CHANGE IN OTHER FIELD CROP CULTIVATION IN THE NORTH WESTERN PROVINCE

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HARTI

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FOREWORD

Having reached a surplus paddy production in the country from mid 2000, government emphasis was placed on the development of Other Field Crop (OFC) sector to achieve self sufficiency targets of many other crops that can be produced in the country. Nevertheless, the performance of this sector in the recent past had not been promising. Therefore it is necessary to explore issues that are impedimented for the expansion of the OFC sector in Sri Lanka in order to provide some policy direction to the policy makers. A request was also made by the ministry of agriculture to investigate the factors responsible for the backward growth of this sector particularly in the North Western Province (NWP). Considering the necessity, HARTI undertook a study on the changes in other field crop sector in the NW province in 2011.

Study identified the main farming system i.e. *Chena* that had been practiced in the dry zone for many years and supplied bulk of the OFC in the country. This traditional system had evolved into several farming systems in the recent past due to a number of factors. According to the study permanent homesteads cultivating mono-crops without fallowing *(Goda hena)*, irrigated rice fields cultivating OFCs and supplementary irrigated uplands cultivating OFCs are the currently existing farming systems in the province. Abandoning of *Chena* cultivation due to legal restrictions, bringing large tracts of dry zone land under irrigation, land distribution programs and the liberalization of input and output markets are identified by the study as the main factors that changed the farming systems in the province. Author emphasizes that less input and less labour demanding innovative farming methods and genetic improvement of local varieties are still needed to develop the other field crop sector in the province as semi-subsistence family labour dependant farming is predominant in the province. Yet sub-commercial systems with cultivation based on market signals are emerging in the province. Therefore the author has recommended that there is a need to explore the feasibility of mechanized large scale commercial cultivation of OFCs and a suitable institutional set up to be established in the dry zone.

I congratulate the researcher for successfully undertaking this study and hope the findings and recommendations in the study will be useful for policy makers and researchers.

E.M. Abhayaratne
Director/HARTI

ACKNOWLEDGEMENT

First of all I must thank director Mr. E.M. Abhayaratne and the deputy director (Research) Dr. L.P. Rupasena of the Hector Kobbekaduwa Agrarian Research and training Institute (HARTI) for giving me this opportunity and providing financial and other resources to undertake this study. I also thank former director Mr. Lalith Kantha Jayasekara for encouraging me to complete this study successfully.

The support given by the research team throughout the study is invaluable. I take this opportunity to thank Mr. Shantha Arunasiri the statistical assistant of my division and the casual investigators who worked with me in conducting the study. I also remember with gratitude the staff of HARTI data bank for generously providing lot of data required for the study. I appreciate the cooperation given by my staff of Agricultural Resources Management Division until the end of the study.

I am much indebted to the staff of all the Agrarian Services Departments of sample locations and the dry zone farmers who willingly extended their support to us during our field survey and provided lot of information. They inspired me to explore more on the issues that extended my study period little bit more.

I am thankful to the comments received from Dr. L.P. Rupasena and from the external reviewers to improve the report. My sincere thanks also go to the editor and the staff of the publication division for undertaking the publication work.

Dr. Wasanthi Wickramasinghe

EXCUTIVE SUMMARY

Other Field Crop (OFC) production in the country has been on the decline after mid 80's and this trend continued the dependency on imports to meet the national requirement of these commodities at an increasing rate. Consequently few crops gained some importance in rural economies. This trend has no exception in the North Western Province too. Reviewing the growth and setback of the sector in relation to the factors of change provides lessons to policy makers to design appropriate policies. Therefore this study attempted to examine the changes taken place in the farming systems in the Kurunegala and Puttalam districts over the years and the factors which influenced the changes in extent cultivated, shift in crop mix and varietal changes to draw the issues impediment for the expansion of the other field crop sector in the NWP.

The main other field crop farming systems in the NWP were identified by reviewing the literature on studies done on other field crop cultivation in the province and by discussions with officials in the Department of Agriculture and Department of Agrarian Development. The three main OFC farming systems were studied taking Moragollagama, Rambe, Madahapola, Nagollagama Agrarian Development Divisions (ADD) from Kurunegala district and Nawagaththegama, Karuwalagaswewa, Kalpitiya ADD from the Puttalam district as study locations. Key informant interviews, focused group discussions and farmer survey were carried out during August to September 2011.

According to the findings it is revealed that there has been a continuous decline in extent under other field crops in the province. Population pressure and legal restrictions have caused people either to abandon *Chena* or to grow their *Chena* land with perennials. Abandoning of *Chena* cultivation has significantly influenced the area under millet and sesame. Today, there are few illegal *Chena* cultivation practices that are taking place. With the abandoning of *Chena* cultivation, bringing large tracts of dry zone land under irrigation and liberalization of the input and output markets, several OFC farming systems evolved in the province. Permanently cultivating homestead with mono-crops without fallowing *(Goda hena)*, cultivation of OFC in irrigated rice fields, OFC cultivation in supplementary irrigated uplands are the existing farming systems that produce OFCs to national production. However, cultivation of OFC under main farming systems found in the province i.e, *chena,* diversified rice fields, and the dry and irrigated uplands has been in the decline.

Economic factors, chiefly market prices and trade policies, have been important determinants in the expansion of OFC cultivation in the country. Liberalisation of the economy, output as well as input markets influenced the farmer's decision that commercial cultivation gained impetus in the direction of increasing cultivation of vegetable and cash crops such as big onion, whereas semi-subsistence low income farming received a setback. Though diversification programs during late 80's had made an impact on cultivation of green gram, cowpea and other subsidiary crops in the rice fields, liberalization of trade has reversed the trend that continuous decline of these crops are evident after mid 90's. Particularly in the Kurunegala district, *yala* cultivation of sesame and chilli has drastically dropped. Several farming systems have evolved for vegetable cultivation in the province. Along the Kalpitiya belt, onion-

chilli-tobacco farming system has changed to high-tech mixed crop cultivation. Liberalization of seed industry has also caused these changes in the farming systems with the abundant availability of imported hybrid seeds in the market.

Diversification has also been constrained during the *yala* season due to water scarcity. In the irrigation assured areas labour shortage has pushed farmers to grow paddy during *yala* season. Extension services and other promotional programs have made an impact for promotion of some OFCs, nevertheless that collapse as the promotion is withdrawn. Pest and diseases endemics have also caused sustainability of some farming systems that some crops have been wiped out from the fields.

Other field crop sector is still predominantly a semi-subsistence family labour dependant farming system in the province although few farming systems have been evolved as sub-commercial systems based on market signals. Therefore less input and less labour demanding innovative farming methods are still needed to be developed for the welfare of the dry zone farmer. Genetic improvement of local varieties with resistance to local conditions is also vital. In addition, water security by micro irrigation methods and tank rehabilitation could assure OFC farming during *yala* season. Extension service, promotional programs, contractual agreements on marketing and school nutrition programs link to production program are important to promote cultivation of OFCs. Research on innovative farming systems should be undertaken that takes productivity, labour saving and sustainability into consideration. Research is needed to be undertaken to explore the feasibility of mechanized large scale commercial cultivation of OFCs and the required institutional set up in the dry zone.

