour use is very important as almost all the agricultural operations are time-specific. This is all the more important when certain specific operations are dependent on natural conditions like availability and frequency of rainfall. However, when irrigation water is available, the timing can be made a little flexible, properly programmed, so that crop damage would not take place. For example, during the harvesting time the crop should not be affected by rain. Hence, we see that labour plays an important role in this operation. In the next section we would be discussing how labour appropriation should ideally take place when transformation of a system takes place. It is therefore, important to study the existing situation under different circumstances. Since we are studying different systems and their components, each system would be studied separately giving due consideration to the important variables such as rainfall, size of holding and whenever possible the type of labour used at each stage.

Kahambana

Our data collection period was from June 28th 1982 to June 31st 1983 consisting of one full year covering the two major cultivation seasons, 1982/83 Maha and 83 Yala.

In Kahambana, the Yala rains occurred between the middle of April and the second week of June. The latter was exactly two weeks prior to the commencement of our survey. By this time clearing and burning of forests had already started in all land types except in the lands where stabilized agriculture is practised. In the latter case land clearing was limited to a very short period (six weeks) obviously due to the relatively less clearing work necessary as a result of the very small plot size cultivated (0.1 ac/farmer). The Maha rains set in by 12th September (11th week of survey) as recorded in the Okkampitiya weather station, and by this time the initial operations were over in all types of land. Within this long duration of about three months devoted for the initial operations, one would not expect any labour competition within the system.

In Kahambana, the first Maha shower of rains fell during the 11th week of our survey (12th Sept.). The second spell of rain commenced during the 15th week (10th Oct.) which was after a lapse of about a month after the first rains and continued till the 28th week (Jan. 16th). Seeding of crops in the chenas and in the other highland plots took place soon after the first rains. first preference has been given to the Sinnakkara lands due to the small extents involved (0.9 ac/farmer). The homesteads and paddy fields were sown only after the 2nd rains. It was apparent, that, as the farmers are more dependent on chena cultivation in this location, less priority was given to paddy cultivation, even though paddy cultivation depends on rainfall. Therefore, labour use appears to have been so organized as not to affect the chena farming. However, just after the commencement of the second spell of rains before land preparation, some casual labour has been employed to errect bunds in the paddy lands so as to collect the available rain water. But this was very marginal, where only about half a man-day has been used as the size of a lowland holdings was about 0.27 acres.

Between sowing and harvesting, apart from guarding against wild animals and other risks, manual weeding is the only other operation that has been only practiced in the highland plots (including chena)

For the highland plots the total man-days used for weeding amounted to about ten per farm (13.8 per acre for all highlands). This work has taken place during the 13-20th weeks which coincided with the first four weeks of the second spell of rain. The first round of weeding has been during the 13th week on the chena lands. This was to control the first weeds likely to have come up with the first spell of rain in the 11th week. This again shows that priority has been given to the chena plot with regard to labour use. It was also interesting to note that in this instance the farmers have not made any efforts to control weeds in the paddy lands.

The other major operation is harvesting. The timing of this operation has been very specific. Harvesting in the highland (67 percent) plots has commenced in the 24th week and continued till the 25th week (ie. 3 months). The major portion of labour use has been for the chena land (96.11 per farmer). This shows that the selection of crops by the chena farmers has been done to ensure a continued supply of food for these farmers.

Harvesting of paddy has taken place during the 35th and 36th weeks. This was just before the March rains called "Thala wassa" (Gingelly rain) and it occurred in the36th week (early March). One significant factor is the timing of cropping operations by the farmers. This is shown by the fact that the paddy, which was fully mature, was harvested just before the rain thus avoiding crop loss. The "Thala wassa" in early March has been made use of to sow gingelly on all the highlands, except on the so-called stabilized chena due to heavy infestation by weeds after the Maha crop. As harvesting of the Maha highland crops was staggered, labour shortages did not occur and only family labour was used for this purpose.

Mahakalugolla

Only one type of land was cultivated in this location. Therefore, there was no competition for labour although there would have been competition between crops. This is particularly important as highland paddy is a very prominent crop in the cropping mix. In contrast to the traditional land preparation techniques practised under typical chena conditions in Mahakalugolla, mechanical farm power sources have been used. This is one reason why the total labour use here is less than in Kahambana. The reason is obvious. Under typical chena farming conditions as in Kahambana, because of tree stumps left behind after burning and clearing of land, the use of any sources of mechanical power is almost impossible. The use of mechanical power sources would therefore be a clear indication of stability because such farmers would have gone to the extent of removing tree stumps etc. In an earlier study on farm power (Farrington & Abeyratne, 1982) it was clearly indicated that the prospect of using particularly 4 wt. was much greater under highland conditions than on lowland. Apart from cost considerations, which would be examined at a later stage, the implication is that a significant amount of labour would be saved. This advantage would be nullified if labour is displaced and not used for productive purposes. This aspect assumes importance as no other land types are cultivated in this location as already stated.

In this location the rains started during the 14th week of the survey (early October). One important feature was that in some fields, land preparation commenced using 4 wt. as early as the sixth week of the survey when the soil moisture conditions were rather poor.

This is surprising as it is a known fact that the reddish brown earth of the dry zone are very difficult to work on when dry, even with the 4 wt. At a latter stage an attempt would be made to understand the soil types of this location. For the moment this may be considered as an indication of the possibility of preparing land to maximize the use of the available rain water. Unlike in Kahambana, a substantial amount of 'attam' labour appears to have been used in Mahakalugolla. This is mainly because of the yayas or tracts comprised of people from the same area. Farmers in this location cultivate on the basis of about five acres per household. So the need for mechanical power sources is justified. The use of tractors is again justified due to the severe iluk growth in this area, specially under stable conditions. Iluk spreads very fast and it makes the use of tractors almost essential to prepare the fields.

During the same period of time farmers were also using manual methods to get seed beds prepared as a large number of crops were grown in this area. Of the total acreage cultivated by the sample farmers, 28 percent was under highland paddy, 22 percent under maize, 18 percent each under vegetables and kurukkan. A few farmers also grew bananas, manioc, cowpea, soya bean, groundnut and green gram. Apart from these crops, perennials such as citrus, mango, jak and sugarcane too were grown near the houses.

Unlike studying a single crop like paddy, where its operations are specific to a certain piece of land, when all the crops are grown on the same piece of land, the analysis of labour use for each operation becomes rather difficult. However some salient features are apparent:
(i) very low input of hired labour, and (ii) the use of attam labour. Although in general, the use of hired labour has been rather low for the initial clearing of land, nearly 25 percent of the total labour use has been hired labour (9.14 md/per farm or 2 md/ac). Subsequently, until harvesting hired labour use has been very low.

After sowing and dibling of plant material, the other labour intensive operation has been manual weeding before harvesting. This main weeding period coincided with the period just before rains. There is a clear difference between the labour input for weeding in this stable plots of land and the chenas in Kahambana.

For example, in Mahakalugolla for manual weeding the per acre input was 4.71 m.d. (22.57 per farm) compared with Kahambana of 2.33 md/ac. This shows that weeding under stable condition is almost a double effort.

Same features as in Kahamban are visible in Mahakalugolla with regard to harvesting, ie. it spread from the 17th week to 44th week (26 weeks). This again clearly shows that due to the risky nature of cropping under rainfed conditions, farmers tend to stagger the cropping (sowing from 10-26th week) and select a variety of crops. This becomes important specially when there is hardly any Yala crop available. In an earlier section it was mentioned that in Mahakalugolla attam labour was prevalent and that it is attributed to cohesiveness of the people as they migrated from the same village. This attam labour was mainly used during the harvesting season. For harvesting nearly 30 percent of the labour was from attam and about 10 percent from casual labour. Casual labour has been mainly used for harvesting of highland paddy.

Paddy chena systems

In the preceding section an attempt was made to outline the labour use in systems where no irrigated paddy component was included and the labour use pattern related to the availability of rainfall. In Mahakalugolla as there was only one type of land, unless there was labour competition for different crops, an analysis in these terms did not arise. However, in Kahambana, certain preferences within the system were apparent. As the farmers were dependent on the chena mostly, priority was given to it when labour allocations were made. Labour allocation however, becomes very complicated when chena farming is practised side by side with irrigated paddy farming. In such situations the competition for labour could be expected between irrigated paddy farming and chena farming, and also between the different land types within the highland system of farming.

The analysis in these terms is very important, as it has implications with regard to cropping intensity. Some of the literature suggests that paddy cultivation tends to get delayed due to heavy concentration of labour on chena operation.

In view of this fact , much of the rain water is not used for land preparation purposes resulting in heavy use of tank water. This reduces capacity of the tank to irrigate a Yala crop. In most writings, the farmers normally are blamed for waiting until irrigation water is available to start preparation of the paddy fields. Conversely, farmers may delay their work in the paddy fields due to other reasons. Usually they have to give priority to particular farming component on which they are mostly dependent. One of the objectives of the present analysis is to test this hypothesis.

Badagiriya

Badagiriya is a typical mixed farming system which consists of both highland and irrigated paddy farming. As mentioned earlier, the size of the lowland paddy holdings in this area is around 2.76 acres as against 1.75 acres of chena. Hence, our hypothesis is that dependency on the paddy component is greater in this location resulting in more emphasis being placed thereon in resource allocation. There can be a competition for certain factors of production between the different components of the farming system. In the preceding section we attempted to show that in Badagiriya labour use was more extensive in chena farming with the resultant effect that paddy farming is mostly mechanized.

Water issues from the Badagiriya tank to the Stage 1 area commenced during the 11th week (10th Sept.) of the survey and went on till January 10th without any rotations. This was a week ahead of the commencement of the Maha rains. The early release of water was due to two reasons. Firstly, only a quarter of the area (500 ac.) was issued with water during the 1982 Yala season. Secondly, due to extended rains till about the middle of August, the tank was at near capacity. Although, at the begining of this report it was assumed that in major irrigation schemes water is available for both seasons, in Badagiriya only one fourth of the area was cultivated during the 1982 Yala under a Bethma system. Therefore, apart from the reduced acreage there was no difference between the farmers of Badagiriya and Gannoruwa. This made it necessary to change our dependency criteria somewhat. This situation is not unique in Badagiriya alone. In most irrigation schemes, unless they are canal linked, water is not 100 percent assured for the Yala season (Abeysekera 1983).

This leads to a risky situation resulting in farmers turning towards the chena system as risk averse strategy. In the light of this experience it is not surprising that farmers wait until water is issued to start operations in the paddy field.

This becomes somewhat unique in Badagiriya. Although farmers began making bunds etc. in paddy fields with the first issue of water, land preparation which took place a week later coincided with sowing of crops in the chena fields. Under these circumstances labour appropriation becomes very critical. As mentioned earlier, bottlenecks relating to labour had been met by using mechanical sources of farm power for land preparation in the paddy fields. During this period (ie. 11-19th week) in the chenas and home gardens, the farmers have used about 18 mandays out of a total labour input of 25 mandays per acre (for the whole farming system) for planting purposes. In the paddy fields less than 2.5 md/ac had been utilized for land preparation.

Land preparation in the paddy fields had been mainly done with the help of casual labour using mechanical power. During the same period family labour had been utilized in the chenas for sowing purposes. This again shows the farmers' primary attention to the chena (ie. while 6.5 md of family labour was used only about 1.5 and if casual labour was utilized in the chena). Thus, priority given for chena is contrary to our earlier hypothesis that in major irrigation schemes one would expect the paddy cultivation to be given priotity. As indicated earlier, even under these circumstances, it shows that when farmers are not assured of the Yala crop, they quickly change their strategy to avoid risks.

Same sort of bottleneck was visible just prior to the sowing of paddy during the 17th week./By the 16th week almostall the farmers had completed sowing their chena plots having commenced the operations in the 11th week. However, dibbling of certain crops in the chena had commenced only after 14th week and overlapped with the sowing of paddy crop during the 17th and 18th weeks. At this stage it may be observed that farmers had concentrated more on using the family labour on the chena (9.6o md/ac) while supplementing it with about 3.4 md/ac of casual labour and using casual labour totally for the paddy sowing.

From this analysis it may be concluded that even under major irrigation conditions due to the risky nature of the paddy crop, farmers pay greater attention to the chena crop. Hence, they use much of the family labour for this purpose and augment the labour requirement for the paddy crop by using casual labour and mechanization.

The other major labour using activity was harvesting. Harvesting in the chenas and homegardens shows a very distinct continuity pattern, commencing the operations during the 22nd week and tailing off from the 32nd to 34th. The process of spreading the harvesting operation is typical with risk aversion situations. With the tailing off of the harvesting in the chenas, harvesting in the paddy fields took place from the 31st week to 33rd and then from the 38th to 41st week. Competition for labour was apparent specially during the 31st to the 33rd week. It was observed that hired labour was used to augment these periods.

Gannoruwa

Gannoruwa, like Badagiriya has a mixed farming system where paddy is cultivated under irrigated conditions along with chena farming under highland conditions. The chena holdings (3.16 ac.) are much bigger than the paddy holdings (1.51 ac.). Given the fact that smaller paddy holdings are cultivated under minor irrigation, where Yala cropping is virtually absent, the dependence of the farmers on the chena system is much greater as compared to Badagiriya. In Gannoruwa, unlike in Badagiriya, a distinct delay in the paddy cultivation is observed. One of the reasons being the flooding that occurs with the onset of rains. The Mal Ara river which feeds the Badagiriya tank is tapped at a number of places by the Gannoruwa farmers to irrigate encroached lowlands. With the onset of rains, the rising water level of the Mal Ara river causes floods in the Gannoruwa paddy tract as a result of water flowing through the illicit channels dug by the farmers. This flooding delays the cultivation of paddy. This is only a part of the story. In Gannoruwa, as the dependency is much more on the chena, the preference of the farmers is to complete the chena operations first in order to use the rain water to the maximum. These two factors place the chena farmers in a vicious circle due to the chain reaction. Due to the delay in commencing operations in the paddy fields, a considerable quantity of tank water is used for initial operations, resulting in an inadequacy of water remaining in the tank to complete the other operations.

Unless the April rains occur in time, most of the paddy fields are destroyed. By mid May the South-west monsoon sets in and, more often than not, the rain coincides with the harvesting period resulting in crop loss. Under these circumstances the farmers are more or less totally dependent on their chenas for subsistence.

Rains in the Gannoruwa area commenced during the 14th week of the survey ie. the first week of October. With the onset of rains the chenas were sown which lasted for about four weeks using mainly family labour (2.57 md/ac). There was no visible labour competition in Gannoruwa as the major operations in the paddy fields commenced only during the 17th week (4th week of October). With the cleaning of bunds ploughing operations commenced during the 25th week and sowing was completed by about the 30th Week.

The next major operation involving labour is harvesting. Here too there does not appear to be any labour competition. Harvesting in the chena was done during theperiod 22nd-36th week. Paddy harvesting commenced during the 39th week and continued till the 45th week. As hypothesised although the S.E. monsoon did not break in time, the April rains got delayed until the 44th and 46th week affecting the paddy harvest to some extent.

The above account clearly indicates that farmers in Gannoruwa practise a risk averse situation by giving more emphasis to chena cultivation.

In considering the paddy-chena systems under different circumstances we still see that farmers pay greater attention towards their chena farming operations. However, as far as labour use is concerned, one may easily identify two different situations in which the labour competition in Badagiriya is apparent. In Gannoruwa it is not so. But still our basic premise stands, ie. although our hypothesis was that in Badagiriya the farmers were more dependent on their paddy produce, the degree of dependence changed due to the insecurity of the paddy crop. However, due to the advantage of cultivating a lesser acreage and also a more assured supply of water the degree of dependence on chena was less in Badagiriya compared with Gannoruwa. In an effort to make maximum use of the rain water by getting a head start with the chenas, the farmers seem to have used their better standard of wealth to hire both mechanical power and hired labour for the field operations connected with paddy farming.

3.3 Crop husbandry and agro-technology

According to the agro-ecological classification of Sri Lanka (Land and Water Use Division, Department of Agriculture, 1981), the areas under study belong to the dry and intermediate zones. Some parts of Moneragala district fall within the low country intermediate zone (IL) while the rest is included in the low country dry zone (DL), and Hambantota district is entirely located in the low country dry zone. The study village in the Moneragala district namely Mahakalugolla lies between DL_1 and DL_2 and Kahambana in DL_1. Both villages in Hambantota lie in DL_5 (See Map 3).

The average annual rainfall is 50" - 75", characterised by a bi-model distribution pattern. The major rainy season extends from October to January, referred to as the North-East monsoonal period or the maha cultivation season. The minor rainy season from March to late July is referred to as the South-West monsoonal rains or the Yala cultivation season. Dry periods follow the wet periods, with a short dry period from February to March and a long dry period from May to September. The rainfall pattern is highly variable both in terms of the total rainfall and its pattern of distribution which makes rainfed agriculture a hazardous task. More specifically in both districts the rainfall is well below the annual average (around 760 mm) has recorded a decrease over the past 26 years. (See Figure 1 & 2).

The dominant soil groups are reddish brown earths (RBE) with immature brown loams, reddish brown non-calciferous soils, alluvial soils, red yellow podsolic soils, regosols with sand, red yellow podsolic soils with laterite humic gley soils and non-calcic brown soils (Panabokke, 1947, De Alwis and Panabokke (1972/73). (See Map 4). The potential land use and management of the above soils have been described in greatet detail by De Alwis and Panabokke (1972/73).

Farming systems in the study areas

As stated in Chpter 2 farming is the main economic activity of the people in thestudy areas of both districts. The main systems practised are rainfed and irrigated farming along with some livestock production.

MAP No. 2 AGRO-ECOLOGICAL REGIONS OF SRI LANKA

Scale 1: 2,000,000

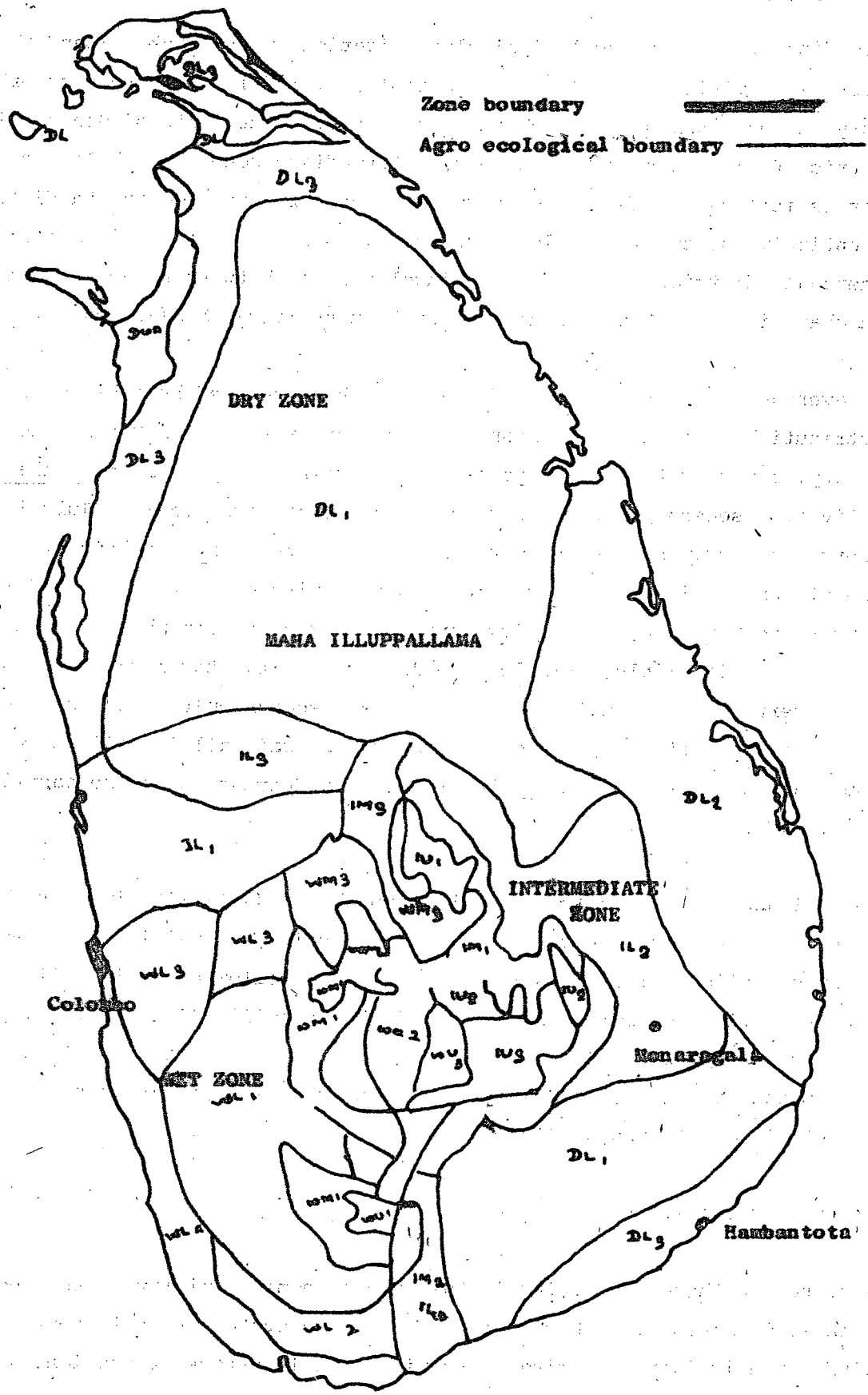


Figure 1. BADAGIRIYA ANNUAL RAINFALL (MAHA)

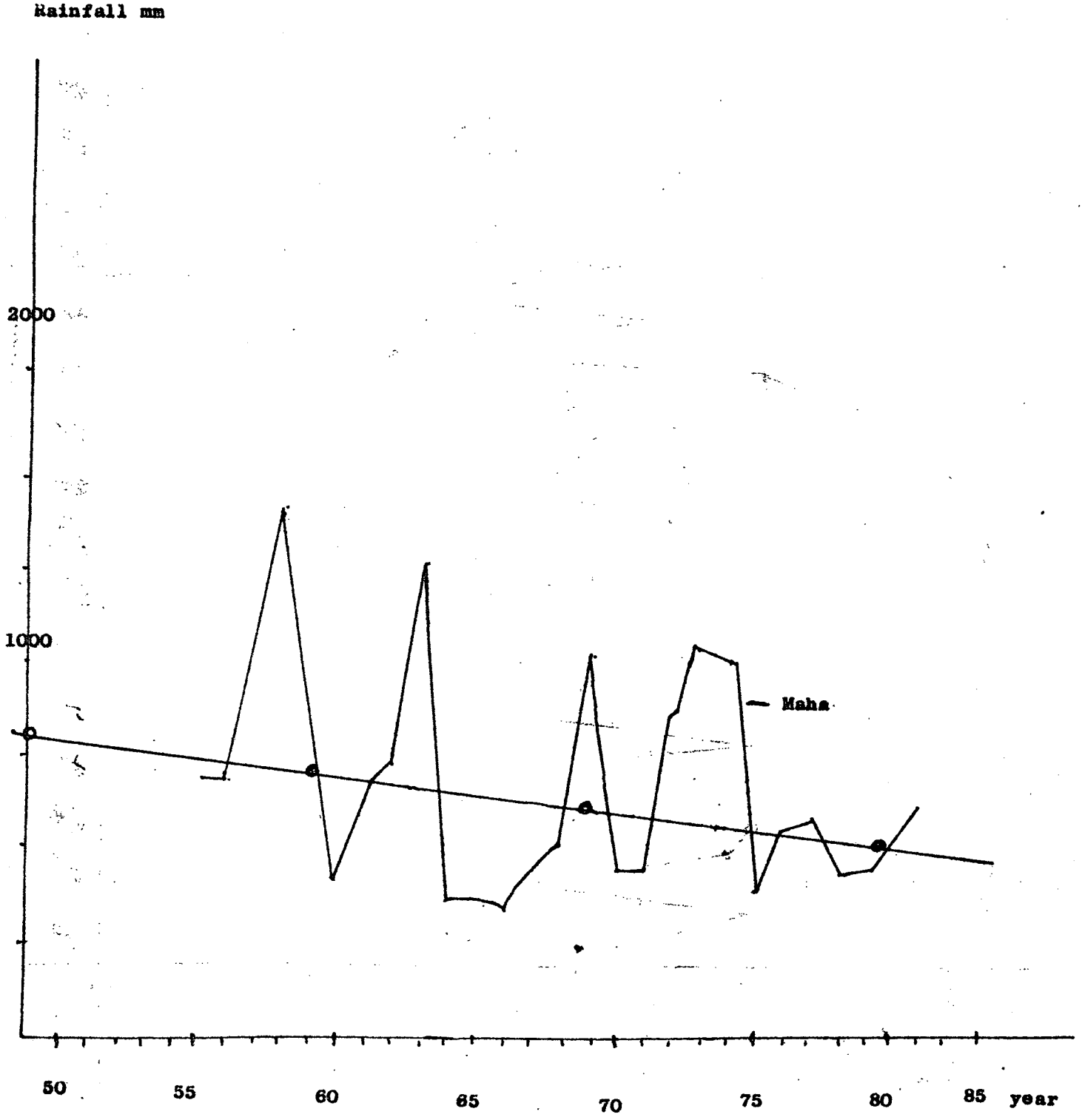
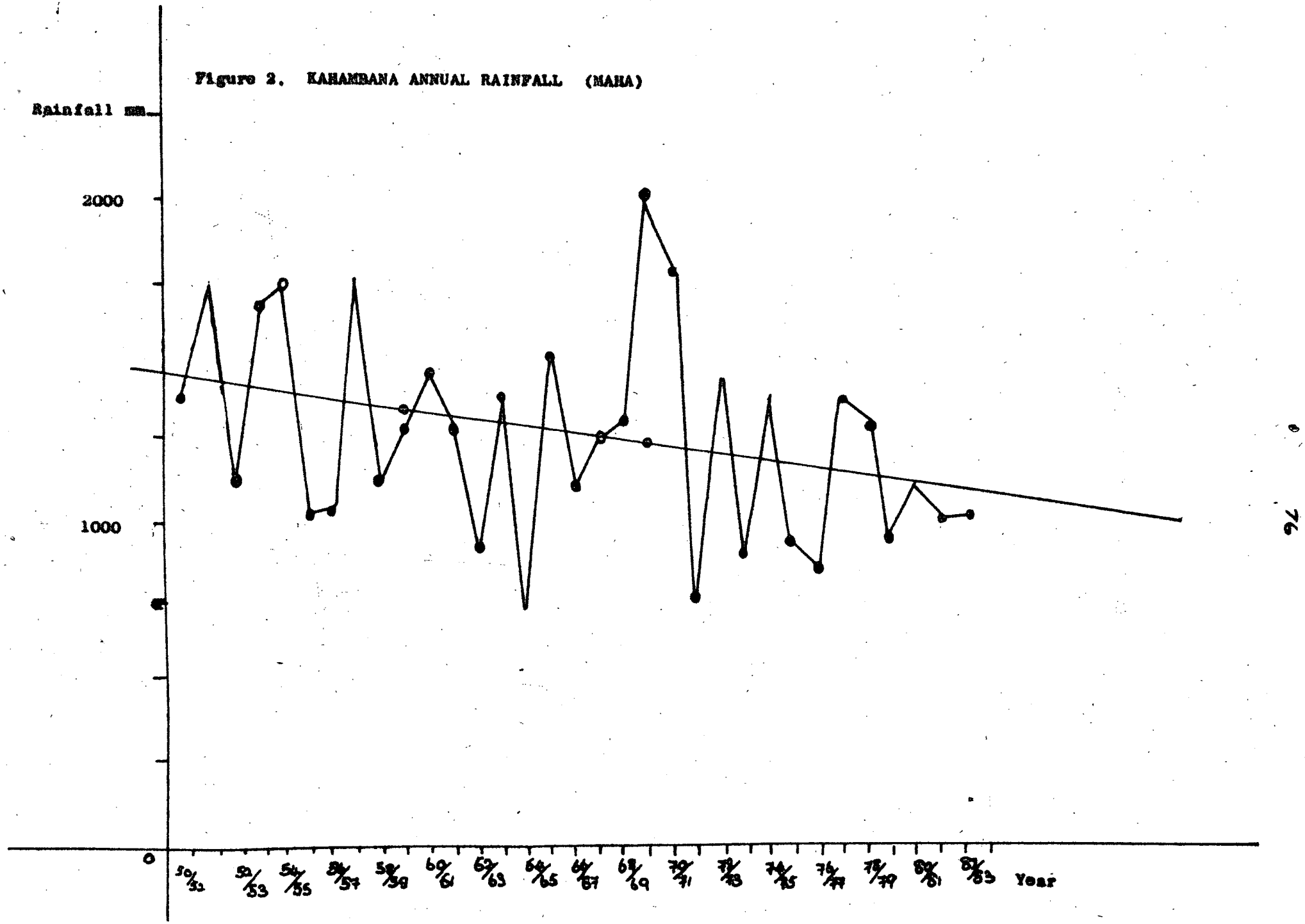
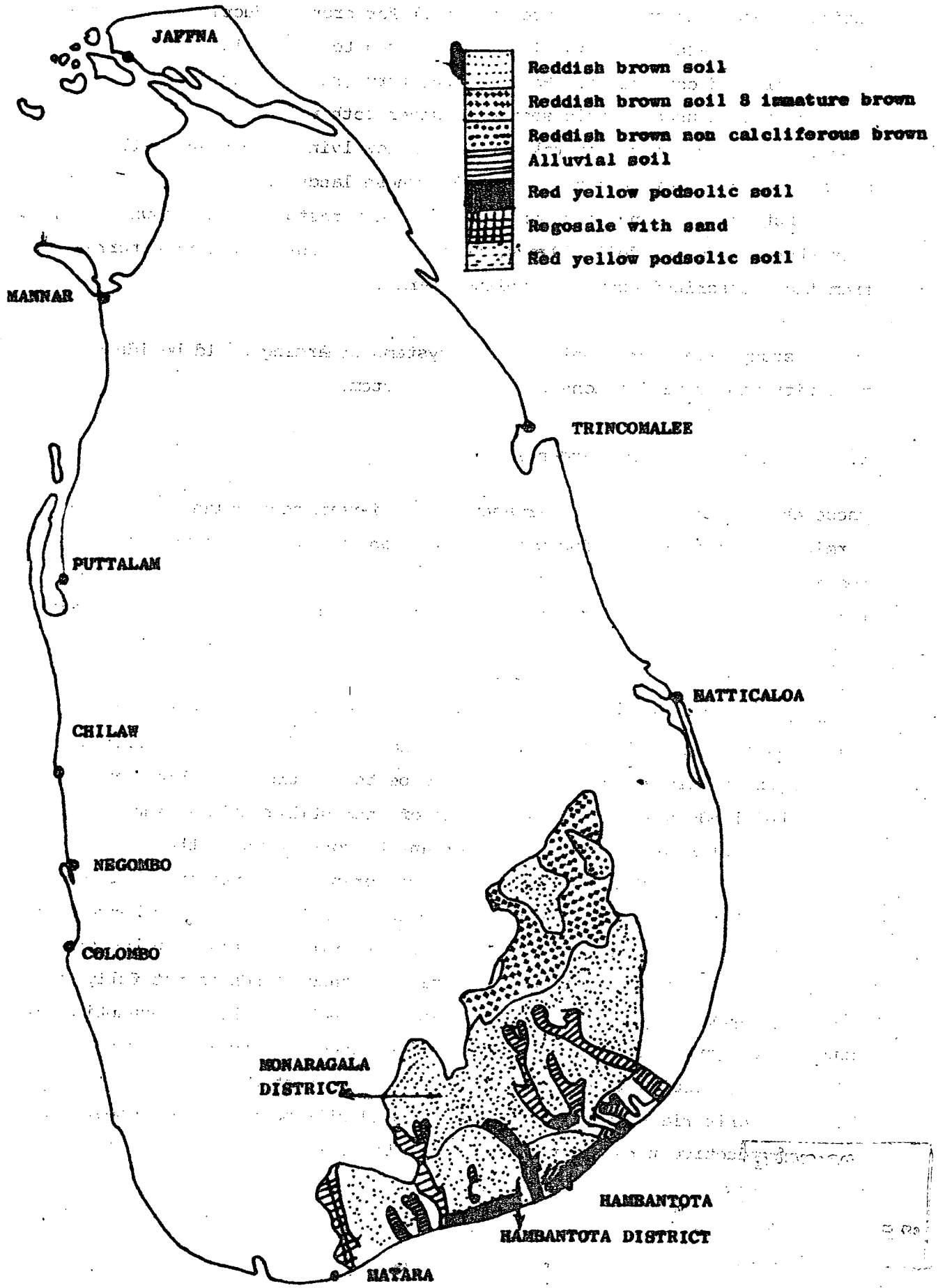


Figure 2. KAHAMBANA ANNUAL RAINFALL (MAHA)



MAP NO. 3. MAJOR SOIL GROUPS IN MONARAGALA AND HAMBANTOTA DISTRICTS



Rainfed farming is described as farming under non-irrigated conditions, entirely dependent on the natural rainfall for crop production. It should be noted that rainfed farming is also referred to as "dryland farming" under semi-arid conditions. However, the terms rainfed farming or highland farming will be used in this section. Under both rainfed and irrigated conditions paddy production takes place in low lying slopes and vally bottoms which are often poorly drained. These lands are mostly devoted to paddy, but areas around tank bunds may be under pasture. (See Brown et.al,'83) Ruthenburg, 1976 has defined these tracts as lowlands or wet rice terraces from those described above as "upland" farms.

In the study areas three well defined systems of farming could be identified with many ramifications within each system.

1. Homesteads (or home gardens)

These can be referred to as permanent or semi-permanent upland systems of farming. Continuous farming with annual crops and with semi-permanent or sometimes permanent tree species have led to the establishment of these homesteads. Homesteads are characterised by clearly demarcated fields with fences, permanent boarder trees and the presence of semi-permanent or permanent dwelling houses. The farmers in all four study villages possess homesteads as is common within the entire region (only difference was in Mahakalugolla where the homestead was amalgamated to the whole system). The origin of this similarity appears to be the settlements which are encroached lands now regularized. Some of them stillremain as encroachments. The most popular semi-permanent or permanent crops grown in the homesteads of the Moneragala district are banana, lime, orange, coconut and jak. Once firmly established, these crops are able to tolerate drought and hence, are considered income earning cash crops. The cropping practised in homestead is highly unorganized; hence the pptential of these lands is not fully utilized. A system of cropping which includes annuals for home consumption together with permanent food, fuel and timber species should be prepared as a model for adoption in homesteads and semi-permanent systems based of two important criteria so that the demand for land will be high, and homesteads may be productive through crop intensification.