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LIST OF ABBREVIATIONS

NWP	-	North Western Province
DOA	-	Department of Agriculture
OFC	-	Other Field Crop
OFCs	-	Other Field Crops
DAD	-	Department of Agrarian Development
HARTI	-	Hector Kobbekaduwa Agrarian Research and Training Institute
ADD	-	Agrarian Development Division
IL 1	-	Low Country Intermediate Zone – 1
IL 3	-	Low Country Intermediate Zone – 3
IM 3	-	Mid Country Intermediate Zone – 3
DL 1	-	Low Country Dry Zone – 1
DL 3	-	Low Country Dry Zone – 3
DS	-	Divisional Secretariat

CHAPTER ONE

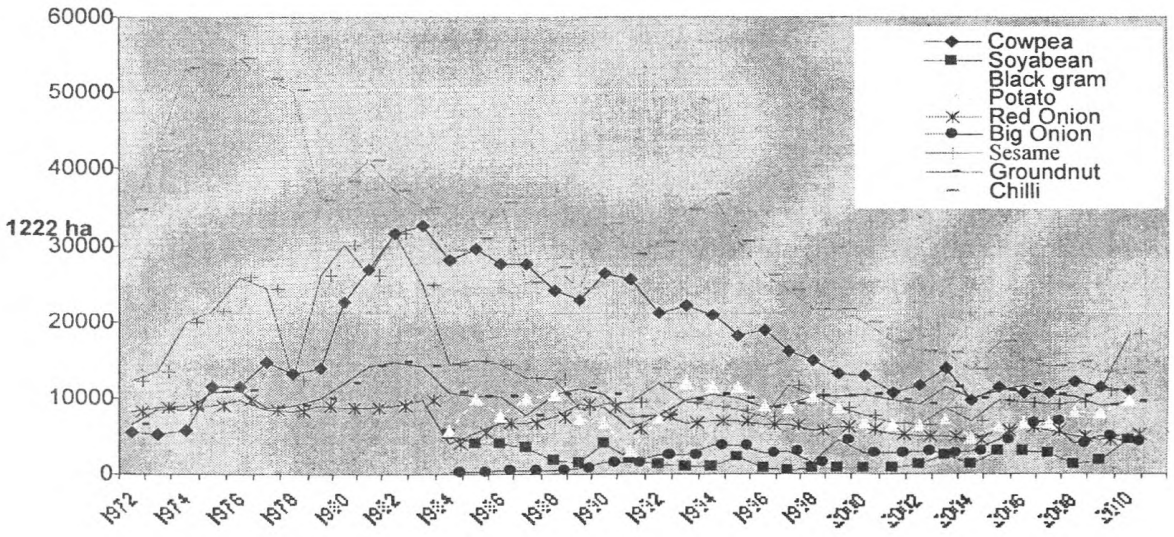
Introduction

1.1 Background

Food crops other than rice primarily constitute the subsidiary food crop sector in Sri Lanka. They are mainly comprised of Other Field Crops (OFCs) and vegetables cultivated in highland in both seasons and lowland in dry season. Crops such as chilli, onion, potato and the traditional subsistence crops constitutes the OFC sector and vegetables cultivated in up country and low country constitutes the vegetable sector.

Kurunegala and Puttalam districts of the North Western Province (NWP), are two of the important OFCs producing districts in the country. Kurunegala district mainly contributes to the traditional subsidiary food crop production while Puttalam district largely contributes to the cash crop production. The main crops grown in Kurunegala that contribute to the national production are cowpea, sesame, groundnut, low country vegetables such as snake-guard, cucumber, ash-pumpkin, brinjal and red-pumpkin and up country vegetables such as beetroot and capsicum. Red Onion is largely cultivated in Puttalam district and district alone constitutes more than 30 percent of the national extent of red onion.

Figure 1.1 Total Extent of Other Field Crops Cultivated, from 1972-2010



Source: Department of Census and Statistics.

It is apparent from the national level data on OFC cultivation, that OFC production at national level has been on the decline after mid 80's and this trend continued for many crops while dependency on imports to meet the national requirement of these commodities increased at an increasing rate (Figure 1.1). On the other hand, few crops gained some importance in rural economies. This trend has no exception in the NWP too.

Number of factors including reduction of *chena* cultivation, liberalization of trade policies, privatization of seed industry, and diversification of rice lands influenced the changes in the OFC sector to its present status. Reviewing the growth and set backs of the sector in relation to the factors of change provides lessons to policy makers to design appropriate policies for the development of this sector.

1.2 Objectives

Therefore the main objective of this study is to understand the issues impeding the expansion of the OFC sector in the NWP considering changes in farming systems in Kurunegala and Puttalam districts that were brought about by different factors.

For achieving the main objective of the study, following objectives were specifically considered.

- To review the OFC production situation at national level and the situation in the NWP from 1970's to date.
- To study the changes in farming systems over the years in Kurunegala and Puttalam districts.
- To review the factors that influenced the changes in extent cultivated, shift in crop mix and varietal changes over the years.
- To derive issues and recommendations to expand the OFC sector in the districts.

1.3 Method of Data Collection

Secondary Data and information from the Department of Census and Statistics, Department of Agriculture (DOA), Data bank of HARRTI (Hector Kobekaduwa Agrarian Research and Training Institute) were taken to review the OFC situation at national level and the situation in the NWP from 1970's to date. The main OFC farming systems in the NWP were identified by reviewing the literature on studies done on OFC cultivation in the province and by discussions with officials in the DOA and Department of Agrarian Development (DAD). To hypothesize the factors that have influenced the OFC farming in Sri Lanka, various studies on the subject were reviewed. Few selected representative faming systems were studied in the field as case studies to verify how far these presumed factors have been in influential in changing the farming systems, the crop composition and the varietal changes in the province. To verify the relevance of factors considered to have affected the OFC production and changing farming systems, key informant interviews, focused group discussions and farmer survey were carried out. This empirical information enabled to portray the farming system, its changes and the current crop cultivation scenario. Study locations were Moragollagama, Rambe, Madahapola, Nagollagama Agrarian Development Divisions (ADDs) from Kurunegala district and Nawagaththegama, Karuwalagaswewa, Kalpitiya ADDs from Puttalam district. ADDs were selected to represent the main OFC farming systems in the two districts. The farmer survey was designed in a manner that group discussions with 30-35 farmers from each ADD division using a structured questionnaire guideline were held. Ten to fifteen farmers comprising most oldest farmers who described their farming practices during 50's 60's and young generation farmers were interviewed individually to find out the changes in the farming systems that are documented in secondary records. Field survey was carried out from August to September 2011.

1.4 Organization of the Report

This report consists of six chapters. After this introductory chapter regional specialization of food crop production in NWP is discussed in the chapter two. Chapter three provides a detailed account of changing scenario of OFC production situation in Sri Lanka and in the NWP. Chapter four gives and insight into factors affecting changes in farming systems in the NWP and the chapter five depicts OFC farming systems in the NWP. The final chapter describes findings, issues and recommendations.

CHAPTER TWO

Regional Specialization of Other Food Crop Production in North Western Province

Kurunegala and Puttalam districts in the NWP are two of the important OFC producing districts in the country. Main part of the districts represents dry and intermediate zones of Sri Lanka and hence the traditional subsidiary food crops cultivating in the region. In the study, both OFCs and vegetables were interchangeably considered as OFCs.