2. Lowland paddy cultivation

Paddy is cultivated in low lying areas in both districts. However, the contrasting feature is that in Mahakalugolla and Kahambana paddy is rainfed and grown only in the Maha season while in Gonnoruwa and Badagiriya Maha is devoted to irrigated paddy as irrigation facilities are available. Double cropping is feasible provided irrigation facilities are available in the Yala season. Often Yala crop is risky and fallowing is the usual practise. Sometimes other subsidiary field crops and vegetables can be seen on these lands.

3. Chena or shifting cultivation

As defined by Ruthenburg (1976), chena or shifting cultivation is an alteration of cropping for two to three years and a long period in which the land is rested for recuperation. As stated earlier, Hambantota is a paddy dominant district while Moneragala is chena dominant. Therefore, the extent of chena grown annually varies, although the practises adopted are much the same in both districts. Basically this system of farming involves cutting and burning of virgin or secondary jungle and mixed cropping for one to three seasons with cereals, legumes, vegetables, condiments and then abandoning it for varing periods ranging from 8-20 years for regeneration of natural vegetation and renovation of soil. Although the agronomic practices, adopted, have not undergone any changes, there has been a reduction in the fallow period, which now is around two to five years as shown below.

Length of the fallow period

The average length of the fallow period in all four villages has been reduced considerably over the past years (Table 3.3.1).

Table 3.3.1 LENGTH OF FALLOW PERIOD PERCENTAGE OF THE RESPONSE

No. of years fallowed	Percentage of farmers reporting			
	Hambantota district		Moneragala district	
	Badagiriya	Gannoruwa	Mahakalugolla	Kahambana
2	7.4	6.2	2.1	5.7
3 - 5	31.5	45.8	27.1	45.7
6 - 10	11.1	27.1	-	28.6
11 - 15	13.0	-	-	8.6
More than 15	9.2	4.2	-	11.4
No. fallowing	27.8	16.7	70.8	-

The general reasons attributed by farmers for shortening the fallow period present an interesting picture which shows a trend towards a semi-permanent and then to a permanent system of agriculture. This could be a reflection of farmer inclination towards permanent cultivation, either willingly or unwillingly, for various reasons as will be discussed later. About 40-50 percent of the farmers in Badagiriya, Gannoruwa and Kahambana reported a fallow period of two to five years. Mahakalugolla presents a special case where only 29 percent practise a similar -length of fallow and 71 pereent practise continuous cultivation more or less similar to the present practises in the developed dry zone areas.

Badagiriya 28 percent and Gannoruwa (17 percent) follow the same practise of non-fallowing. In cases where land availability is limited and population pressure has been evident, this tendency appears to be dominant. Thus, in Kahambana a relatively high availability of forest lands indicates a fallow of six to ten years and 11 percent of the farmers reported a fallow extending over 15 years. For how long land is available in plenty will apparently decide the length of fallow as in the other villages. A feature of special interest in Mahakalugolla is that some farmers grow sugarcane continuously over several seasons.

Sugarcane unlike other annual chena crops is semi-permanent which could grow under adverse weather conditions. Competition from weeds and loss of fertility due to chena farming doesn't affect the cane crop so severely like other short term annuals. It requires less labour but gives a relatively high income with low input costs. This aspect will be dealt with in detail under crops and cropping. Continuous cultivation reported by Mahakalugolla farmers (71 percent) should not be misinterpreted and is mainly attributed to the continuous cultivation of sugar cane on some of the highlands in the Mahakalugolla village. This could be identified as the intermediate stage (semi-permanent agriculture) before it is transformed into permanent agriculture.

The most evident explanations for the reduction of the fallow period are the population growth due to migration and non-availability of forest land (Table 3.3.2).

Table 3.3.2 REASONS GIVEN BY FARMERS FOR THE REDUCTION OF FALLOW PERIOD (% OF THE RESPONSE)

Reasons	Hambantota district		Moneragala district	
	Badagiriya	Gannoruwa	Mahakalu-golla	Kahambana
Population pressure	28.6	38.4	9.6	29,2
Lack of forest land	57.1	50.0	34.6	68.7
Competition exerted by migrant chena farmers	6.1	4.6	-	2.1
Due to restrictions made by law as jungle clearing	8.2	5.8	53.8	-
Easiness to cultivate the already developed land	-	1.2	2.0	-

However, about 54 percent of the farmers at Mahakalugolla reported that restrictions made by law as the reason for shortening the fallow period. The situation is specific to Mahakalugolla as a government reafforestation programme is being carried out in the adjacent areas. Thus, the frequent visits by the government officers have had an effect on reducing the clearing of jungle lands. With the present trend towards short fallow periods it will be essential to introduce modern cultivation practices and ensure availability of necessary infrastructural facilities to maximise production.

Crop Husbandry

A wide variety of crops is grown under rainfed conditions in chenas in all four villages studied. The type of crops grown and the emphasis placed on them depend, to a great extent, on the purposes for which they will be subsequently utilized. The nature of farming practised therefore can be identified as purely subsistence, semi-commercialized and ocmmercialized. In most of the villages chena farming is for the purpose of meeting the consumption demand, while the surplus is sold for cash income to meet other living expenses. However, there are exceptions. Cotton in Badagiriya and Gannoruwa and sugarcane in Mahakalugolla are grown entirely for commercial purposes. Unlike in the past when chena farming was of a subsistence nature, a gradual tendency towards semi-commercialization to commercialization can be observed in the present day context.

The main crops grown in Badagiriya and Hambantota are kurakkan, cowpea, green gram, chillies, ground nut, maize and cotton, while in Kahambana and Mahakalugolla maize, kurakkan, cowpea, ground nut, manioc and sugarcane are grown in that order of importance (Table 3.3.3).

Choice of crops

The choice of any crop for cultivation is determined by two major considerations viz. (a) as a source of food and (b) as a source of income. Tables 3.3.4 and 3.3.7 show the criteria for choosing various crops in chena farming in the study areas. The Badagiriya farmers grow kurakkan, maize and green gram mainly for consumption; pumpkin is grown for both purposes and gingelly, chillies, cowpea, soya bean and cotton as cash crops. The trend is similar at Gannoruwa, but green gram and pumpkin are dominat cash crops.

Table 3.3.3 CROPS GROWN IN 1982/83 MAHA SEASON

Type of crop	% Of the response			
	Hambantota		Moneragala	
	Badagiriya	Gannoruwa	Mahakalugolla	Kahambana
Cotton	2.5	10.08	-	-
Kurakkan	12.8	19 33	24.3	21.8
Vegetables	6.5	3.36	-	0.8
Chillies	8.6	17.22	0.4	-
Red-pumpkin	1.8	-	-	-
Green gram	18.5	14.70	-	1.2
Cowpea	14.8	11.34	10.8	24.6
Gingelly	4.3	-	-	2.o
Maize	6.9	4.62	30.7	24.7
Ground nut	12.0	2.52	5.9	22.1
Meneri	0.4	-	-	-
Dhal	8.3	-	-	-
Ash pumpkin	1.1	2.52	-	-
Onion	0.7	-	-	-
Ma	0.4	1.26	-	-
Plantain	0.4	-	0.7	-
Pumpkin	-	8.82	5.9	-
Manioc	-	0.84	10.8	-
Bringals	-	1.26	-	-
Kudara	-	-	-	0.4
Bitter gourd	-	0.42	-	-
Kollu	-	-	-	0.4
Sesame seed	-	1.68	-	-
Black gram	-	-	-	0.4
Sugar cane	-	-	6.3	-
Gram	-	-	-	0.8
Soya bean	-	-	2.6	-
Sorghum	-	-	-	1.2
Lime	-	-	0.4	-
Paddy	-	-	0.4	-

The villagers in Moneragala district grow few crops for food eg. kurakkan, maize, ash plantain and manioc, while the rest are grown as cash crops. Sugarcane is grown widely in the Mahakalugolla and is the major cash crop of the area. Apart from the two variables ie. marketability and to meet food requirements. The general views expressed by farmers in all four areas in crop selection include other criteria such as crop duration, climatic adaptability, tolerance to pest and diseases, less rigorous management practices and less damage by wild animals.

Table 3.3.4 (g) (HAMBANTOTA-BADAGIRIYA)- THE CHOICE OF CROPS IN CHENA

Crop	% of the response				
	For consumption	For income	For higher income	Short-term crops	Easy to cultivate
Cotton	-	33.3	66.7	-	-
Kurakkan	96.6	-	-	-	3.4
Chillies	44.3	48.27	3.45	3.45	-
Red pumpkin	50.0	50.0	-	-	-
Green gram	36.4	32.7	7.3	20.0	3.6
Cowpea	29.0	45.2	6.5	16.1	3.2
Gingelly	-	50.0	16.7	16.7	16.6
Maize	80.0	-	-	-	20.0
Ground nut	18.52	48.15	11.11	14.81	7.41
Soya bean	-	-	100.00	-	-
Ash pumpkin	-	-	-	-	100.00

Table 3.3.5 (g) HAMBANTOTA-GANNORUWA) - THE CHOICE OF CROPS IN CHENA

Crop	% of the response				
	For consumption	For income	Easy to cultivate	For higher income	Short-term crop
Cotton	-	94.4	-	5.6	-
Kurakkan	91.6	4.2	4.2	-	-
Chillies	52.4	33.3	4.8	9.5	-
Green gram	31.2	37.5	18.8	-	12.5
Cowpea	60.0	30.0	10.0	-	-
Maize	75.0	12.5	12.5	-	-
Ground nut	33.3	33.3	-	-	33.4
Pumpkin	20.0	40.0	26.7	13.3	-

Table 3.3.6 (g) (MONERAGALA-MAHAKALUGOLLA) - THE CHOICE OF CROPS IN CHENA

Crop	% of the response					
	For consumption	For income	Easy to cultivate	For igher income	Short term crop	Suitable for area
Kurakkan	50.0	18.8	15.6	3.1	-	18.8
Chillies	-	100.0	-	-	-	-
Cowpea	12.5	41.7	-	33.8	8.0	4.0
Maize	37.7	13.0	26.2	4.3	-	18.8
Ground nut	-	26.7	13.3	40.0	6.7	13.3
Soya bean	-	44.4	-	55.6	-	-
Pumpkin	-	25.0	25.0	50.0	-	-
Sugar cane	-	24.0	8.0	68.0	-	-
Manioc	50.0	12.5	25.0	12.5	-	-
Plantain	50.0	50.0	-	-	-	-

Table 3.3.7 (g) (MONERAGALA-KANAMBANA) - THE CHOICE OF CROPS IN CHENA

Crop	% of the response				
	For consumption	For income	For higher income	Easy to cultivate	Short term crop
Kurakkan	61.8	26.5	-	8.8	2.9
Cowpea	27.0	33.3	6.3	18.8	14.6
Maize	27.8	35.2	11.1	16.7	9.2
Ground nut	21.2	32.0	21.2	12.8	12.8
Soya bean	-	-	100.0	-	-
Paddy	100.0	-	-	-	-

Crop duration is important when farming under rainfed conditions. Hence short duration crops such as green gram, gingelly, ground nut, cowpea appear to be dominant annual crops in all areas. These crops including red pumpkin, ash pumpkin, maize and manioc are also the ones that are easy to cultivate as they do not require much inputs or effort on the part of the farmer.

From the foregoing Tables it is clear that the traditional food crops such as paddy, maize, kurakkan and manioc have continued to remain in the chena system. On the other hand, the choice of cash crops have changed over the years. Often some crops have been grown in limited extents and sometimes completely dropped by certain farmers due to the unfavourable market prices and other constraints encountered in their cultivation. Thus, both in Badagiriya and Gannoruwa in the Hambantota district cotton has been dropped from the cropping systems due to low yield, poor market facilities, pest and disease occurances and difficulties in obtaining seed cotton for planting. In Badagiriya, chillies and tomatoes have also been dropped in 1982/83 Maha, due to damage, by wild animals and drought.

Table 3.3.8 CROPS DROPPED DURING THE LAST 5 YEARS

Crop	Reasons	% of the response	
		Gannoruwa	Badagiriya
Cotton	1. Damage by wild animals	-	8.3
	2. Abandoned by many farmers	-	8.3
	3. Difficult to market	40.0	33.3
	4. Cannot obtain seeds for planting	-	8.3
	5. Disease and pest problems	40.0	25.0
	6. Low yield	20.0	16.8
Chillies	1. Damaged by wild animals	-	50.0
	2. Lack of irrigation water	-	50.0
Tomato	1. Low yield	-	100.0

Of the other crops that were traditionally grown in chenas, presently dropped are sorghum, black gram and fox tail millet due to diseases and severe bird damage. The introduction of new crops to the two villages in the Moneragala district also presents an interesting picture of farmer's awareness of economics of farming. During the past five years cowpea, sugar cane, ground nut, soya bean and chillies have been introduced to Mahakalugolla, while cowpea and ground nut have assumed dominance in Kahambana. The reasons for introduring the new crops have been based on two criteria viz. easy to grow and to market. In other words, these crops are ecologically adaptable to the area, less risky and enjoy a favourable market price (ie. economically viable). There have been no new crop introductions to both villages in the Hambantota district. The stage of agricultural development in the two districts has been responsible for this and is therefore, contrasting. The former is a chena dominant and socio-economically less developed village, while the latter is paddy dominant, more developed and is blessed with a well established Regional Agricultural Research Station situated at at Angunakolapellessa. This may have influenced the introduction of new crop varieties and some agro-techonology many years ago.

Table 3.3.9 NEW CROPS INTRODUCED DURING THE LAST 5 YEARS

Crop	Season	Reason	Mahakalugolla	Kahambana
Cowpea	Maha	1. By using new seeds	10.0	7.4
		2. Easy to cultivate	70.0	35.71
		3. Easy for marketing	20.0	50.0
		4. For consumption	-	7.14
Sugar-cane	Maha	1. Easy to cultivate	50.0	
		2. Easy for marketing	50.0	
Ground nut	Maha	1. Easy to cultivate	33.7	83.3
		2. Easy for marketing	66.3	-
		3. Certified seed is good	-	16.7
Soya bean	Maha	1. Easy to cultivate	66.7	
		2. Easy for marketing	33.3	
Chillies	Maha	1. Easy to cultivate	100.0	

Crop losses occur frequently in chenas. Although quantitative data are not available, crop losses have been a serious problem and a risk to the chena farmers. In chenas drought and wild animal damage are the major causes for crop losses. As indicated earlier, the extent to which damage reported again reflected the stage of development of the districts. Table 3.3.10 shows that drought is the major factor responsible for crop losses in Badagiriya and Gannoruwa in the Hambantota district (63 percent and 86 percent) while in Mahakalugolla and Kahambana damage by wild animals is reported as substantial (84 percent and 49 percent). Crop losses in paddy are mostly due to drought (75 - 100 percent). Farmers in both these villages claim that chena farming is much less risky than paddy cultivation associated with timeliness of cultivation and use of short duration crops.

Cropping calendar

The cropping calendar for the Maha season begins around May/June in all four villages with the initial activity of land clearing. The land clearing is extended into the months of June and August, but a majority of farmers clear in July at Gannoruwa. Thus, 60 percent of farmers cleard their

Table 3.3.10 CAUSES OF CROP LOSSES

Cause	% of the response											
	Hambantota District						Moneragala District					
	Badagiriya			Gannoruwa			Mahakalugolla			Kahambana		
	Chena	Paddy	Home gardening	Chena	Paddy	Home gardening	Chena	Paddy	Home gardening	Chena	Paddy	Home gardening
Drought,	62.9	47.6	15.4	85.7	100.0	100.0	14.54	86.8	-	49.3	75.0	100.0
Disease & pest	8.1	15.9	2.6	-	-	-	1.82	13.2	-	-	-	-
Wild animals	11.3	9.5	5.1	10.7	-	-	83.64	-	100.0	49.3	25.0	-
Not responded	17.7	27.0	76.9	-	-	-	-	-	-	-	-	-
Excess rain	-	-	-	3.6	-	-	-	-	-	1.4	-	-

lands in July at Gannoruwa, 89 percent at Badagiriya, 67 percent at Mahakalugolla and 100 percent in June at Kahambana. This operation is completed during July and August in all the study areas, but most of the farmers complete this operation in July (63-97 percent). The clearing operation is followed by the burning of the felled shrubs and trees which commences over the same period. The majority of farmers complete burning in July or August. The burning will be easier if the leaves of felled trees are allowed to dry. Hence, burning is usually done about two to three weeks after clearing of jungle lands. The above operations are mandatory for the cultivation of chenas but the other operations such as fencing and land preparation are not done by many farmers. Thus, in Gannoruwa and Badagiriya only 35 percent and 38 percent respectively of the farmers have erected fences for crop protection from wild animals.

In Mahakalugolla, it is still lower at 8 percent, while in Kahambana 86 percent of the farmers have erected fences. Fencing, if done, generally begins around July/August and extends to September or early October. Land preparation is very limited and minimum tillage is the general practise. This operation begins around September (50 - 80 percent) and is completed by October in Hambantota study areas, and in September in the Moneragala study areas. Seeding or transplanting is done with the onset of the N.E. monsoonal rains which commences in late September or early October. Thus, in Gannoruwa, seeding or transplanting is mainly in October (76 percent) and in Badagiriya in September/October (45 - 51 percent) and in both cases completed in October. In Mahakalugolla (75 percent) and Kahambana (97 percent) of farmers seed their crops in September and complete in September/October. Therefore, in all cases the land clearing to seeding is restricted to the months of June-October and the cropping synchronizes with the monsoonal rainfall. As evidenced by the earlier chapters, there is hardly any after care in terms of crop management, but weeding is found to be a regular practise in all four locations. Weeding begins in September or October depending on the time of seeding of the crops as indicated earlier and could continue until November or December depending on the locations and the crop. As reported earlier most farmers grow short duration crops that will mature in about 3 - 3½ months, so that the falling of rains will coincide with the time of harvesting. Therefore, in the chronological order harvesting begins in December and goes on till March and sometimes early April. However, most of the crops are harvested in January.

At Gannoruwa, a large proportion of the harvests are collected in January (70 percent) at Badagiriya from December/- January (46 - 52 percent) and in both locations at the Moneragala district in January. It is clear that the harvesting season is virtually limited to the months of December and January, and the harvests, being mostly perishable, create problems in marketing and a glut in the market is always a normal occurance.

Chapter four

PRODUCTIVITY OF THE TOTAL SYSTEM

Input output parameters of the farming system

Input and output parameters are good indicators of the viability of a particular farming system under a changing environment. They also indicate the directions of change that may be envisaged. Some of the important variables that would be studied, under this section are as follows:

I. Agricultural input use in terms of
   a) crop establishment
   b) physical quantities
   c) sources of purchase

II. Agricultural output in terms of
   a) physical quantities
   b) income per farm and acre
   c) disposal mechanisms

III. Off-farm income

IV. Off-farm expenditure

ACRICULTURAL INPUT USE

(a) Crop establishment

As indicated in previous chapters, minimum tillage practises are adopted in chena farming. The operations involve cutting and slashing of shrub jungle and undergrowth, allowing them to dry for sometime and setting them on fire. The earlier system of mixed cropping is practised to a limited extent and presently small extents of land are deveted to individual crops allocated on the basis of topographical and soil characteristics. Thus, fertile highlands are planted with sugar cane (Mahakalugolla) and cotton (Badagiriya) etc, while millets are grown on sandy low lying tracts in Gannoruwa and Badagiriya.

Cereals such as finger millets, maize etc. are broadcast sown; pulses are dibbled into the soils by using a pointed stick. The practise of minimum tillage with least disturbance to the soil and the seeding of crops whether mixed or in monoculture at high density unconsciously controls erosion to a considerable extent and also controls weeds for sometime. However, farmers make no conscious effort to maintain the soil fertility as will be described later.

(b) Physical quantities

This is one of the most important variables that determines the stage or growth of a particular system. Under classical chena conditions input use is minimal as a certain degree of natural soil fertility, weed control and pest and disease control are maintained. With a changing situation however, the need arises to use outside inputs in order to sustain a higher level of production. In fact it is a sine-qua-non for stabilized agriculture. The present situation with regard to this aspect, under different conditions will be analysed in the ensuing paragraphs.

The earlier hypothesis fits well with the Kahambana situation where, apart from labour and seeds, no other inputs have gone into farming. The source of seed material too has always been the remaining stock of the previous harvest.

As mentioned earlier when chenas become more stabilized, one would expect that the use of inputs would have a greater chance of sustaining productivity. But the evidence available from Mahakalugolla is rather surprising. In a tank-based village economy rice plays a major role in the diet of the people. However, as in Kahambana, where the economy is based on the produce of highlands, the place for rice is rather marginal and the staple diet is mostly kurakkan. In a strictly shifting system making an effort to errect bunds to impound water in order to cultivate the fields is rather a wastage of time and energy. But in Mahakalugolla the situation is rather different. Here the economy is more monetised and open compared to Kahambana and the community has moved further from consumption of kurakkan towards rice. Also as shifting from one piece of land to another is not very frequent, farmers have made an effort to destump the fields and to erect bunds to impound whatever rain water is available so as to have a successful paddy crop.

To justify their efforts, a distinct difference could be observed with regard to the cultural practices for the highland paddy crop viz-a-viz the other highland crops.

In Mahakalugolla, almost all the paddy fields were under old improved varieties (like H_4). Although substantial amounts of chemical fertilizer (urea) had been used, it was for below the recommendations. In fact no basal application of fertilizer had been used (See Table 4.1). This is understandable since basal application is normally done under lowland conditions just before sowing. Under highland conditions mostly it is kakulan (dry) sowing and if rains are delayed, the application of fertilizer becomes useless. Although no top dressing (TDM) mixture is recommended for Moneragala district apart from use of urea, TDM too has been used and in all 75-80 Kg/ac. has been used for both 3-3½ and 4-4½ varieties. Although the top dressing is adequate for 3-3½ varieties, it is less than the recommended dosage for 4-4½ varieties (101.8 Kg/ac).

Also in Mahakalugolla a substantial quantity of insecticides has been used on 3-3½ month paddy varieties. One salient feature is the use of weedicides and it is again mostly in the fields of 3-3½ month varieties. This is probably due to the fact that weed growth is more pronounced in fields where varieties with less tillering and erect types are grown. Another important observation in Mahakalugolla was that almost all the farmers have obtained their input requirements with their own funds. This again reflects the need for institutional credit for unregistered highlands as well, if right quantities of inputs are to be used.

Although a substantial quantity of inputs is used in Mahakalugolla for paddy production, no other inputs apart from seeds have been used for other highland crops. These seeds again have come from their own stock, except for soya bean and vegetable seeds, which they have obtained from government institutions. As in the case of paddy, very marginal amounts of weedicide have been used.

Table 4.1 FERTILIZER USE FOR PADDY CULTIVATION IN THE DIFFERENT SYSTEMS (MAHA)

*(The values stated land area differ from that of Table 3.1 since here we considered those who actually grew a particular variety in a given piece of land. When averages were calculated the total sample was considered).

Village	Land type											
	Allotted lowland			Rented in lowland			Encroached			Other lowlands			Highland		
	Paddy variety			Paddy variety			Paddy variety			Paddy variety			Paddy variety		
	Local	3-3½	4-4½	Local	3-3½	4-4½	Local	3-3½	4-4½	Local	3-3½	4-4½	Local	3-3½	4-4½
Badagiriya															
Average farm size (Acres)			2.82			2.0			1.5			2.0			
Quantity per acre															
V_1 (Kg)			50.0			-			-			-			
Urea			46.6			37.5			66.6			72.2			
TDM			38.4			-			66.6			-			
Gannoruwa															
Average farm size (Acre)	2.75		1.97						3.0						
Quantity per acre															
V_1	-		50.7						-						
Urea	-		32.9						16.7						
TDM	-		15.0						-						
Mahakalugolla															
Average farm size (Acres)													1.44		1.66
Quantity per acre															
V_1													-		-
Urea													35.7		25.0
TDM													46.0		50.0

When chena cultivation is practised along with lowland paddy production, a substantial degree of difference in the use of inputs is apparent subject to the dependency criteria (Table 4.1). In Badagiriya where it was shown that farmers are more dependent on their paddy, the emphasis has been more on the allotted lowland. This is quite obvious as water is assured to these plots. Although less than the recommended quantity (50 Kg/ac) V_1 basal mixture has been used on the allotted lowlands, least amounts of fertilizer (only urea) were used on rented lands because a share of the produce is payable to the landlord as a result of the existing tenancy arrangement. In Gannoruwa, the application of fertilizer (specially top dressing) was much lower than in Badagiriya.

Both in Badagiriya and Gannoruwa no fertilizers at all were used on the highlands. Use of insecticides was quite common in Badagiriya chenas.

As far as input use is concerned, one could identify a difference in the four different systems. In systems where long fallows are practised with sole dependence on chenas, no attempts appear to have been made to use any kind of purchased inputs to increase production. However, when fallows are shortened and complete dependency on chena becomes imminant, some degree of input use by way of agro chemicals and fertilizer is observed as expected. However, the level of use and the type of inputs pose a number of questions as it is doubtful whether this would enhance and sustain productivity. For example, such input use is not evenly distributed throughout the system but is skewed towards highland paddy (as in Mahakalugolla). Paddy is a crop very sensitive to moisture stress and Sri Lanka has not so far been able to breed varieties suitable for highland conditions. Under these circumstances, the potential for highland production lies on non-paddy crops at least for the near future. Hence, it is apparent that although highland agriculture has, to a certain extent, transformed into stabilized forms, the cultural practices adopted and the crop mix practised tend to be a serious impediment to its sustenance.

There was also a distinct difference when chena was practised along with ifrigated lowland paddy cultivation. Where the dependency was more on the lowland component, input use was higher on paddy, but the reverse does not appear to have taken place when dependency is more on the chena component.

In fact whether certain inputs can be used on the chena component was found to be solely dependent on the economic condition of the household.

Therefore, we see that, in Badagiriya, as they are better off with their paddy production, some of the income has been used on agro-chemicals for use on the chena. But no fertilizer was used on chena. The attitudes towards this was outlined in an earlier section.

(c) Sources of purchases

Pesticides are purchased either from cooperatives through Agrarian Service Centres or from private dealers. Purchases from private dealers (50-72 percent) appear to be more common than from government agencies. The non-availability of pesticides at the time they are needed has been the primary reason for this practice as was explained at group discussions among farmers in the Badagiriya and Gannoruwa where pesticides are used for controlling cotton pests.

Purchases of inputs appear to be difficult for want of cash at the commencement of the cultivation season. This may be one reason for less use of inputs observed earlier and the practice of a system of land rotation instead of crop rotation.

Information relating to agricultural input use is obtained mainly through the agricultural extension agents of the area; also with ones own experience and advice from traders and cooperatives. Farmers in Badagiriya who also cultivate paddy under a major irrigation scheme, being more exposed to new agro-technology, depend on their own knowledge too (28 percent) for making cultivation decisions.

Table 4.2 INFORMATION ON AGRICULTURAL INPUT USE

S o u r c e	Hambantota Badagiriya	Moneragala Mahakalugolla
Govt. extension agent	44.6	50.0
Relatives, friends, other farmers	21.6	22.2
Traders	1.5	16.7
Leaflets	4.6	-
Own knowledge	27.7	11.1

It should be mentioned here that an extension package for upland rainfed cropping is not available as in the case of lowland paddy.

AGRICULTURAL OUTPUT

(a) Physical qualities

In the preceeding section an attempt was made to understand the use of external inputs in the different farming systems. It was noted that in the highland components (particularly the chena component including the stabilized chenas in Mahakalugolla), with the exception of rainfed paddy fields, the use of inputs such as fertilizer was almost absent. In Badagiriya some agro-chemicals were used on the chenas.

This points to the fact that so long as crop varieties of the same output potential are grown in all the systems, the output is mainly dependent on the inherent fertility levels of the particular type of soil. This aspect is rather complex as soil fertility depends on many factors. The charcteristics of the different soil types were discussed in a previous section. one of the aims of comparing the productivity of the different systems with each other is to evaluate the significance of soil or other agronomic factors.

As mentioned earlier, each system has its own preference with regard to cropping mix. This is partly due to the agronomic suitability and also partly due to one's preference for a particular crop. For example, in Mahakalugolla highland paddy is popular than in Kahambana.

Although highland paddy is preferred in Mahakalugolla, its nonsuitability is evident by its low yields. For example, in Badagiriya, under lowland conditions, the yield was 786 Kg/ac. as against 479.8 Kg/ac. in Mahakalugolla.* However, in Gannoruwa the yield was much lower. This is mainly due to crop losses as was mentioned earlier. This risk is well cushioned by the diversity of crops in Gannoruwa.

---

* In Mahakalugolla the variety grown was H_4 whose yield potential is less than the varieties grown in Badagiriya.

The effect of the length of fallow is quite evident by the variation in yields between Kahambana and Mahakalugolla. Specially with crops like maize, kuruakkan and ground nut which are common to both locations, a significant drop in yield is observed in Mahakalugolla. In Kahambana, the yield of maize was 932.4 kg/ac. as compared with 598.1 kg/ac in Mahakalugolla (See Table 4.3 to 4.6 for other examples).

The other important crops in Mahakalugolla are manioc, sugarcane and vegetables. These crops are almost absent in Kahambana. There are important reasons for cultivating these crops. Sugarcane is a semi-perennial crop which lasts for 5-10 years. Hence, this is a good crop that can be grown for many years without much labour input for weeding etc.

In Mahakalugolla iluk (Impereta spp) was one of the most difficult weeds found and hence the continuous cropping with sugarcane. Thisi is almost difficult to control, but sugarcane being a very good cover help to keep it under control. The other important factor in favour of sugarcane is the availability of processing centres in abundance with a ready market for the syrup, mainly for illicit brewing of liquor. Manioc is grown specially due to its heavey demand in the PPottuvil area (Vitebsky, 1982) where it is consumed heavily. Another salient feature is that vegetable growing is virtually absent in Kahambana compared with Mahakalugolla. This is quite obvious as the location of Kahambana provides poor marketing facilities for vegetables.

Taking these two villages into consideration, it may be assumed that, apart from agronomic suitabilities, the availability of marketing facilities is one of the most important considerations for the selection of crops. This may sometimes override the productivity factor of the crop under a given set of conditions.

The length of fallow in the chena systems selected in Badagiriya and Gannoruwa is more or less the same, where shrub jungle of less than five years old is cleared for farming. The difference in the yield in the two locations is difficult ot explain unless a detailed soil analysis is carried out. However, it may be observed that in Gannoruwa the diversity of crops is much greater than in Badagiriya in order to offset the risks involved in the paddy crop (See Table 4.5-4.6). For example, about ten crops are grown in the chenas of Gannoruwa as compared with about eight crops in Badagiriya.

Despite this diversity most farmers preferred crops like green gram, cowpea, finger millet (kurakkan) and vegetables. In Badagiriya however, green gram and cowpea were more popular in the chena. (For yield differences of chena crops please refer to Table 4.5 and 4.6).

Table 4.3 OUTPUT PER ACRE BY CROP TYPE AND LAND TYPE BY SEASON (KAHAMBANA)

Land type	Crop type	Land size*		Total output (Kg)		Output per acre (Kg)	
		Maha	Yala	Maha	Yala	Maha	Yala
Other lowlands	Paddy 3-3½ mths	0.68	-	68.8	-	101.1	-
Chena without permits	maize	1.11		1035.0	-	932.43	-
	kurakkan	1.18	-	839.0	-	711.02	-
	mung	0.31	-	15.5	-		
	cowpea	0.52	-	117.0	-	225.0	-
	ground nut	1.05	-	729.0	-	694.2	-
Other highland (stabilized)	maize	1.00	-	81.5	-	81.5	-
	gingelly	1.00	-	92.0	-	92.0	-
Sinnakkara land	maize	1.30	-	198.0	-	152.3	-
	kurakkan	1.50	-	129.0	-	86.0	-
	mung	-	-	2.5	-	-	-
	cowpea	0.67	-	24.0	-	35.8	-
	ground nut	1.50	-	288.0	-	192.0	-
	sorghum	0.25	-	50.0	-	200.0	-
Home gardens	maize	1.00	-	101.0	-	101.0	-
	kurakkan	1.00	-	59.0	-	59	-
	cowpea	0.75	-	16.0	-	21.33	-

* In this instance , instead of taking the total sample size, only the number of farmers who grow the particular crop was taken to calculate the land size. This criteria was used for Table 4.3 to 4.6.

Table 4.5 OUTPUT PER ACRE BY CROP TYPE AND LAND TYPE BY SEASON - GANNORUWA

Land type	Crop type	Land size		Total Output (kg)		Output Per acre	
		Maha	Yala	Maha	Yala	Maha	Yala
Owned lowland	Paddy 4-4½ mths	1.97		366.0		185.78	
Encroached lowland	Paddy 4-4½ mths	3.00		262.0		87.3	
Chena	Gingelly	1.00		0.7		0.7	
	Kurakkan	1.03		287.0		278.6	
	Maize	0.30		5.0		16.6	
	Mung	0.46		112.2		243.9	
	Cowpea	0.29		23.0		79.3	
	Pulses	0.31		5.0		16.1	
	Ground Nut	0.23		47.0		204.3	
	Cotton	1.62		129.0		79.6	
	Chillies	0.58		3.2		5.5	
	Vegetables	1.15		484.0		420.3	
Home gardens	Maize	0.18		2.0		11.1	
	Cowpea	0.25		0.5		2.0	
	Other pulses	0.12		1.0		8.3	
	Vegetables	0.25		1.0		4.0	

Table 4.4 OUTPUT PER ACRE BY CROP TYPE AND LAND TYPE BY SEASON - MAHAKALUGOLLA

Land type	Crop type	Land size		Total output (kg)		Output per acre	
		Maha	Yala	Maha	Yala	Maha	Yala
	Varieties	1.00	-	28.0	-	28	-
Other highlands	Paddy 3-3½ mths.	1.44	-	691.0	-	479.8	-
(stabilized chena)	Paddy 4-4½ mths	1.66	-	358.0	-	215	-
	Kurakkan	0.81	-	236.0	3.3	291.3	-
	Maize	1.08	-	646.0	-	598.1	-
	Ground Nut	0.05	0.35	20.0	4.0	400.0	11.4
	Vegetables;	1.02	-	1456.0	-	1427.4	-
	Manioc		-	202.0	-	439.1	-
	Cowpea	0.83	0.41	-	2.0	-	4.8
	Sugarcane	1.45	-	-	-	-	-

Table 4.6 OUTPUT PER ACRE BY CROP TYPE AND LAND BY SEASON-BADAGIRIYA

Land type	Crop type	Land size		Total output(kg)		Output per acre (kg)	
		Maha	Yala	Maha	Yala	Maha	Yala
Allotted paddy land	4-4½ mths Paddy	2.82		5082.5		1802.3	
	3-3½ " paddy		2.36		3281.4		1147.3
Encro-ched lowland	4-4½ mths Paddy	2.00		28.0		14.0	
	3-3½ " Paddy		1.50		152.4		101.6
Other lowland	4-4½ mths Paddy	2.00		256.0		128.0	
	3-3½ " Paddy		2.00		3674.5		1837.2
Chena	Paddy	3.0		148.0		49.3	
	Maize	0.28		6.0		21.4	
	Chillies	1.30		0.3		0.2	
	Grount Nut	0.43		32.0		74.4	
	Vegetables	0.30		7.0		23.3	
	Cowpea	1.20		194.0		161.6	
	Mung	0.45		61.0		135.5	
	Kurakkan	0.75		242.0		322.6	
Home gardens	Maize	0.17		0.8		5.8	
	Cowpea	0.16		2.5		15.6	
	Mung	0.33		12.6		38.1	
	Kurakkan	0.78		30.0		38.4	
	Gingelly	0.61		0.9		1.4	

Certain crops like maize have performed better in Moneragala district than in Hambantota district. Kurakkan performed well under all the high-land conditions. Green gram did not do well in Moneragala district. One of the inference that can be drawn from these observations is that although the length of fallow and the soil fertility level have some bearing on the productivity of a particular crop the effect of certain other macro-variables, like rainfall or soil suitability, on the productivity of crops too is important. Hence, it is imperative to identify the crops that are suitable under different agro-climatic conditions.