2.1 Regional Specialization of OFC Cultivation in Kurunegala District

The DS divisions, Giribawa, Galgmuwa, Polpithigama, Kotavehara, Ambanpola, Maho and Nikaweratiya that represents the Dry Zone (DZ) and Low Country Intermediate Zone - 3 (IL 3) are mainly cultivated with subsidiary food crops. This region produces mainly green gram, cowpea, sesame, groundnut and chilli.

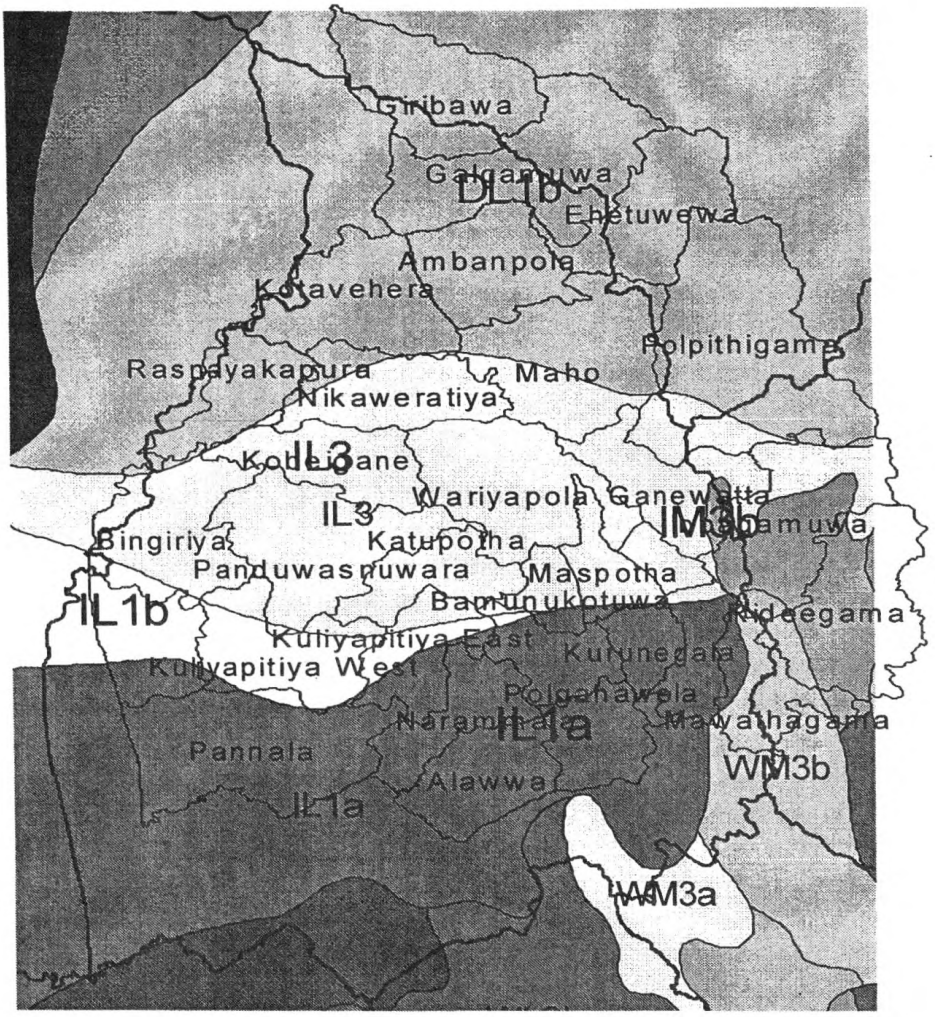
Belongs to Mid Country Intermediate Zone – 3 (IM 3) Polpithigama, Ibbagamuwa DS divisions bordering the Matale district is specialized in cultivating up country vegetables such as beetroot, capsicum and raddish while the Low Country Intermediate Zone – 1 (IL1) region in the district is mainly cultivated with low country vegetables such as snake-guard, cucumber, ash-pumpkin, brinjal and red-pumpkin (Map 2.1).

Based on the cultivation statistics of last 10 years (2001-2010), the crop with the highest extent cultivated in the district was green gram and it was 1713 ha which constituted eighteen percent of the national extent. The next cultivated crops in the district were cowpea, groundnut and chilli which are on average 1206 ha, 1174 ha and 1191 ha respectively. Finger millet that cultivated in large extents in 70's is now cultivated by farmers in very less extents and it is about to 400-500 ha.

Among the several low country vegetables cultivated in the district, large extents are cultivated with brinjal, red pumpkin and ladies fingers. Almost fifteen percent of the national extent of cucumber is cultivated in the Kurunegala district during the last 10 years.

Beetroot and capsicum are now extensively cultivated in the district which constitute about thirteen percent of the national extent. The cultivated extents of beetroot and capsicum in the last ten years are on average 320 ha and 386 ha respectively (Table 2.2)

Map 2.1 : Study Locations in Kurunegala District and Agro-ecological Zones



Source: Department of Survey, Department of Agriculture

Table 2.1: Cultivation of Crops by Agro-ecological Zone in Kurunegala District

Agro-ecological Zone	Divisional Secratariet (DS) Division	Main Crops Cultivated
DL1 & IL3	Giribawa, Galgamuwa, Polpithigama, Kotavehara, Ambanpola, Maho Nikaweratiya	Greengram, Cowpea, Finger millet,Maize, Chilli, Blackgram, Sesame Groundnut
IM3	Polpithigama, Ibbagamuwa	Big Onion, Chilli, Beetroot, Raddish Capsicum
IL 1	Wariyapola, Kobeigane, Hettipola Bingiriya, Kuliyapitiya, Pannala	Low country vegetables

Table 2.2: Other Extensively Cultivated Field Crops in Kurunegala District, 2000-2010 with Percent Contribution to the National Extent

Crop	Extent (ha)	Percent Contribution	Crop	Extent (ha)	Percent Contribution
Other Field Crops			**Low Country Vegetables**		
Green gram	1713	18	Cucumber	444	15
Cowpea	1206	11	Ash pumpkin	149	16
Groundnut	1174	11	Snake gourd	286	10
Chilli	1191	8	Red pumpkin	674	9
Finger millet	428	7	Ash plantain	885	9
Sesame	560	6	Ladies fingers	577	8
Maize	1025		Bitter gourd	301	7
Up country Vegetables			Brinjals	654	6
Beet-root	320	13			
Capsicum	386	13			
Raddish	235	8			
Tomatoe	186	3			