(b) Income per farm acre

In the preceeding section, the agricultural outputin terms of physical quantities of each crop was discussed. The basic objective in our research however, is to study the impact of each component on the system so that an overall comparisen of the systems can be attempted.

Since a particular component consists of various types of crops, unless a common unit of comparison can be deduced, it is rather difficult to compare the different components. Hence, rather than physical quantities, the monetary value of the produce is used in this connection. However, another difficulty is that in societies, where the non-monetized sector predominates, cash transactions are rather marginal. For the purpose of this study imputed values based the prevailing market prices were used.

Except in Badagiriya the Yala cultivation was almost a failure in the other locations. This pattern of cultivation is not unusual except in Kahambana. In this location normally the farmers do practise Yala chena but during this year due to the delayed rains the yala crop was a failure. Per acre comparisons are difficult as there are several components within a system of different land size. In certain instances Yala cultivation was possible in a part of the farm making it difficult to calculate per acre incomes. Hence, most of the comparisons are done on a per farm basis.

As far as gross and net revenues from agriculutre sources were concerned, Badagiriya recorded the highest income. For example, it recorded a gross revenue of Rs. 31,479 and a net income of Rs. 24,216.12 per annum. The Maha income was nearly 60 percent of the total (See Table 4.7). The expenditure was only about ½th of the grows revenue (See Table 4.7). In Badagiriya 88 percent of the gross incomes were from allotted lowlands showing the higher dependency of households on the paddy farms; the next highest income came from the chena fields.

Looking at this aspect in the other three locations, it was observed that Kahambana came second followed by Mahakalugolla and Gannoruwa. In Kahambana the largest income was from the chena component (65.8 percent). This high income demonstrates the high fertility levels in the highlands which are under long fallows. Gannoruwa is the poorest of all the locations. One reason is the non-availability of an assured supply of irrigation water for a successful paddy crop. Secondly, the availability of jungle land is very marginal compelling farmers to obtain chena permits to clear the shrub jungle which is relatively depleted of nutrient sources. The gross income were well balanced between the chena produce and the other source including livestock produce (8 percent) and irrigated paddy. Therefore, under such risky circumstances it is not surprising that farmers pay greater attention to their chenas. Thus, we see that in Badagiriya the farmers are more dependent on paddy whereas in Gannoruwa they are mostly dependent on chenas.

(c) Disposal mechanism

Another major criterion that was considered in our selection of study location was the market-oriented cultivation pattern. In order to establish this point we collected data relating to the disposal mechanisms of farm produce. The data thus collected showed us quite clearly that in Kahambana the production was consumption oriented while in Mahakalugolla it was marke-oriented. In Kahambana nearly 60 percent of the chena produce was kept for consumption while in Mahakalugolla almost 60 percent of the harvest was marketed. Accessibility to markets and the selection of crops are two distinct factors attributable to this phenomenon. As mentioned earlier, Kahambana is more or less totally cut off from towns and market places giving rise to a circumstance where the crops that can only be consumed in the farm itself are cultivated.

Table 4.7 PER FARM NET REVENUE FROM AGRICULTURAL ENTREPRISES (Rs)

Village		Maha	Yala	Total
Kahambana	GR	11875.68	-	11875.68
	E	2385.54	96.87	2482.41
	NR	9490.14	-96.87	9393.27
Mahakalugolla	GR	9691.90	37.43	9729.33
	E	1956.91	259.83	2216.74
	NR	7734.99	222.40	7512.59
Gannoruwa	GR	4917.02	-	4917.02
	E	1953.61	84.91	2038.52
	NR	2963.41	-84.91	2878.50
Badagiriya	GR	19725.61	11753.60	31479.21
	E	5299.76	1963.33	7263.09
	NR	14425.85	9790.27	24216.12

GR - Gross Revenue E - Expenditure NR - Net Revenue

Mahakalugolla being located closer to a major trunk road, accessibility to market facilities is much easier. As a result, the selection of crops has been based on this criterion. For example, crops like sugar cane, bananas, vegetables were common in Mahakalugolla and they were mostly marketed rather than being kept for consumption.

It was mentioned earlier that in Kahambana production is more consumption-oriented. However, some variations are observed when each crop is considered separately. For example, crops like green gram, cowpea, ground nut and sorghum were being produced mostly for the market. This leads us to the inference that even in backward communities newly introduced crops are mostly grown with the market in mind. In Badagiriya too the same pattern was observed. The yields of certain crops being too little the disposal mechanisms, when considered in terms of percentage, present a distorted picture.

However, when crops produced in bulk are considered, it is clear that certain crops like kurakkan and maize are produced entirely for home consumption. The pattern in Gannoruwa is the same.

Expenditure on farming operations

It is known that expenditure on farming is conditioned by several factors like risk, productivity, access to inputs, awareness of available technology and market orientation. yet, it would show to a certain extent the degree of concentration directed towards a system. Once this expenditure is disaggregated to the type of land within the system, it is possible to get an idea of the degree of preference to a particular component of the farming system.

The level of expenditure is directly related to the physical inputs described earlier. Labour is a major input, specially where highland cultivation is concerned and in most cases comprises of family help. Therefore an imputed value would not give the correct expenditure pattern. Hence, actual expenditure in cash terms was considered here.

The per farm expenditure was lowest in Gannoruwa and Mahakalugolla (Rs. 2,038.52 and 2,216.74 respectively). This is quite obvious as clearing of jungle was minimal in both locations thereby reducing the need for labour. However, in Kahambana the expenditure Rs. 2,482.41 per farm was higher as jungle clearing involved a heavy input of labour.

The per farm expenditure in Badagiriya amounted to Rs. 7,263.09. This figure is attributed to a number of reasons. Firstly, on the average, irrigated farming here was much more than in the other locations. This component absorbed heavy amounts of other inputs like fertilizer, agro chemicals and mechanical sources of farm power for land preparation. These items of expenditure contributed towards a high total.

As Table 4.8 indicates, of the total expenditure on farming for each location, the highest proportion for labour has been utilized in Kahambana (97.73 percent), whereas in the other three locations it varied from 30 percent to 57 percent.

In Kahambana 70 percent of the expenditure on labour for Maha has been on the chenas. The lowest proportion of labour use has been in Mahakalugolla (31.1 percent). This was mainly due to the heavy expenditure (50 percent) incurred on mechanical farm power to till the lands. This re-emphasizes the fact that in these almost continuously cropped lands weeds specially iluk can be effectively controlled only by using techniques like tractors at, least during the cropping year. An earlier study on farm power (Farrington & Abeyratne, 1982) has shown that the potential for tractors in the country lies in the highlands.

In Badagiriya and Gannoruwa too, a substantial quantity of farm power 08 percent and 30 percent respectively was used. But it was totally used in the irrigated lowlands. In Badagiriya the proportion was smaller. This was because about 44 percent of the total expenditure was on fertilizer and agro-chemicals which was again used heavily in the lowlands. Although the expenditure on farm power was almost similar in both Badagiriya and Gannoruwa (Rs. 587/- & Rs. 604/- respectively), the type of mechanical power used was different. While in Badagiriya 4-wheel tractors were used predominantly in paddy fields, in Gannoruwa 2-wheel tractors were used. This was mainly due to the smaller size of holdings and the boggy nature of the land in this location.

Off farm income and expenditure

Off-farm income is an indicator of the relative productivity of the farming system as well as the availability of off-farm employment opportunities in a particular location. However, higher incomes from farming do not necesaaryily mean lower income from non-farm activities though it may be the case in certain instances to compensate situations. For example good incomes from farming activities may have a multiplier effect on certain non-farm activities. For example, higher farm incomes may result in certain farmers purchasing tractors, rice mills etc. which generate non-farm activities.

Howev r, the vice-versa may be not true in many instances. Poor farm incomes if not due to agroclimatic reasons, can be attrubuted to institutional factors and the infrasturctural facilities of an area. Hence, under these circumstances the generation of non-farm activities can well be marginal.

Table 4.8 EXPENDITURE (Rs.) FOR FARMING OPERATIONS

	LOCATION															
	Kahambana				Mahakalugolla				Badagiriya				Gannoruwa			
	Labour (L)	Other input (OI)	Farm power (FP)	Total	L	OI	FP	Total	L	OI	FP	Total	L	OI	(FP)	Total
MA PF	2336.38	-	49.16	2385.54	524.87	189.18	1242.86	1956.91	2785.46	1927.76	584.54	5299.76	1079.10	270.26	604.25	1953.61
A Expenditure as a % of total	97.9	-	2.1	100	26.8	9.6	63.5	100	51.8	36.3	11.0	100	55.2	13.8	30.9	100
YA PF	89.82	7.05	-	96.87	164.79	16.33	78.76	259.83	687.77	1223.72	51.84	1963.33	84.91	-	-	84.91
A Expenditure as a % of total	92.7	7.2	-	100	63.4	6.2	30.3	100	35.0	62.3	2.6	100	100	-	-	100
TA PF	2426.20	7.05	49.16	2482.41	689.61	205.51	1321.62	2216.74	3473.63	3151.48	438.38	7263.09	1163.91	270.26	604.25	2038.52
L Expenditure as a % of total	97.63	0.28	1.98	100	31.10	9.27	59.61	100	47.82	43.39	8.07	100	57.09	13.25	29.64	100

PF - Per farm

In analysing the level of off-farm activity in our study locations, it would be useful to bear these facts in mind.

As Table 4.9 indicates off-farm income was highest in Badagiriya (Rs.13,325.4 per farmer per annum). Although the sources of income are not very clear it may be assumed that the profits from farming may have been channelled towards non-farm activities like trade, money lending etc.

We have already noted that farm incomes were very low in Gannoruwa. In order to compensate for this situation the non-farm incomes have been quite large) Rs.5,107.48) which was the second highest in our study locations. A third of the income was from white collar employment (refer educational status). As much as 50 percent was from loans while 20 percent came from manual labour.

In Kahambana nearly 45 percent of the off-farm incomes came from self-employment. Self-employment activities mostly appeared to be illegal as for instance selling of timber, gemming and growing of cannibus. (This has also been reported by Brown et al 1983). This type of activity is not surprising as opportunities for traditional off-farm employment are almost totally absent in this location. It was also noted that more than a third of the off-farm incomes has been from subsidies including food stamps which can be considered as the major contribution. In Mahakalugolla which recorded an off-farm income of Rs. 4,762.00 per annum, nearly half of it came from subsidies, 18 percent from manual labour and another 18 percent from self-employment.

As far as the household expenditure pattern is concerned, the highest propotion has been spent on food, ranging from 38.03 percent in Badagiriya to 57.07 percent in Kahambana, The drop in percentage in Badagiriya is in agreement with the Engles theory that when income rise, a lower percentage is spent on food. Total expenditure too was very high in Badagiriya (Rs. 15,716.15) compared to the other locations where the average was around Rs. 6,300/-. In Badagiriya nearly 20 percent was to pay back loans. In Gannoruwa too nearly 17 percent has spent for repaying loans, but in the other two locations, specially in Kahambana, repayment of loans was almost absent. These data lead to the hypothesis that when farmers get used to handling more cash a component of loans too comes into the picture.

The data also show that Kahambana is still a subsistence economy. Other major items of expenditure were clothing, education, transport and health (15-21 percent). The proportion spent on other consumer goods ranged between 11-18 percent. Expenditure on social activities was 1-3 percent. The saving habit was very marginal (1-6 percent).

Table 4.9 NET FARM REVENUE PER FARMER PER ANNUM

Location	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
Farm income	11875.68	9729.33	31479.21	4917.02
Off-farm income	4762.38	3824.03	13325.41	5107.48
Gross income	16638.06	13553.36	44804.62	10024.50
Farm expenditure	2482.40	2216.74	7263.09	2038.00
Non-farm expenditure	6582.40	5673.78	15716.15	6663.84
Total expenditure	9064.81	7890.52	22979.24	8701.84
Net revenue	7573.25	5662.84	21825.38	1322.66
Loans	5.13	1382.55	6088.00	430.00
Net revenue less loans	7568.12	4280.29	15737.38	892.66

The above table gives some indication of the financial picture. The purpose of this section is to give an idea of the trends in the financial situation in the different locations. Though the figures may be not very accurate, one can vissualize the relative position of each farming system. With an assured supply of water and also market facilities, profitability of a system is well demonstrated in the case of Badagiriya. Conversely in Gannoruwa the supply of water is erratic. Hence, the risky nature of a farming system, dependent on irrigated paddy, is well demonstrated by the fact that farmers are compelled to be more dependent on their chena. But, here again, rent restrictions do not allow them to exploit the natural fertility of virgin forests, resulting in a poor economic situation. Under such circumstances the off-farm incomes of farmers exceed the real farm incomes although the base of the village economy is agriculture.

In exclusive highland systems the relative profitability is well illustrated in the case of Kahambana. Apart from gross farm incomes other parameters are more or less same in both locations. However, one needs exercise caution as we have used imputed values for produce consumed as well as for produce kept as seed material. Therefore,in real terms, there may not be a net profit.

Chapter five

THE KEY VARIABLES FOR A CHANGE IN THE SYSTEM

In the preceeding chapters we were able to identify the performance of different farming systems and the role played by the chena component within each system. Specifically we were able to show the role of the chena under different circumstances subject to the criteria of dependency and length of fallow, in terms of agronomic and economic variables. The objective of this chapter is to identify the circumstances which might impel an individual household or a community to move from one farming system to another particularly from truly shifting and subsistence-oriented chena to semi-permanent or permanent highland cropping associated with cash cropping.

The discussions in the preceeding chapters outlined the circumstances under which the systems operate. We had an opportunity to identify the important variables that play a key role in each system. These variables may give us some notion with regard to the direction where the policies should be oriented towards achieving our main objective ie. to stabilize modes of production.

The variables should be considered under two different circumstances:

(i) Circumstances where irrigated paddy does not play an important role in the peasant economy ie. purely highland systems as found in Moneragala.

(ii) Circumstances where irrigated paddy plays a major role in the peasant economy ie. mixed farming systems as found in Hambantota.

These variables can be categorized into six broad categories:

(1) Availability of land tenancy rights and the size of holding

(2) Availability of know-how - extension, new technologies, cropping models, cropping mix, weeds and fertility, risks and uncertainty

(3) Availability of farm power and manual labour

(4) Availability of marketing facilities

(5) Government policy on clearing of forests, financial aid etc.

(6) Farmers' attitudes

The relative importance of each of these variables depends on what level of transformation the chena component is in a particular system of farming ie. it depends on the length of fallow and market orientation. Since most of these variables are interrelated, it is difficult to differentiate the effect of a certain variable on the performance of the system. It becomes all the more difficult as each component of a system complements or supplements each other. In spite of these limitations it is important to understand the effect of these variables for a change in the system.

(1) Availability of land, tenancy rights and the size of holding

The most important variables under this broad heading are:

(a) availability of forest land

(b) lack of tenancy rights for crown land under highland cultivation, and

(c) level of dependency on the highland component viz-a-viz paddy cultivation

Many of these aspects were covered in the preceeding chapters and we were able to show clearly that the availability of forest land was the key variable for practising chena. This was despite the availability of highlands with land rights (as in Kahambana). But in circumstances where availability of forest land was very marginal, farmers were compelled to practise stabilized highland farming. The importance of owning the farm was cited under these circumstances in order to obtain institutional credit, subsidies etc. to develop the system (Mahakalugolla). Therefore, it may be assumed that if official assistance can be coupled with ownership of land, highland farming could be made more stable even in instances where forest land is available in abundance.

When only highland cultivation is being practised it is only a question of whether to stablize or not, but when the system includes an irrigated paddy component as well, the dependency question too come into the picture.

Most of the answers are then related to the attitudes of the farmers and the availability of know-how. These aspects would be discussed later.

The size of holding is also a crucial factor. It was seen that when the length of fallow decreased or when the paddy component was absent, large extents were cultivated to sustain productivity (as in Mahakalugolla). With the introduction of technology the size of holding that has to be cultivated is likely to be different. The current land policy limits permit to two acres per family for upland cultivation and so is a constraint to the development of stabilized systems which would incorporate rotations with a fallow period (Brown et al. 1983).

(2) Availability of know-how

This is one of the most important variables one should reckon with as many improvements could be effected if one is aware of the vast improvements that have taken place in the field of technology. Under this heading the following sub-variables can be considered.

(1) The availability of new technology	- crop models - methods of sustaining fertility - methods of controlling weeds
(2) Methods available to transfer new technology	- effectiveness of the extension services

1. Availability of new technology

This is of vital importance. Our observations clearly show that although rainfall regimes and soil characteristics differ from area to area, crop selection have been mostly based on the subsistence needs or as a response to change in the market possibilities.

During our field visits in Moneragala it was observed that within the district there are four : soil types viz. reddish brown earths, low humic gleys, non- calcic brown soils and immature brown loams. Even among these four soil types there were major differences from one location to another, underlying the importance of knowing the soil characteristics in selecting crops for a particular location in order to optimize production.

It was also a observed that the type of soil had a bearing on the type of draught power used for land preparation. For example, in places like Mahakalugolla, where the soils were of reddish-brown earth type, four wheel tractors wereused for land preparation. Elsewhere, oxen were used on farms where non-calcic brown soils were found. Therefore, we see the importance of correlating the soil type not only to the crops grown but also to the cultural practices.

It was also seen that even on the same type of soil, depending on the length of fallow, and depth of soil, cultural practices like burning had an effect on soil fertility which in turn had a bearing on crop growth.

The system of shifting cultivation with long fallow periods is one of the most potential means of land use to sustain total productivity of most tropical soils. Such systems, which were a reality years ago, have now become almost impossible as a result of the pressure for agricultural lands resulting from population increases. At the same time, it has become distinctly clear that monoculture with annual crops grown successively over long periods in tropical soils has no chance of success due to exposure of the soil to high temperatures and constant erosion by heavy monsoonal rains. Use of mineral fertilizers could improve soils temporarily. For long term use incorporation of organic manures becomes essential. Although the use of organic matter has been greatly appreciated in all agricultural systems all over the world, the problems associated with its use arise mainly due to the need for large quantities (of over 10t/ac or more) and the time or availability of the material for incorporation into the soil. The use of minimum tillage or "no till" systems of land preparation for organic matter conservation and the use of living or dead mulches on the surface of the soil or partly incorporated for conservation of moisture, as practiced in Nigeria, demonstrate the possibility of sustaining agricultural production to a considerable extent in tropical soils.

In the original chena system with a long fallow of 15 - 20 years followed by cropping for two to three years with about 20 percent efficiency in land use, cropping posed no problem. It was accepted that long fallow was a period without cropping. The forest regrowth renovated the soil and the growing forest cover provided fuel wood and fodder for village cattle, a system that sychronized with the village life. Therefore, in order to sustain the productivity of chena lands a better understanding of forest fallow-systems would be required. The scientific base appears to be the forest that helps to regenerate the sub-soil and improve its physical condition. Abeyratne's (1956) research into the forest-fallow system to evolve a sustainable agriculture could be considered a pioneering work which has spread into many of the West African countries.

The research presently being carried out by Handawela (Personal Communication) at the Maha Illuppallama Research Station on simulated forest or avenue cropping is an improvement on the original work of Abeyratne which aims to accelerate the regenerative process by having forest trees as a component of the total system. In this context, agroforestry systems which mean systems of land management involving the use of trees and shrubs in combination with agricultural food or feed crops and livestock become extremely important. They are designed to optimize the output of usable products and to maintain or improve productivity of the soil (Agro-Forestry Systems - Editorial, Vol. 1. 1982).

The combined use of agro-forestry and new tillage techniques appears to be crucial in the development of stabilized farming systems in the tropics because they form an evolution of the old-age forest-fallow system. Therefore, this approach would be the most feasible in the development on farming models. This approach also does not require adjustments to new management practises by farmers with least disruption to their way of life in the village. The extension services need to be strengthened for the improvement of the existing systems. Potential crops from an agro-ecological point of view and marketability should be incorporated into the systems. Thus, there are no serious implications in the above approach as in other models proposed for stabilizing the dryland farming systems. In this way the model farms could be developed rather than those expensive settlement schemes as envisaged in the earlier land development and re-settlement schemes.

2. Methods available to transfer new technology

Some attempts were made to identify the attitudes of the farmers regarding the present status of a the extension services and how extension service could effect changes in the farming system.

There is a remarkable difference from location to location with regard to the exposure of farmers to the extension service. This is directly linked with the type of farming system practised and how remotely the village is located. For example in Badagiriya which is a paddy-oriented irrigation settlement, almost all the farmers have received advice from extension services mainly regarding paddy farming (72 percent). Gannoruwa being an old settlement has received less attention (58 percent) yet mostly for paddy (62.6 percent). In Kahambana, being a very remote location, hardly anybody had received advice while Mahakalugolla has been exposed somewhat (60.4 percent) to the extension service as paddy is grown at least under highland conditions. One of the most important inferences that can be drawn from this analysis is that the more remote the settlement becomes the less it gets exposed to extension services and that the paddy crop receives more attention from the extension services than the highland crops.

It was clearly seen that extension services can make a big contibution towards a change in the system. Specially in the three locations other than Badagiriya, most of the farmers felt that if extension facilities were available they hoped to make changes in their farming practices. These three locations are mostly dependent on the highland component.

Table 5.1 METHODS SUGGESTED BY FARMERS (WHO THOUGHT A CHANGE WAS POSSIBLE) TO CHANGE THE FARMING PRACTICES IF EXTENSION SERVICES ARE AVAILABLE

Reason	Gannoruwa		Kahambana		Mahakalugolla	
	No.	%	No.	%	No.	%
1. Cultivating pests & disease resistent varieties	3	21.4	2	8.3	8	23.5
2. Adopting new improved methods	8	57.1	4	16.6	24	70.5
3. By cultivating larger extents	3	21.4	18	75.0	2	5.8
Total	14	100.0	24	100.0	34	100.0

The above Table indicates the methods that the farmers hope to adopt if a satisfactory extension service is available. There was a difference in the emphasis laid on the different methods by each location. For example, in Kahambana, the majority (75 percent) felt that extension services would help them to cultivate large extents. In fact in a preceeding chapter we showed that in Kahambana one of the main reasons put forward by farmers for continuous cultivation was to increase incomes. But we hypothesized at that stage that the farmers felt so because chena was the sole source of their income and that the only way to increase income was to cultivate continuously adopting new technology. Here they feel that they could cultivate large extents with the help of extension services. Hence the logical conclusion we could come up within this discussion is that Kahambana farmers are not aware of the potential of extension services. In other words, they appear to be unaware that the primary function of the extension service is to disseminate new technology to the farmers. This again reflects the remoteness of the village and the need for a dynamic extension service in order to disseminate new technology to remote areas like Kahambana where extensive chena cultivation is taking place.

However, in the other locations it was interesting to note that formers were aware that they could adopt new improved technologies making use of extension services. This exposure to extension services is mainly due to the fact that in these areas paddy is a major component in the farming systems (in Mahakalugolla it is highland paddy). However, some farmers felt that it would not be possible to change the system even if the extension services were available because they found it difficult to adopt methods prescribed. As far as chena was concerned, the main advice they have obtained was with regard to pests and disease control measures, use of fertilizers and planting methods. As all these practices are capital intensive techniques, it is doubtful whether farmers have the necessary funds to obtain these items. Chenas being mostly encroached crown lands, farmers are not in a position to obtain credit specially from institutional sources. Therefore, it is quite reasonable for the farmers to feel that it is difficult to adopt practises advocated by the extension service. The response was mainly from three locations except Badagiriya. The latter is a settlement scheme where farmers have cultivating rights for both highlands and lowland allotments. Therefore, they are in a position to obtain even institutional loans to purchase agricultural inputs. This was one reason, as we indicated earlier, why the Badagiriya farmers were in a position to use agro-chemicals on their chenas. (Another reason was that they grew cotton which is a highly insect susceptible crop).

As one would expect, the more the farmers were dependent on the highland component, the less the extent of satisfaction was as regards the present extension service in the area (See Table 5.2).

Table 5.2 WHETHER FARMERS ARE SATISFIED WITH THE EXTENSION SERVICES OF THE AREA

Response	Badagiriya		Gannoruwa		Kahambana		Mahakalugolla	
	No.	%	No.	%	No.	%	No.	%
Yes	51	94.4	26	54.2	1	2.8	37	77.1
No	3	5.6	20	41.7	35	97.2	11	22.9
No response	-	-	2	4.1	-	-	-	-
Total	54	100.0	48	100.0	36	100.0	48	100.0

The reasons for non-satisfaction were area-specific. In Kahambana where almost 100 percent was not satisfied, the majority of farmers felt that a useful service was not obtained (85.7 percent) or that the services were not satisfactory. Considering the earlier responses this clearly shows the lack of exposure of the Kahambana farmers to the extension service. In other areas, specially in Gannoruwa and Mahakalugolla, lack of adequate extension staff was mentioned.

In response to a specific question as to what sort of instructions they expected from the extension services in order to develop the hihgland component, most answers were similar in all the locations. For example, they expected formal training on new cultivation methods and also provision of equipment like weeders, seeders, sprayers and other inputs (see Table 5.3). The latter response reflects the non-availability of institutional mechanisms to meet the needs of farmers to improve the highland component. Actually most farmers felt that if these facilities were available through an extension service, it may be possible to convert the existing chena lands to stabilized highland farms. This supports our earlier hypothesis that extension advice should go hand in hand with the provision of facilities advocated by the extension staff.

Table 5.3 KINDS OF SERVICES EXPECTED FROM THE EXTENSION SERVICE TO DEVELOP CHENA FARMING

Type of services	Badagiriya		Gannoruwa		Kahambana		Mahakalúgolla	
	No.	%	No.	%	No.	%	No.	%
1. Visit the farm and advice when needed	2	2.7	10	21.7	5	7.5	7	8.5
2. Training on new technology	31	42.4	14	30.4	9	13.4	34	41.5
3. Providing equipment and inputs	31	42.4	11	23.9	28	41.8	37	45.1
4. Helping to obtain credit facilities	1	1.4	9	19.6	12	17.9	4	4.9
5. Providing more extension officers	2	2.8	1	2.2	-	-	-	-
6. Others	6	8.2	1	2.2	10	19.4	-	-

(3) Availability of farm power and manual labour

This aspect was dealt with at length under the section "Labour Utilization Pattern" in the total system. The discussion covered two dimensions: (1) when both chena and irrigated paddy were present how did labour appropriation take place and (2) when only the highland component was present how were the different sources of farm power used.

In the first situation dependency criterion played a major role. For example, in Gannoruwa the farmers were more dependent on the chena component. Hence it was quite apparent that in order to avoid any labour competition, the cultivation of the two components of the farming system took place at different intervals concentrating on the chena component first in order to maximize the use of available rain water under risky conditions. If cultivation operations in both components had taken place at the same time it would have resulted in labour competition making it necessary for the farmers to hire labour or machinery. This is not only costly but also would make it necessary for the farmers to devote some of their time in supervising the operations.

At this time usually the opportunity cost of the farmers' labour is high because of the importance of ensuring a successful chena crop. Therefore, they concentrate first on the chena which often results in loss of the paddy crop as it invaribly gets caught in the rains at the time of harvesting or the crop gets caught in a drought during the growing period because by that time most of the water from the tank had been used for land preparation. But in Badagiriya the situation was much different in the sense that cultivation of both paddy and chena took place almost at the same point of time. For example, land preparation of paddy lands coincided with the sowing/planting in the chenas. Here unlike in Gannoruwa, farmers are less dependent on chena. This apparent competition in labour was solved by resorting to machanization of land preparation in the paddy fields.

The implications of this phenomenon for stabilized chena farming are several. Highland farming is entirely dependent on water whether chena is practisedwith or without fallow. Therefore, use of the first rains must be made to establish a successful crop. This means that paddy cultivation has to be postponed unless adequate farm power is available for land preparation with the onset of rains. There is a growing body of thought that most farmers use excessive amounts of tank water for land preparation as they start land preparation only after tanks are full. The result of this situation is that Yala cultivation is not possible as there is not enough water left in the reservoirs. Our suggestion to delay paddy cultivaion was not because of the fact farmers wait until the tank is full, but because they take time to finish chena operations. This argument would appear to be logical in situations where both paddy and chena are grown as two components of the farming system.

Badagiriya was unique this year as water was released almost along with the rains and because of mechanization labour bottlenecks were less prevalent. Therefore, one of the answers to rectify this situation lies in mechanization.

This may be better understood if we consider the situation in Moneragala. As the lowland paddy component was absent in Moneragala district there was no visible labour competition. In Kahambana, however we observed that when there were many highland farms, priority was always given to the chena component.

In the stabilized highlands of Mahakalugolla it was interesting to note that mechanical sources of power were used enabling to save a substantial amount of labour. Use of mechanical power sources was possible as tree stumps were absent in these fields whereas in typical chenas this was normally not possible. In other chenas (stabilized highlands) where tree stumps had been removed and where the soil type was more sandy, animal draught was used for land preparation. For any type of power source to be used, except manual labour, one of the prerequisites is to have the land free of impediments like tree stumps. This process helps to save labour rather than displace it. Labour, thus saved, may be potentially used for carrying out improved cultural practices at the time of land preparation eg. soil and water conservation, planting in rows to facilitate weeding etc.

An earlier study (Farrington & Abeyratne, 1982) clearly showed that it is much more advantageous to use mechanical sources of power on the highlands, provided that they are flat land of rather large holdings without any tree stumps left on them. This study also showed that although tractors are used widely in paddy cultivation in this country there were no advantages in terms of increasing land use intensity and productivity or timing of cultivation. With regard to timing of cultivation, the use of tractors on highlands could be advantageous as land preparation could be completed as early as possible so that the first rains can be made use of for the planting of chena crops. Attention can then be directed towards the paddy farms earlier than now. However, use of tractors has inherent problems like heavy costs. Therefore, whereever possible, on light textured soils, animal draught should be recommended or minimum tillage techniques (Wijewardena & Weerakoon, 1984) now being experimented should be tried out.

4. Availability of marketing facilities

In the preceeding chapters we highlighted the importance of marketing in the operation of a particular system. It was seen that rather than agronomic considerations, in many locations, the availability of better marketing facilities played a major role in the selection of crops to a particular farming system(as in Mahakalugolla). Also it was seen that in certain instances due to lack of accessibility, farmers hardly changed

their cropping pattern and that they still grew subsistence-oriented crops (Kahambana). In this section we hope to analyse the effect of transport and marketing facilities on the functioning of a particular system and how any changes of these variables would alter the farming system, specially towards stability.

Transport facilities

Availability of better road facilities and/or transport facilities is one of the key variables that determines the defficiency of a marketing system. In our study locations, as was mentioned earlier, a wide diversity with regard to the road facilities was seen. For example, accessibility to Kahambana was very difficult. Mahakalugolla, Badagiriya and Gannoruwa are located adjoining major trunk roads. Yet accessibility to chenas in Mahakalugolla was rather difficult. The roads were not tarred and very narrow. The road conditions were reflected in the responses to a question as to how satisfied the farmers were with the transport facilities. In Kahambana none was satisfied with the transport facilities whereas in Badagiriya more more than 2/3 were satisfied. The importance of good roads was again voiced by those who were not satisfied with the present transport facilities. Specially in Kahambana all the farmers considered the availability of good roads as a pre-requisite for better transport facilities. Almost all the farmers felt that this would bring about changes in the system through producing new crops and in larger quantities for the market; also crops that are easy to market and using better methods as markets are assured.

Channels of marketing and pricing

As with transport facilities, in all the areas except Badagiriya, the majority of the farmers were not satisfied with the existing marketing facilities. The pattern of response was very much similar to that regarding the availability of transport facilities.

Farmers felt that if a marketing system provided higher prices through guaranteed prices etc. and if purchasing could be done through Institutions like Co-operatives or if facilities were provided to sell inside the village itself, changes in the farming systems could be expected (See Table 5.3).

Table 5.3 KINDS OF MARKETING FACILITIES FARMERS* EXPECT

Kinds of facilities	Badagiriya		Gannoruwa		Mahakalugolla		Kahambana	
	No.	%	No.	%	No.	%	No.	%
Purchasing through Inst. like Co-ops	4	20.0	10	32.3	14	33.3	5	17.9
By providing a guaranteed price and higher price	11	55.0	7	22.6	16	38.0	21	75.0
By producing facilities to dispose within the village itself	4	20.0	8	25.8	12	28.6	-	-
Better crop grading system	1	5.0	1	3.2	-	-	-	-
Transport facilities to take goods to town	-	-	4	12.9	-	-	-	-
Impartiality of institutional officers	-	-	1	3.2	-	-	2	7.1
T o t a l	20	100.0	31	100.0	42	100.0	28	100.0

* Farmers who were not satisfied with the present marketing system.

In Kahambana (85.2) and Gannoruwa (68,5) where the transport facilities were very poor, the farmers felt that if good roads and better marketing facilities were provided, they may be induced to grow more and more of different crops. This is a clear indication, that farmers, now depending mostly on chena for subsistence needs, would change the system towards a commercially-oriented one, provided guaranteed marketing facilities were avilable. Also there were clear signs of development of the systems as farmers were prepared to embark on diversification of crops requiring introduction of new crops as well as new technology. Heartening responses like using fertilizers and agro-chemicals as well as the use of modern machinery for land preparation were also noted (See Table 5.4).