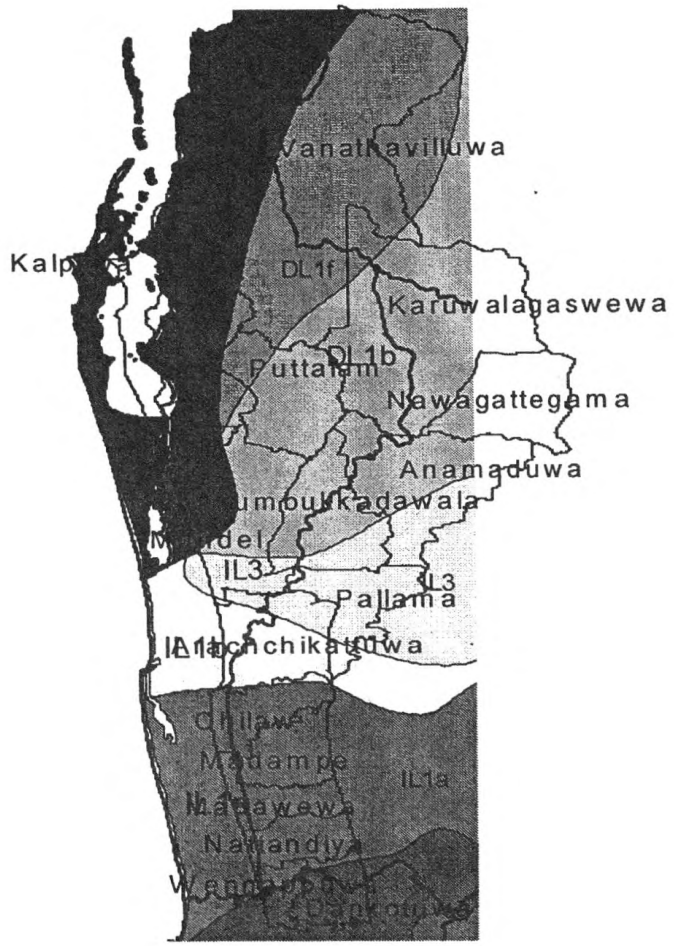
Source: Department of Census and Statistics

2.2 Regional Specialization of OFC Cultivation in Puttalam District

The Northern Dry Zone segment (DL_1 and DL_3) of Puttalam district constitutes about 70 percent of the land area of Puttalam district and the main food crop cultivating region. The Southern Segment (IL_3) is in the Coconut Triangle and falls within the urban area and is in close proximity to the city of Colombo. Mainly coconut plantations are extensively spread out in this region.

The Dry Zone regions in the mainland are the traditional *chena* lands that were cultivated with subsidiary food crops such as, greengram and groundnut. The cowpea production is mainly confined to the Northern Dry Zone (DL_1 and DL_3) areas of Anamaduwa and Puttalam electorates. A special farming system in the Kalpitiya Peninsula is related to red onion, chilli and upcountry vegetables (Map 2.2)

Map 2.2 : Study Locations and Agro-ecological Zones in Puttalam District



Source: Department of Survey, Department of Agriculture

Table 2.3: Cultivation of Crops by Agro-ecological Zone in Puttalam District

Agro-ecological Zone		DS Division	Main Crops Cultivated
Northern Segment	DL1 & DL3	Anamaduwa, Karuwalagaswewa Nawagattegama, Puttalam Vanathavilluwa, Pallama Mundel, Mahakumbukkadawala	Greengram, Cowpea Blackgram, Sesame Groundnut, Finger millet, Maize
Kalpitiya peninsula	DL 3	Kalpitiya	Red Onion, Chilli, Tobacco, Beetroot, Raddish, Capsicum
Southern Segment	IL3	Arachchikattuwa, Chilaw Dankotuwa, Wennappuwa Madampe Mahawewa Nattandiya	Mainly Coconut Cultivation

Table 2.4: Other Field Crops Extensively Cultivated in Puttalam District, 2001-2010

Crop	Extent (ha)	Percent Contribution to the National Extent
Red onion	1633	32
Chilli	1175	8
Ground nut	786	8
Greengram	568	6
Cowpea	548	5
Sesame	448	5
Capsicum	214	7
Raddish	191	7
Beetroot	168	8
Cabbage	153	4
Luffa	123	4

Source: Department of Census and Statistics.

The crop with the highest extent cultivated in Puttalam district was red-onion and it is on average 1,633 ha during last 10 years and it constitutes 32 percent of the national extent. On average 1,175 ha of chilli has been cultivated in Puttalam district during the last 10 years (Table 2.4).

CHAPTER THREE

Changing OFC Situation in Sri Lanka and North Western Province

Chena, the oldest farming system, was the principal source of food other than rice particularly in the dry zone of Sri Lanka and its cultivation continued to be an important food source in the dry zone until recently. Owing to a number of factors, this *chena* system was abandoned and other farming systems evolved over *chena* for OFC cultivation particularly in the dry zone. Changes and evolution of *chena* farming system as the principal source of food in recent history brought changes in crops cultivated in addition to their composition. Among the factors, strict enforcement of regulations against *chena* cultivation, taking large tracts of dry zone land under irrigation settlements, liberalization of trade policies, privatization of seed industry, and efforts on diversification of irrigated rice lands were largely influential in changing farming system and the crops and varieties cultivated that subsequently changed the OFC production situation in the dry zone.

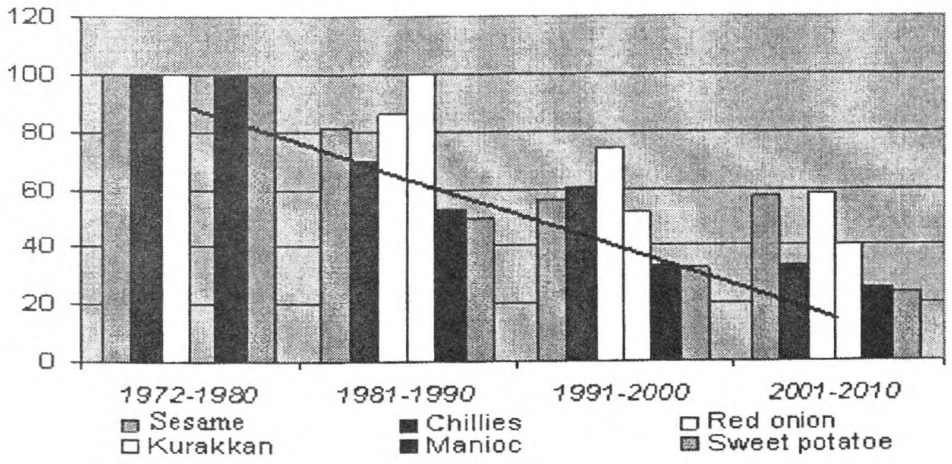
This chapter illustrates the changes in the OFC cultivation in the country and in the districts of Kurunegala and Puttalam from 1970's to date.

3.1 Changes in OFC Cultivation in Sri Lanka

Following observations are made by reviewing national data from 70's to date.

- Significant drop in cultivated extent of crops such as, sesame, finger millet, chilli is observed from mid 70's and from early 80's at national level.

Figure 3.1: Average Area Index for Main OFCs Cultivated in Sri Lanka (1972-1980)

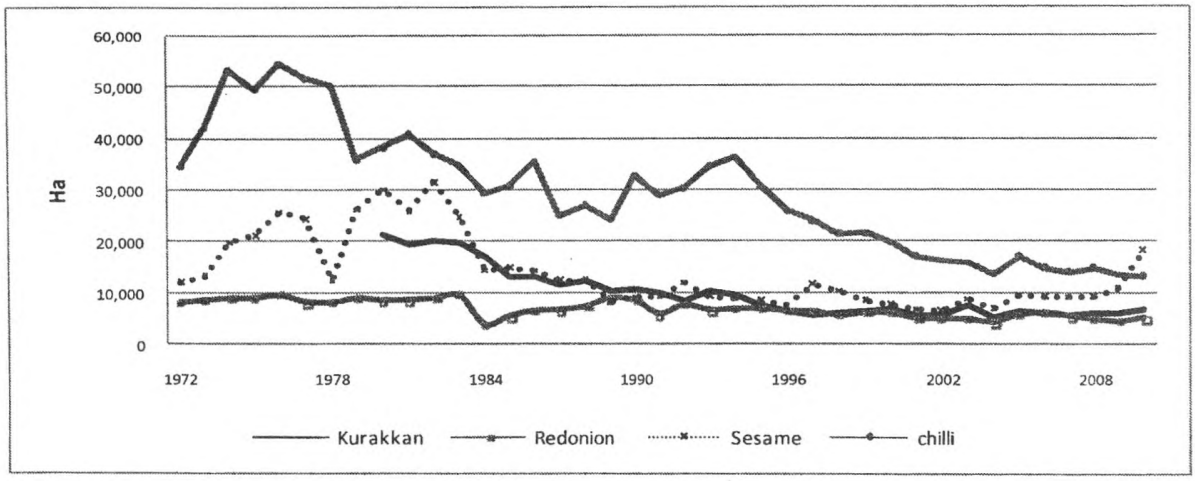


Source: Department of Census and Statistics

- The total extent cultivated with chilli in Sri Lanka drops from 50,000 ha in early 70's to 15,000 ha in 2000's. The highest extent of chilli cultivation was recorded in the country in 1976.

- The highest extent of 31,625 ha of sesame cultivation was recorded in 1982 and thereafter cultivation drops to the lowest of 6,582 ha in 2002. Yet, cultivation trend was observed after 2002 and 18,397 ha had been cultivated with sesame in the country in 2010 (Figure 3.2).

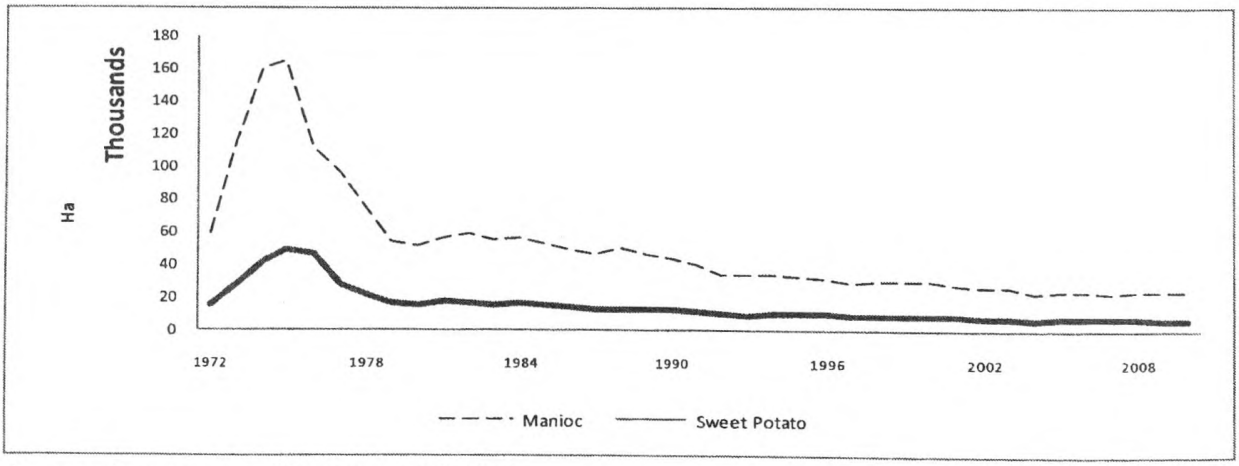
Figure 3.2: Total Extent Cultivated with Chilli, Kurakkan, Red Onion and Sesame



Source: Department of Census and Statistics

- Manioc and sweet potato cultivation in the country that reached the peak in 1976 dropped drastically (Figure 3.3).

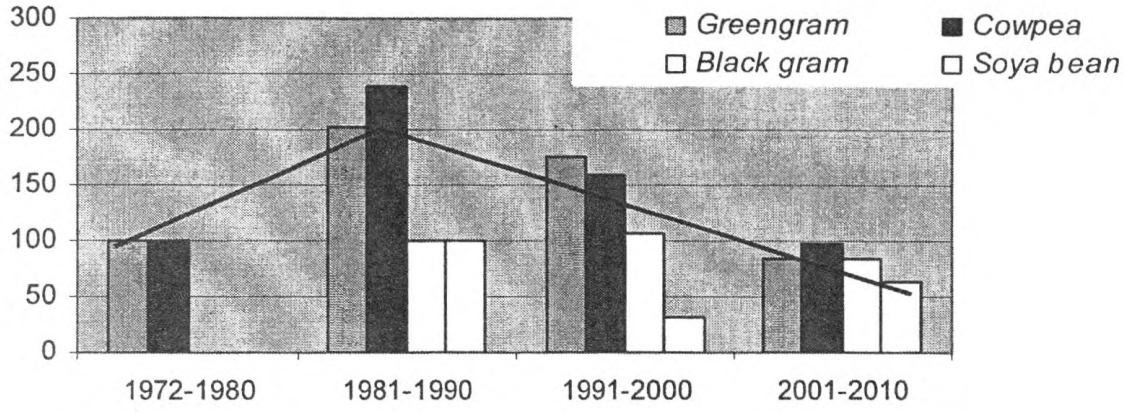
Figure 3.3: Total Cultivated Extent with Manioc and Sweet Potato



Source: Department of Census and Statistics.

- Upto mid 80's and early 90's pulses cultivation in the country incraesed sharpely and the highest extents of cowpea and greengram production were recorded in 1983 and 1990 respectively (Figure 3.4).

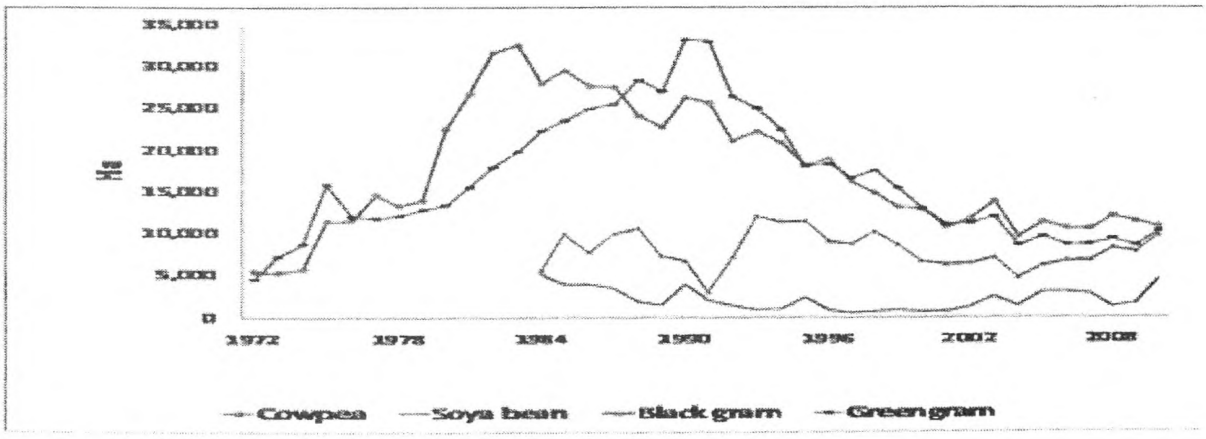
Figure 3.4: Average Area Index for Main Pulses Cultivated in Sri Lanka (1972-1980=100)



Source: Department of Census and Statistics

- Green gram and cowpea cultivation have dropped to about 9,000- 10,000 ha in the last few years from its peak cultivation of 33,200 ha and 32,600 ha respectively.
- Soybean cultivation that dropped continuously until 1997 slightly increased in the last few years and 4,500 ha cultivation was recorded in 2010 (Figure 3.5).