Table 5.4 CHANGES ENVISAGED IF BETTER MARKETING* FACILITIES WERE AVAILABLE

Method	Badagiriya		Gannoruwa		Mahakalugolla		Kahambana	
	No.	%	No.	%	No.	%	No.	%
By stabilizing and bettering incomes	13	34.2	10	28.6	30	39.5	3	11.1
By providing irrigation facilities	1	2.6	-	-	-	-	-	-
Can use fertilizer/ herbicides insecticides etc.	9	23.7	1	2.9	15	19.7	1	3.7
Can use modern machines for land proparation	6	15.8	-	-	6	7.9	-	-
Would be induced to grow more and more different types of crops	9	23.7	24	68.5	25	32.9	23	85.2
Total	38	100.0	35	100.0	76	100.0	27	100.0

* Farmers who responded for a change with better marketing facilities.

Although majority of farmers were aware of the prevailing market prices for their products, in places like Kahambana, nearly a third were ignorant of this fact. Also, it was surprising that nearly 31 percent in Badagiriya did not know the prevailing prices in the nearest town. This response may be due to two different unconnected reasons. In Kahambana, the poor accessibility accounts for their lack of knowledge whereas in Badagiriya farmers were less dependent on chenas for existence. This may be attributed to the non-marketing of produce. The prices obtained by Kahambana farmers (79.2 percent) were not comparable with the prevailing prices in the market. This was mainly because they had to dispose of their produce at the village fair (81.4 percent) where the bargaining power was rather low due to a glut in the market as all the farmers brought their produce to sell at the same time.

In Badagiriya too nearly 76 percent of the farmers sold their produce to private traders who come to collect them at the same village. This too reduced the bargaining power giving lesser prices to the farmer. However, Gannoruwa and Mahakalugolla where the farmers are market-oriented and more dependent on chenas, show a diversity in their marketing channels (See Table 5.5). More than 3/4 of the respondents said that the prices they received were comparable with those paid in the nearest town.

Table 5.5 CHANNELS OF MARKETING

Channel	Badagiriya		Gannoruwa		Mahakalugolla		Kahambana	
	No.	%	No.	%	No.	%	No.	%
Village level collecting traders	28	40.6	8	10.7	1	1.2	5	11.63
Private traders (Lorry owners)	24	34.8	24	32.0	44	52.4	1	2.32
Private traders in the nearby town	12	17.4	15	20.0	1	1.2	1	2.32
At village fair to consumers	3	4.3	2	26.0	23	27.4	19	44.19
At village fair to traders	2	2.9	9	12.0	-	-	16	37.21
Paddy Marketing Board	-	-	-	-	2	2.4	-	-
Co-operatives	-	-	17	22.7	13	-	1	2.32
Total	69	100.0	75	100.0	84	100.0	43	100.0

The majority of the farmers felt that regardless of the location the discrepancy of the prices between what they get and what is prevailing in the market can be bridged by the intervention of a government institution to purchase the produce. Whether a Government institution is the best channel to purchase the produce is another matter, but it may well provide a healthy competition to ensure a floor price. This leads to another question regarding the awareness of the floor price scheme. We observed that in Kahambana and Badagiriya a very low percentage (53.3 and 55.6 percent) of the farmers were aware of the floor price scheme.

Their ignorance is clearly seen from the fact that nearly a third of the Kahambana farmers thought of a control price as a measure in bridging the gap between what they receive and the prices prevailing in the market.

The importance of farmers' getting a satisfactory price is clearly underlined by the fact that they consider it to be a pre-requistite to change the farming practices. It was interesting to note that specially in Gannoruwa (47.8 percent) and Mahakalugolla (40.7 percent) many farmers felt that satisfactory prices would allow them to practise crop rotation (See Table 5.6). In these two locations where the farmers are mainly dependent on the highland component under a fast depleting fallow period or no fallow, they seemed to have understood the value of crop rotation to sustain production. They felt a satisfactory price would allow them to choose a crop suitable for a system of this nature. Some farmers also felt that a satisfactory price would help to change over to a permanent crop system (Table 5.6). This was particularly mentioned by Kahambana (54.1 percent) and Badagiriya (61.6 percent) farmers. These responses clearly show the location specificity as well as signs of willingness to stabilize the farming system.

Table 5.6 HOW SATISFACTORY PRICES WOULD CONTRIBUTE TO CHANGE THE FARMING SYSTEM

Method	Badagiriya		Gannoruwa		Mahakalugolla		Kahambana	
	No.	%	No.	%	No.	%	No.	%
Use of crop rotation	8	13.3	33	47.8	37	40.7	1	2.7
Change to a permanent crop system	37	61.6	16	23.3	31	34.0	20	54.1
Increasing value of production	7	11.7	9	13.0	2	2.2	8	21.6
Farming of crops which have a high price	4	6.7	2	2.9	4	4.4	7	18.9
Use of modern methods	3	5.0	9	13.0	15	16.5	-	-
Use of inputs	1	1.7	-	-	-	-	-	-
Use of different crops	-	-	-	-	2	2.2	1	2.7
Total	60	100.0	69	100.0	91	100.0	37	100.0

The foregoing clearly show that transport facilities, marketing channels and the prices offered are key variables likely to influence the change of a system. All these factors are interrelated and these three points are important to a better marketing system.

Although some of these factors were of overall importance, there were certain variables which were location specific. For example the road conditions in Kahambana, where classical type of chena cultivation was practised, were very poor thus giving rise to a number of problems like poor transport facilities. Therefore, only one or two marketing channels existed resulting in lack of exposure to pricing etc. It was clearly indicated that a change in these variables would prompt a more stable agricultural system.

5. Policy with reference to legislations

It was mentioned earlier that despite the government taking stringent measures to curb chena cultivation, jungle clearing is taking place unabated. Legislations along would not solve the problem. There are many other factors one should focus attention on in order to make legislations more effective.

An attempt was made to identify the attitudes of the farmers regarding the government policy on this issue. Some very interesting responses were received. Almost all the Kahambana farmers responded saying that they would resort to illegal chena cultivation even if stringent measures are taken to curb chena farming. In fact, it was shown earlier that in Kahambana despite the fact that sinnakkara lands were available, they resorted to chena farming due to the plentiful availability of jungle land. We also showed that under certain circumstances like better infrastructural facilities, extension services etc. they were willing to change the system. Thus, we see that if legislation is to be imposed other supporting factors should be looked after.

Although we tried to show that ownershp of land did not contribute much towards stability, this aspect cannot be reported as unimportant as, at least to a certain degree, this factor acts as the initial impetus for stabilization. In Kahambana although lands were given on sinnakkara titles, almost one half of the respondents was not certain about the legality of these titles. Therefore, they had not made any attempts to

develop these lands. Farmers appeared to be willing to change chena into permanent highlands by using more inputs, growing permanent crops and adopt soil and water conservation measures if land was given legally to them (See Table 5.7).

Table 5.7 CHANGE ENVISAGED IF LAND IS GIVEN LEGALLY

Change in farming practices	Badagiriya		Gannoruwa		Mahakalugolla		Kahambana	
	No.	%	No.	%	No.	%	No.	%
Change into permanent land	29	29.3	36	24.7	33	24.6	15	57.5
Use outside inputs	21	21.2	21	21.2	40	29.9	1	3.0
Use soil and water conservation measures	14	14.1	33	22.6	8	6.0	1	3.0
Cultivation of permanent crops	14	14.1	33	22 7	38	28.4	8	24.2
If irrigation facilities are available land could be made stabilized	11	11.1	4	2.7	-	-	2	6.0
Build a permanent house	6	6.1	6	4.1	14	10.4	-	-
Others	4	4.0	3	2.1	1	0.7	2	6.0
T o t a l	99	100.0	146	100.0	134	100.0	29	100.0

As mentioned earlier, farmers insisted that, apart from legal title to develop land into a stable system they would require facilities in terms of credit, inputs, extension advice, irrigation etc. The emphasis laid on these aspects were different from one location to another. For example, in Mahakalugolla where the system is almost stabilized, the farmers would require inputs like fertilizer and agro chemicals, advice on machinery, sprayers and tractors to develop the farming system. But in Kahambana, protection from wild animals was a big problem and Gannoruwa farmers mentioned the need for credit to purchase inputs.

Although government had introduced laws to curb chena farming, almost all the farmers voiced that they had never received any instructions with regard to stabilizing of chenas. Those who have stabilized so far, have done so with their own initiations due to non-availability of lands primarily and also due to government regulations.

Although farmers had been aware of government legislation banning chena farming, it was found that the rules governing were not known to most of them. Nearly 80 percent of the Kahambana farmers did not know the actual regulations. Table 5.8 indicates the level of awareness of the various laws governing chena clearing. Hence, it is urgently necessary that information should be clearly disseminated as it reflects the confusion that has caused in the minds of the farmers.

Table 5.8 REGULATIONS KNOWN TO FARMERS

Regulation	Badagiriya		Gannoruwa		Mahakalugolla		Kahambana	
	No.	%	No.	%	No.	%	No.	%
Not aware of regulations	-	-	1	1.3	2	3.3	30	81.1
Chena farming prohibited	42	53.16	10	13.2	17	28.3	3	5.1
Need permits to cultivate chena	21	26.5	17	22.4	16	26.7	1	2.7
Felling of valuable trees prohibited	10	12.6	31	41.7	24	40.0	3	8.1
Needs permit to clear shrub jungles	1	1.2	5	6.6	1	1.7	-	-
Permit only for 2 acres	1	2.1	10	13.2	-	-	-	-
Timber transport prohibited	4	5.0	-	-	-	-	-	-
Others	-	-	2	2.6	-	-	-	-
T o t a l	79	100.0	76	100.0	60	100.0	37	100.0

6. Farmers' attitudes towards a different system

To get the farmers perception regarding this aspect, one should identify what they feel about continuous cultivation and any prerequisites they consider necessary for a changed system.

Table 5.9 PREFERENCE FOR CONTINUOUS CULTIVATION- % OF THE RESPONSES

Village	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
Yes	42.8	89.3	56.3	61.4
No	57.1	10.7	43.7	29.5
Not responded	-	-	-	9.1

Table 5.9 gives some contradictory views compared to the earlier perceptions regarding the possibility of continuing the chena system of farming. We mentioned in an earlier section that the majority of the farmers felt that chena system of farming was not possible in the future due to various reasons (See Chapter 1). However, the above Table indicates that apart from Mahakalugolla (where continuous cultivation is already taking place) in all the other locations a substantial proportion does not prefer continuous cultivation. It is interesting to find out the reasons behind this thinking. First, let us consider the main reasons for continuous cultivation.

Table 5.10 THE MAIN REASON AS A % OUTLINED IN THE DIFFERENT LOCATIONS FOR CONTINUOUS CULTIVATION

Reasons	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
Could be owned in the future	-	20.0	2.6	9.7
Income could be increased	76.5	-	-	-
Present chena near the house	-	-	15.3	-
Easy to cultivate the land	5.9	25.0	48.7	19.4
Changes of getting other facilities	-	25.0	-	19.4
Lack of forest land	11.7	2.5	7.7	38.7

Although in the previous section we mentioned that diminishing forest resources to be a major reason among others why chena farming was not possible in the future, the preference for continuous farming was not based on availability of land, except in Gannoruwa (38.7 percent). This special situation could be only explained through the fact that in Gannoruwa, law enforcement is very much severe in this area even for clearing of shrub-land. In fact as mentioned earlier, almost all the chena cultivators were permit holders. Thus, under these circumstances lack of forest land could be considered as a very good reason to pursue continuous cultivation.

However, there are many other reasons sometimes location specific. In Kahambana, for example, the major reason was to increase the income levels.

This is amply reflected by the fact that in Kahambana where the dependence is solely on classical chena farming, and due to the isolated nature of the village. In Kahambana even for productive chena farming there is a necessity to go into deep jungle and avenues of off-farm incomes too are very poor. Thus, the economic situation is the main variable for any change. Hence, they pursue that the only alternative left is to cultivate the same piece of land, may be using different techniques of cultivation. Another important reason mentioned in all the locations were that they would like to cultivate the same piece of land continuously since it is easy to cultivate. However, may be contradict the argument where they tend to shift due to drop in fertility and weed problems. But this could be interpreted as, if these problems are looked after, they would consider it much easier to cultivate the same piece of land since the drudgery of feelling jungles and protecting the farm produce by wild animals is minimized, since this becomes more and more difficult when chenas are situated in the far out jungle.

Another reason unique to Mahakalugolla and Gannoruwa was that they feel they would be in a better position to get other external facilities if the chena is stable. Here, we have understood that in Mahakalugolla, the chena system is almost stabilized and in Gannoruwa the farmers are forced to minimize shifting due to the strict enforcement of law and diminishing land reso ces. In this instance, the circumstances have forced the farmers to think in these terms for getting external help in order to develop the farming system. In fact, it is coupled with the perception of owning the land in the future. This gives us an indication that there could be a relationship between owning the land, stabilization and getting external resources to develop the farming system. This becomes all the more clear when we consider the fact that unless ownership could be proved, it is hard to obtain institutional loans for farming.

There was a substantial proportion specially in Kahambana (37.1 percent) and Badagiriya (43.7 percent) who were opposed to continuous cultivation and even in Gannoruwa nearly a third felt so. It is intersting to note that the reason behind this perception is mostly location specific. For example, in Kahambana, where classical chena is being practiced in fairly thick forests, chena farming is done on a Yaya basis for example, as wheel chenas.

Under these circumstances, since a group of farmers is involved in operations such as felling of trees the effort is less and they are in a position to build up a very strong fence ("Dhadu wata") with the unburnt big tree trunks and it is easy to secure the produce from wild animals due to several watch huts built in the adjacent chenas. Thus, in a way minimizing damage by wild animals is a group effort. But this picture changes if continuous cultivation is practised. For example, protecting ones chena becomes an extremely difficult one since an individual finds it difficult to erect a strong fence along. Thus, in places where wild animals damage is more servere, this reason can be a strong impediment to advocate continuous cropping unless farmers are motivated to a certain type of group action. Lack of irrigation facilities (34.4 percent) too was quoted in Kahambana. This could be very much related to the drop in rainfall (See Section on Agro-Technology) which may be a function of clearing jungles at a faster rate. In Badagiriya, where chena is farmed along with major irrigation, paddy, the strongest objection (42.3 percent) was low fertility of the soil. This ties very well with their earlier response to the question on the scope of chena farming in the future, where we tried to show that they perceived that unless the land is fallowed, fertility would not be sustained. In Gannoruwa, the important reasons were the difficulty in weed control (58.8 percent) and the lack of inputs of cultivation practices. This latter reason couples with the problem of weed control and maintenance of soil fertility since nearly 8 percent specifically mentioned this as a problem (See Table 5.11).

In conclusion, we can say that the main reasons in objecting to continuous cultivation is based on maintaining soil fertility, controlling weeds, lack of inputs for cultivation practices, which is connected with the other two problems mentioned before and problems pertaining to minimizing damage by wild animals and lack of irrigation facilities. An important feature in this regard is that there are problems specific to a particular location. Thus, an attempt to induce a particular system towards stability should be seen as a complex one depending on the circumstances rather than thinking of blanket solutions.

Having understood this situation mainly for policy-purposes, apart from agronomic evidence and theoretical modals, one should consider the farmers point of view with reference to sustainirg productivity without using the conventional fallowing system, and what are the other prequisites they consider important for continuous farming. Let us consider the latter aspect first.

Table 5.11 REASONS QUOTED AGAINST CONTINUOUS CULTIVATION (% OF RESPONSES)

Reasons	Village			
	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
1. Lack of inputs for cultivation practices	6.3	20	-	23.1
2. Damage by wild animals	50.0	20	7.6	15.4
3. Lack of irrigation facilities	34.4	20	3.8	-
4. Not all the farmers like this change	3.1	-	-	-
5. Has been allocated for use by the State	3.1	-	7.6	-
6. The income obtained is not satisfactory	3.1	-	3.8	-
7. Low fertility of the soil	-	20	42.3	7.7
8. Chena is far	-	20	15.3	-
9. Difficult in weed control	-	-	11.5	53.8
10. Lack of govt. support	-	-	3.8	-
11. No ownership for the land	-	-	-	-

Table 5. 12 THE MAIN PREREQUISITES FOR CONTINUOUS FARMING AS PERCEIVED BY THE FARMERS (% OF RESPONSES)

Pre-requisites	% of farmers			
	Location			
	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
1.State aid for land preparation and other inputs	28.9	79.5	40.7	94.9
2.Providing irrigation facilities	40.8	-	26.3	3.4
3.Controlling of wild animal damage	26.3	-	1.3	-
4.Permanent ownership of land	1.3	20.4	13.1	-
5.Having group farms	1.3	-	13.1	1.7

Although some of these are location specific prerequisites, the salient feature that dominates all other reasons was for state aid, more specifically in Mahakalugolla and Gannoruwa (See Table 5. 12). Especially in these two areas, on the one hand pressure to increase productivity is more since they are more dependent on the highland component and on the other hand, Mahakalugolla is more or less stabilized and Gannoruwa too is under pressure with reference to the clearing of forest land for chena farming. Thus, they understand the need to change the cultural practices, by way of better land preparation and the use of new crops and varieties and the use of fertilizer and other improved technologies. This in fact leads to a major question regarding state aid that is available for highland farming. It is a known fact that for paddy farming the landowners as well as tenant cultivators are provided with institutional credit at very low interest rates and even the non-institutional credit sources are very much organised to finance paddy production. But the small farm highland sector has been neglected in this regard for highlands. If the ownership could be proved and the farmer meets the normal banking requirements loan facilities are available but in circumstances where ownership cannot be proved the available facilities are almost nil.