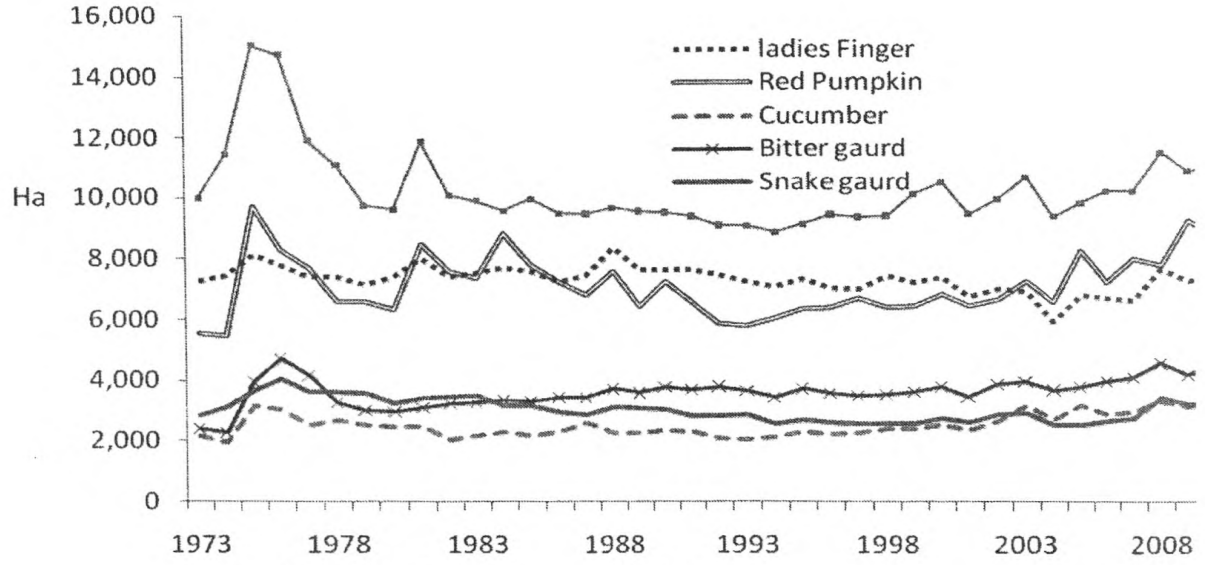
Figure 3.5: Total Extent Cultivated with Greengram, Cowpea, Black gram and Soybean



Source: Department of Census and Statistics.

- Although the cultivation surge of low country vegetables that experienced in 1970- 1977 was dropped, a more or less stable cultivation could be observed nationally (Figure 3.6).

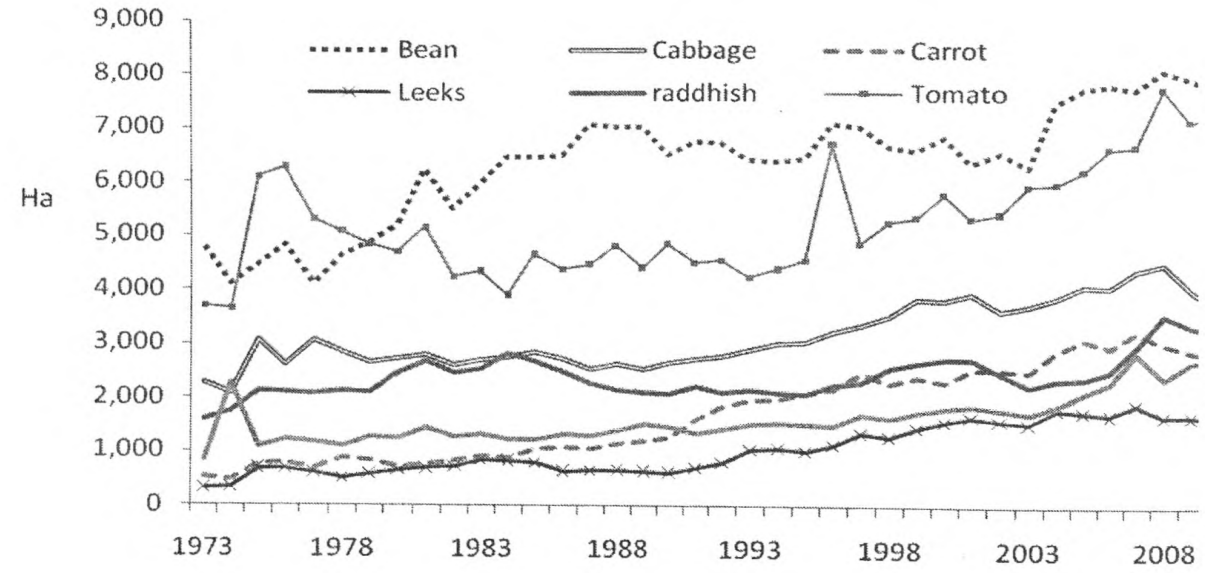
Figure 3.6: Total Extent Cultivated with Low Country Vegetables



Source: Department of Census and Statistics

- Nevertheless, a continuous increase in the up country vegetable cultivation is observed in the country (Figure 3.7).

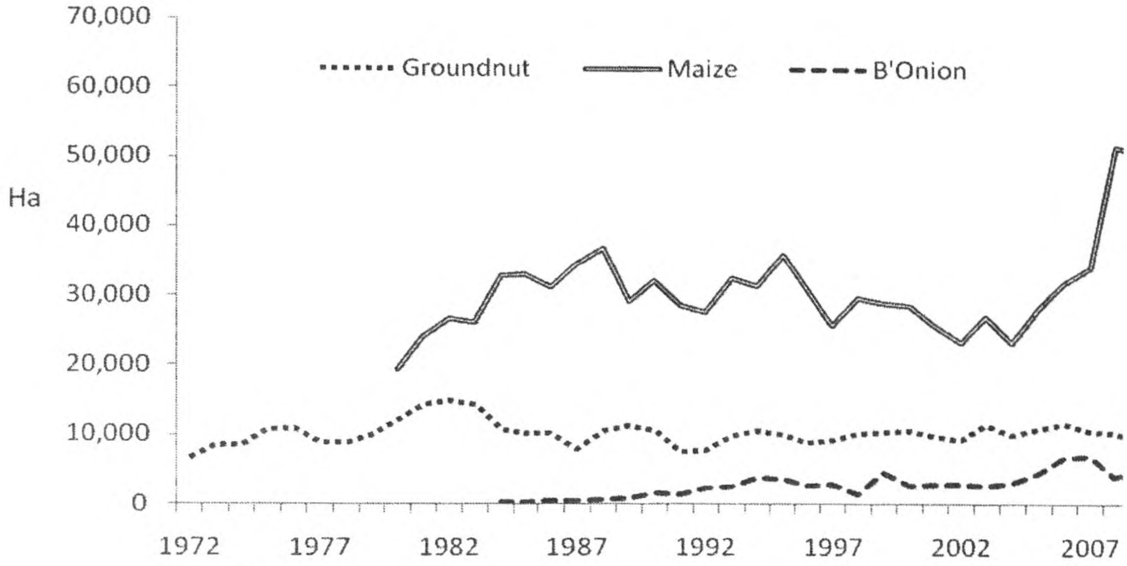
Figure 3.7: Total Extent Cultivated with Up Country Vegetables



Source: Department of Census and Statistics

- Cultivation of maize in the country increased by 300 percent compared to cultivation in 80's. This cultivation boom is recorded after 2006 (Figure 3.8).