Chena farming being done on Crown lands does not qulify for any institutional credit schemes. Thus, it is imperative that while stable agriculture -is advocated other prerequisites such as ownership along with financial aid through credit facilities etc. should be looked into. All these factors have to be considered as a package deal. Only ownership would not help. For example, it was highlighted that in Kahambana although Sinnakkara land was given it did not evolve into a stable system. There are other prerequisites specific to each location like providing irrigation facilities, and controlling wild animal damage. These aspects have to be looked into with a different angle. For example, highland farming is supposed to be a form of non-irrigated agriculture. Thus, it is impossible to provide irrigation facilities in most instances. One way of getting over this problem is to evolve drought resistant shortage varieties of crops. Also, synchronising crop growth with rainfall availability, erecting farm ponds as done in Muthukandiya scheme to tide over difficult periods during the Yala season.

As mentioned earlier the other important factor is what the farmers felt necessary to sustain productivity without fallow given the fact that fallows rejuvenate soil fertility and is capable of smothering weeds. There were two main responses to the question, one was the using of chemicals to maintain fertility and to control weeds, which is very much in line with our earlier hypothesis (See Table 5.15). The other main response was that there is no other system or cannot think of another system. This last response is very important since this shows that there is an immense scope for farmer training using effective extension methods. Farmers feel that weeds and soil fertility to be the main problems, but also that using new method of land preparation, new seed varieties and chemicals as an answer too far sustained productivity under continuous cultivation, but they lack knowledge and funds to embark on a venture of this nature.

Table 5.13 METHODS OF SUSTAINING PRODUCTIVITY WITHOUT FALLOWING

Method	% of responses			
	Location			
	Kahambana	Mahakalugolla	Badagiriya	Gannoruwa
1. Use fo herbicides, fertilizers etc.	44.2	38.8	48.6	15.3
2. Cannot think of another system	34.9	31.4	16.1	53.8
3. Crop rotation	-	1.9	2.1	3.8
4. Soil conservation methods	11.6.	-	6.5	-
5. Extension services	-	18.5	3.2	-
6. Use of tractors for land preparation	4.7	7.4	9.7	3.8

Chapter Six

CONCLUSIONS AND POLICY RECOMMENDATIONS

CONCLUSIONS

Chena farming is one of the oldest forms of subsistence-oriented farming systems in this country and possibly many other parts of the world. However, its successful sustenance depends on the maintenance of soil fertility and keeping the weeds under control. In the past, those two aspects were not a problem as a sufficient length of time was allowed as fallow to rejuvenate the soils and to control harmful annual weeds.

However, the chena system of farming has been subject to a number of transformations lately. On the one hand, a reduction in the fallow period has occurred as a result of population pressure on the land available for cultivation. On the other hand, there has been a change in the crop mix as a response to the change in the market situation. However, hardly any evidence is available to show that steps have been taken to sustain productivity in order to overcome the problems created due to short fallows.

Although the government is spending vast amounts of money on irrigation development, available data point to the possibility that substantial extents of land will not come under irrigation and that they will have to be developed under rainfed conditions. Most of these highlands are still under chena cultivation. The state is now taking steps to develop highlands and avoid chena farming as it poses a threat to the forest reserves.

Under these circumstances, we felt it opportune to undertake a study in order to understand the role of chena in the context of a farming system

and to study it in a dynamic sense with due consideration to its transformation in terms of fallow period and the extent to which farmers are dependent on the chena component in relation to the other components of the farming system.

In this study it was hoped, as the major objective, to study a range of situations where highland farming is a component with special reference to the chena. It also aims to highlight the circumstances under which a particular system operates. It was also hoped to understand the variables that play a major role in transforming a truly shifting mode of cultivation to a semi-permanent and/or permanent highland cropping system. Therefore, the study focussed attention on four types of systems, two systems where only highland farming is present and the other two where alongside with highland farming, irrigated paddy cultivation is also practised. The major conclusions are as follows :

1. The relationship to size of land

There is a distinct relationship between the size of holding of the chena plot and the length of fallow and also to what extent the farmers are dependent on the chena component. For example, in systems where chena farming is practised concurrently with irrigated paddy farming, and if paddy is under major irrigation, the dependency is more on paddy. In such cases the size of the chena farm is smaller compared to the systems where paddy is grown under minor irrigation. In pure highland systems with greater stability (shorter fallows) the land size was bigger. Thus, it is clear that, depending on the circumstances, farmers would vary the size of the highland component to sustain a particular level of living.

2. Circumstances under which chena farming operates

Chena farming is characterised by the fact that, after a few seasons, farmers shift to another plot in order to avoid the imminent drop in fertility and also the threat of weed growth. Farming with less inputs is possible as long as plenty of forest land is available. Our study too reveals this fact. However, there were other reasons as to why chena farming continues unabated. Lack of legal titles to the land, ineffectiveness of the implementation of laws banning forest clearing, lack of extension

service facilities and funds in meeting the requirements of new technology were important reasons. Failure in terms of these factors has resulted in non-development of sustainable agriculture under highland conditions. Even in instances where stabilization has been already achieved, concantrating on a factor like law enforcement would not give the desired results unless other factors too are looked after.

3. Choice of crops

Although certain crops like highland paddy, maize, kurakkan and manioc have remained as traditional food crops in chenas, exposure to markets has resulted in a change in the crop mix. For example, marketable crops like cowpea, sugar cane, soya bean and chillies are some of the crops that have been adopted. The reasons for the adoption of these new crops have been based on two factors viz. easy to grow and easy to market. In other words these crops are ecologically adaptable to the area, less risky and enjoy a favourable market.

The adoption of these crops was seen to be linked to some degree of market exposure and also location specificality. The remoteness of Kahambana has resulted in non-adoption of perishable crops like vagetables, Hence, we would conclude that marketing facilities constitute the major variable in the selection of crops rather than agronomic suitability. When dependence was more on the chena component, one could observe the diversity of crops too to be greater.

4. Labour use pattern

The main objective of this analysis was to understand the labour use patterns for different components in each farming system in order to see the implications if a change is to take place towards more stabilized agriculture instead of continuing with chena farming. This aspect is very important for two reasons. Firstly, chena or any type of highland farming has to start with the occurrence of the first rains if a successful crop is to be obtained. Secondly, the present practice with irrigated paddy farming is that farmers tend to delay the cultivation practices until water is released from the tanks, thus, wasting the water from the initial rains.

However, one of the objectives of the government is to induce the farmers to start paddy operations along with the initial Maha rains so as to conserve some water in the tanks for a successful Yala paddy crop. If the stated objective is to be realised one would naturally expect bottlenecks in regard to labour to complete the work simultaneously both in regard to chena and paddy to be minimal. The present study shows instances where farmers are more dependent on the chena component. For example, when chena is practised concurrently with a risky paddy component (under minor irrigation), farmers concentrate first on the chena component. Hence, no labour bottlenecks arise. In instances where paddy and chena operations coincide (as in Badagiriya with major irrigation paddy), mostly family labour is used for work in the chena and farmers turn to mechanical power for land preparation in paddy fields. This again shows that so long as farmers depend on highlands (chena), they will always pay more attention to the chena component. In Mahakalugolla, farmers resorted to mechanical power in the highlands and it was possible as the highlands were free of stumps etc. The total labour input per acre was less compared to classical chenas (Kahambana). Thus, our findings are not -in agreement with those of the studies done on Walagambahuwa (Upesena S.H. Mimeo) which show that there were no bottlenecks regarding labour when both chena and paddy operations starts with initial rains. However, we have to conclude that unless mechanical power is used on, at least one of the components of the farming system, there are bound to be labour bottlenecks.

5. Productivity of the system

(a) Input use

In a strictly long fallow system, the natural rejuvenation of the soil would ensure productivity. In a system which shows a drop in the fallow, external input use is imperative. However, the survey revealed that apart from some exceptional cases, external input use has been very marginal. In Mahakalugolla (almost stabilized), some input use was observed. This was mainly for highland paddy. This reflects the fact that extension service advice has been mostly towards paddy cultivation, although paddy is not the most suitable crop under these circumstances. Although fertilizer use was more common (yet lower than recommended), in the irrigated paddy fields, no attempt has been made to use fertilizer on the chenas.

(b) Output

The output of crops is clearly related to two variables viz. (1) length of fallow, and (2) level of input use. The greater the length of fallow, as in the case of Kahambana, the higher the productivity would be. In the case of irrigated paddy where fertilizer use was high (Badagiriya), the yields were high. This aspect of high input use is an indication of an assured supply of irrigation water and higher dependence on the paddy crop. Apart from these two variables there were indications that agronomic unsuitability too may have contributed to the low productivity of certain crops. For example, maize performed better in the Moneragala district, while green gram performed better in the Hambantota district. Therefore, better efforts should be made to identify crops agronomically suitable for different conditions.

(c) Incomes

Incomes from the various components of the farming systems give an indication of the level of dependency and how important a particular component in the system is. As expected, in Badagiriya the higher level of dependency on the paddy component is demonstrated by the fact that 88 percent of the gross revenue came from paddy. In Kahambana, despite the farming system comprising several types of highland components, 2/3 of the gross income (includes imputed value) came from the chenas. Gannoruwa shows the same trend, but economically it was the worst situation. Here paddy cultivation is associated with an element of risk as irrigated water is not quite assured, and chena is practi ed under very short fallows. But in Mahakalugolla, despite highland farming being practised without fallow and without much attention to cultural practices, the market orientation has offset the disadvantages. Hence, it may be concluded that the tendency on the part of farmers is to move towards stability and even to change the crops according to the circumstances. But what is lacking is that farmers have not been adequately exposed to the advantage of using outside inputs and to adopt better agronomic practices. However, they lack the funds to adopt them.

POLICY RECOMMENDATIONS

These recommendations are based on the identified key variables that play a major role for a change in the system, ie. from fully shifting chena for subsistence to semi-permanent and permanent highland cropping associated with cash cropping. The variables are discussed below. However, these variables should not be treated in isolation but should be considered as a package deal.

(1) Availability of land, tenancy rights and size of holding:

It has been repeatedly shown in many studies that one of the prerequisites for a farmer to develop a particular piece of land is to have the sole rights to the land he tills. However, giving a title is by no means an end to the situation. This should be done in relation to several other factors. Firstly, the size of holding has to be decided. Some progress has been made in this direction at the Muthukandiya Scheme in the Moneragala district. However, unlike in irrigated paddy farming, highland crops are more susceptible to variation in soils, rainfall etc. Hence, it is imperative that studies should be initiated to identify the crops that are suitable for different conditions and then to identify the viable size of farm. This should be done in relation to the availability of labour in a farm family as well. Labour may well be a bottleneck in instances where chena farming is practised along with irrigated paddy. In instances where chena farming is almost showing stability (as in Mahakalugolla), land rights would immediately enable farmers to obtain institutional credit. However, this should be done in combination with credit being available and extension services being effective. In places like Kahambana where chena is still being practised under classical conditions along with land rights, extension services etc, strict enforcement of the law banning forest clearing should be adhered to. Otherwise forest clearing would continue unabated.

(2) Availability of technological know-how and extension services

It has been mentioned that under tropical conditions growing of annual crops successfully over a long period is not suitable. (The introduction of semi-perennials like banana, sugar cane in Mahakalugolla is an indication of this). Hence, the crop mix should include tree crops and cultivation should take place with the minimum of disturbance to the soil. The introduction of tree crops and feed crops for animal hunbandry may

result in a viable system. Studies carried out by the Department of Agriculture currently on "no till" farming, avenue cropping etc. should be tested under on-farm conditions. Introduction of these technologies would require a very big extension effort. Model farms in line with the present T & V system would act as good demonstration plots. For the intermediate zone where chena farming is practised, another suitable farm model is being tested by the Minor Export Crops Department in the Gampola area. It will be worthwhile to reduce the number of crops in the system so that adoption would be easy. The extension system in the country tends to be biased towards paddy production. However, recently the Department has made efforts to cover non-paddy crops as well. For rainfed highland cropping clear messages are needed if the extension service is to be effective in order to change an existing pattern particularly with regard to new crops, use of inputs and soil and water conservation measures. Special attention is needed for remote areas where chena cultivation is practised.

(3) Availability of farm power and manual labour

If both paddy and highlands are to be cultivated simultaneously, the need for mechanical sources of farm power is inevitable for either of this components. If chenas are stabilized there is an added advantage as the stumps are removed. As suggested in an earlier study (Farrington and Abeyratne, 1982) more efforts should be made to use tractors on highlands as they perform more efficiently in the highlands and buffaloes be used on the lowlands wherever possible. As the current fleet of tractors and buffaloes will not be adequate to meet the power demands of both the highlands and mudlands, as a cheap source of energy, every effort should be made to revive the animal draught component (refer to Farrington and Abeyratne, 1982 for recommendations with this regard). If this recommendation is implemented with regard to tractors, only a certain number for replacements will need to be imported.

(4) Availability of marketing facilities

In many instances the availability of marketing facilities and related infrastructures has been the key variable in changing the crop mix. For example, in remote areas (Kahambana) farmers still grow subsistence oriented crops, whereas Mahakalugolla which shows stability is geared towards

market-oriented crops and this location is well served by good roads. Thus, we see that there is some relationship between the change of crops, marketing and stability. Therefore, as a first step, it is imperative that action should be taken to improve the conditions of roads especially to locations where chena cultivation is practised by clearing virgin forests. This will also enable the law officers to perform their duties better and the extension staff to transfer their messages more effectively.

Linked with the transport facilities in remote areas the available marketing facilities were not satisfactory. Here again, as an initial step at least during the time of harvesting, which spread over a few weeks, mobile purchasing units should be installed so that farmers would be in a bargaining position by coming to know the prevailing prices etc.

(5) Policy with reference to legislations

Although the government has introduced various laws with regard to the clearing of forest lands for chena cultivation, farmers are still not aware of the specific references or the consequences attached to the laws. Hence, as a first step, the government should make every effort to communicate these messages by means of posters in public places. However, in order to make this effective along with firm implementation of the law, every effort should be made to improve concurrently the other services like extension, marketing, credit facilities, legal titles etc.

REFERENCES

Abeysekera, W.A.T. (1983), A Preliminary Assessment of the Performance of a Major Irrigation Rehabilitation Programme; the case of Tank Irrigation Modernization Project, ARTI Research Study 60, Colombo.

Abeyratne, E.L.F. (1956), Dryland Farming Ceylon. Tropical Agriculturist, Vol. CXII.

Brohier, R.L. (1975), Food for People, Lake House, Colombo.

Brown, Mike, et al (1983), Development of Stabilized Rainfed Farming Systems in the Intermediate Zone of Moneragala District of Sri Lanka: CCRA Bulletin, 14.

Central Bank of Ceylon (1975), Survey of Economic Conditions in the Mahaweli Development Area - 1974, Colombo, 96 p.

De Alwis, K.A. & Panabokke, C. (1972/73), Hand Book of the Soils of Sri Lanka (Ceylon), Soil Science Society of Ceylon, Colombo.

Dept. of Census and Statistics (1972), Census of Population - 1971, Preliminary Release No. 2, 11 p.

Dept. of Census and Statistics (1980), Basic Village Level Statistics-1977, Hambantota district, Memeographed, 12 p.

Dept. of Census and Statistics (1980), Basic Village Level Statistics, 1977, Moneragla district, memeographed, 13 p.

Dept. of Census and Statistics, (1982), Labour force and Socio-economic Survey 1980/81, Preliminary Report, Colombo, 67 p.

Farrington, J. & Abeyratne, Fredrick (1982): Farm Power and Water Use in the Dry Zone, Part II, ARTI, Colombo.

Gooneratne, W. et. al (1980), Rainfed Farming in the Dry Zone of Sri Lanka, Research Study No. 36, ARTI, Colombo.

Gunasinghe,N. (1976), "Social Change and the Disintegration of a Traditional System of Exchange Labour in Kandyan Sri Lanka" Economic Review, Vol. 1 No. 10.

Harris, Barbara (1977), Tractors, Profits and Debt in Hambantota District Sri Lanka in Green Revolution (ed) Farmer B.H., Macmillan Press

Joachim, A.W.R. and Kandiah, S. (1948), The Effect of Shifting (Chena) Cultivation and Subsequent Regeneration of Vegetation in Soil Composition and Structure Tropical Agriculturist, Vol. CIV, No. 1.

Leach, E.R.L. (1968), Pul Eliya - A Village in Ceylon, Cambridge.

Rutherberg, Hans (1971), Farming Systems in the Tropics, Clarendon Press, Oxford, London.

Rosayro, R.A.De. Some Aspects of Shifting Cultivation in Ceylon. Tropical Agriculturist LXVI (4 & 5).

Stockdale, F.A. (1962), Chena Problems and Some Suggestions for its Solution, Tropical Agriculturist, LXVI (4 & 5).

Silva, W.P.T. (1977), Green Revolution (ed) Farmer, B.H. Macmillan.

Upasena, S.H. (mimeo), Stabilization of Chena Identification of Cropping in the Highland Component of the Dry Zone of Sri Lanka.

Vitebsky, Piers (1983), Some Preliminary Reflections on the Sociology of Chena in an area of Moneragala district (mimeo).

Yalman, N. (1967), Under the Bo-tree: Studies in Caste, Kinship & Marriage in the Interior of Ceylon, California University Press.

Wijewardena, Ray & Weerakoon, Lionel (1982), Why Farm Power? Paper presented at the Regional Seminar on Farm Power, October, 1982.