Figure 3.8: Total Extent Cultivated with Commercial OFCs in Sri Lanka



Source: Department of Census and Statistics

3.2 Changes in OFC Cultivation in the Kurunegala District

This section deals with cultivation changes in the Kurunegala district during the period from 1970's to date and also the regional shifts in cultivation. Following observations can be made by reviewing the past data.

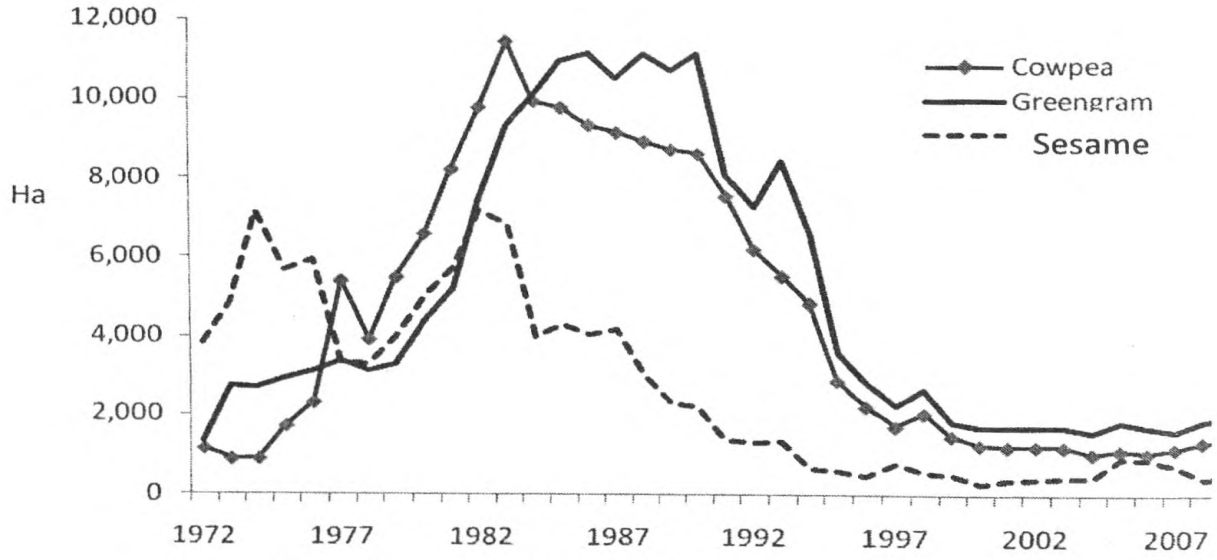
- There is a large drop in extent cultivated under OFCs after 80's.
- Kurunegala district alone contributed 25 percent of the cultivation of green gram, cowpea and sesame in the country during 1970's.
- During 1980's large extents of land were cultivated with green gram and cowpea contributing to 35–40 percent of the national extent. However, the cultivation of green gram and cowpea in the Kurunegala district was drastically dropped and the significance of the district as the main green gram and cowpea producing district was also lowered with time. Currently less than 3,500 ha are cultivated with both green gram and cowpea.
- Green gram and cowpea cultivation was spread both in *maha* and *yala* seasons and its cultivation drop follows the same pattern in both seasons.
- Sesame cultivation drastically dropped after 1982. Although sesame cultivation increased in the last 4-5 years nationally, Kurunegala district does not show any cultivation increase. Particularly, the main cultivation that takes place during *yala* season has dropped from 6,000 ha to about 260 ha in 2010. The current total extent under sesame cultivation in the district was only 450 ha (Figure 3.8, 3.9 and Table 3.1).

Table 3.1: OFC Extensively Cultivated in Kurunegala District and Percent Contribution to the National Extent

Crop	1971-1980		1981-1990		1991-2000		2001-2010	
	Extent (Ha)	As % of the National Extent	Extent (Ha)	As % of the National Extent	Extent (Ha)	As % of the National Extent	Extent (Ha)	As % of the National Extent
Finger millet	-	-	1332	8	500	7	428	7
Green gram	2990	28	9244	41	4484	20	1713	18
Cowpea	3145	27	9476	34	3108	18	1207	11
Sesame	4799	23	4226	27	734	8	581	6
Ground nut	415	4	1107	10	1067	11	1223	12
Chilli	4772		3283	11	1959	7	1198	8
Maize			1170		999		1024	

Source: Department of Census and Statistics

Figure 3.9: Extent Cultivated with Cowpea Greengram and Sesame



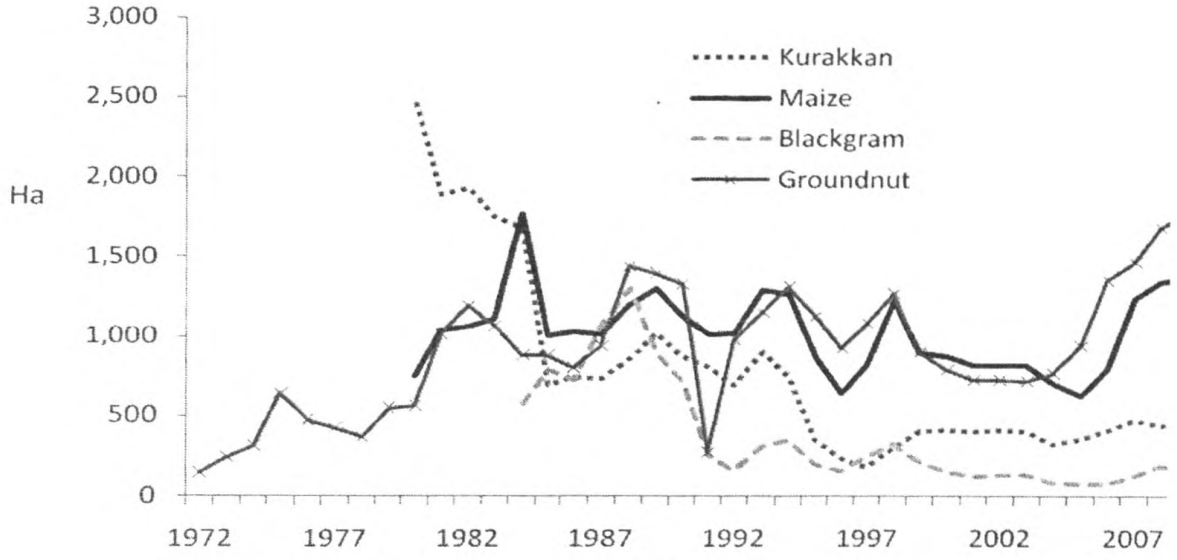
Source: Department of Census and Statistics

- Yet, groundnut cultivation shows an increasing trend in the district although national extent of groundnut has not increased. Accordingly, the district contribution had increased from four percent in 1970's to twelve percent in 2000's. Currently, 1,500-1,700 ha are cultivated with groundnut.

- Following general trend in maize cultivation in the country, Kurunegala district also shows an increasing trend in its cultivation.

- The extent under sesame contributed least among the OFCs to the national extent in Kurunegala district. The main cultivation that took place during *maha* season has dropped from 2,000 ha in 1980 to 500 ha in 2010 (Figure 3.9).

Figure 3.10: Extent Cultivated with Finger Millet, Maize, Blackgram and Groundnut



Source: Department of Census and Statistics

- Chilli cultivation during *maha* season has dropped from 3,500 ha in 1980 to 700 ha in 2010 while during *yala* season cultivation has dropped.

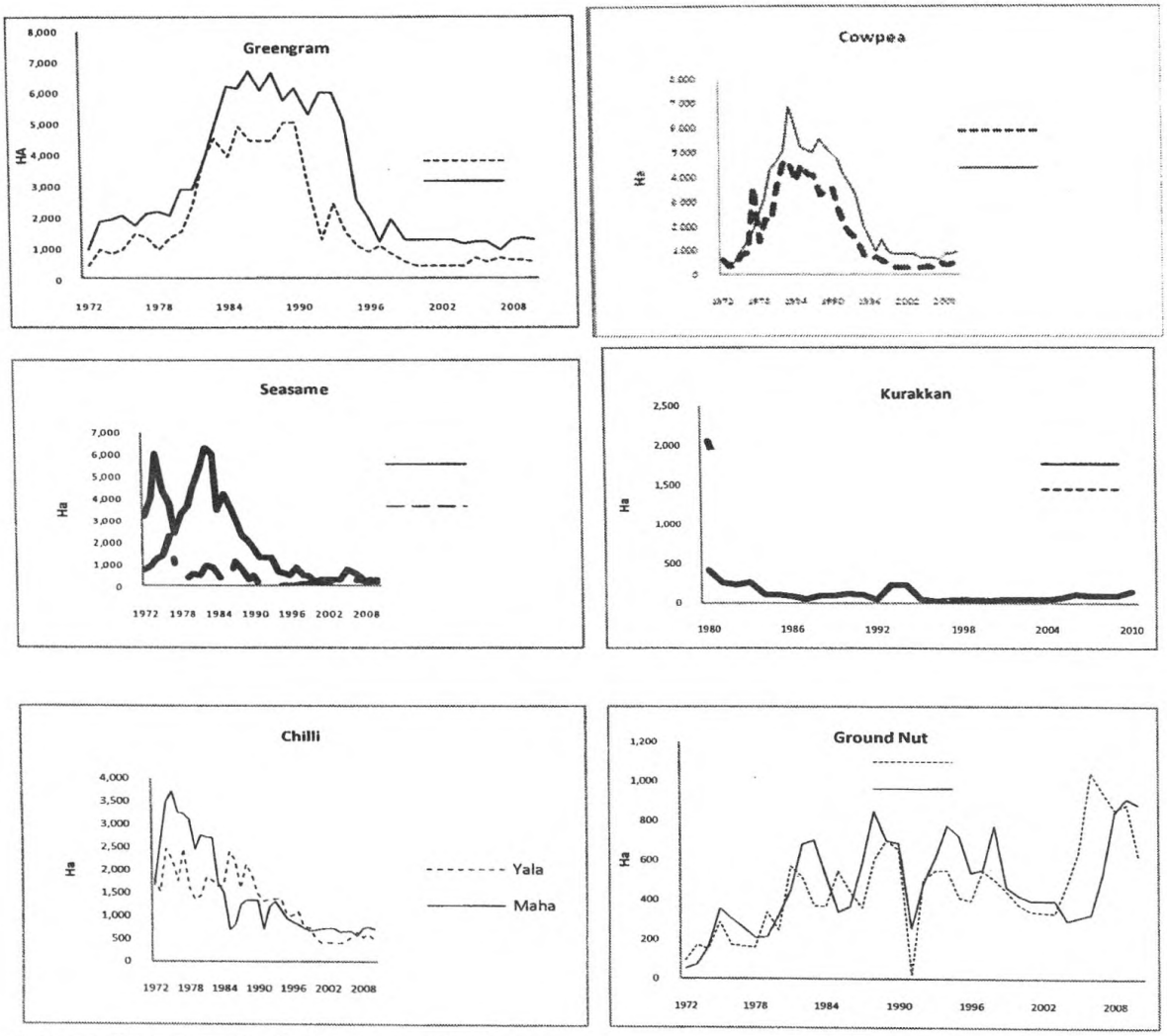
- Green gram and cowpea cultivation during *maha* season has dropped from 90's in *Giribawa*, Galgamuwa, Maho, Kotavehera, Nikaweratiya and Polpithigama DS divisions in the dry zone and the intermediate zone of the district.

- In *Polpithigama* DS division where cowpea, chilli, green gram and ground nut were cultivated in large extents in 90's, their cultivation during *maha* season has dropped and maize cultivation has spread.

- During the last 20 years groundnut cultivation has spread into *Giribawa, Galgamuwa* and *Maho* DS divisions.

- Chilli is yet cultivated in small extents in *Galgamuwa* and *Maho* DS divisions during *maha* season (Figure 3.11 and Table 3.2, 3.3).

Figure 3.11: Extent Cultivated during *Maha* and *Yala* Seasons under OFC in Kurunegala District



Source: Department of Census and Statistics

Table 3.2: Cultivated Extent of Greengram, Cowpea, Blackgram and Groundnut in Hectares by DS Division during 1992/93 and 2009/2010 *Maha* Seasons

DL1& IL3	Green Gram		Cowpea		Black Gram		Ground Nuts	
DS Division	1992/93	2009/10	1992/93	2009/10	1992/93	2009/10	1992/93	2009/10
Giribawa	352	221	752	268	166	20	6	146
Galgamuwa (including Ehatuwewa)	850	274	856	307	43	21	13	199
Maho (including Ambanpola)	2262	224	696	120	1	4	40	249
Kotavehera	886	92	654	37	82	15	67	27
Rasnayakapura		22		17		1		66
Nikaweratiya	784	103	380	60	17	4	121	23
Polpithigama	675	135	331	84		1	121	6

Source: Department of Census and Statistics

Table 3.3: Cultivated Extent of Finger millet, Maize, Sesame and Chilli in Hectares by DS Division during 1992/93 and 2009/2010 *Maha* Seasons

DL1 & IL3	Finger Millet		Maize		Sesame		Chilli	
DS Division	1992/93	2009/10	1992/93	2009/10	1992/93	2009/10	1992/93	2009/10
Giribawa	71	119	240	325	240	24	47	42
Galgamuwa (including Ehatuwewa)	204	163	494	411	494	49	238	147
Maho (including Ambanpola)	63	29	117	74	117	35	169	158
Kotavehera	189	24	221	32	221	25	109	23
Nikaweratiya	17	30	32	37	32	42	54	14
Polpithigama	43	64	38	260	38	12	434	26

Source: Department of Census and Statistics

- Cultivation of up country vegetables such as beetroot, tomato and raddish has increased in their extents in the district. During the last 10 years, the extent cultivated under beetroot contributed thirteen percent to the national extent.

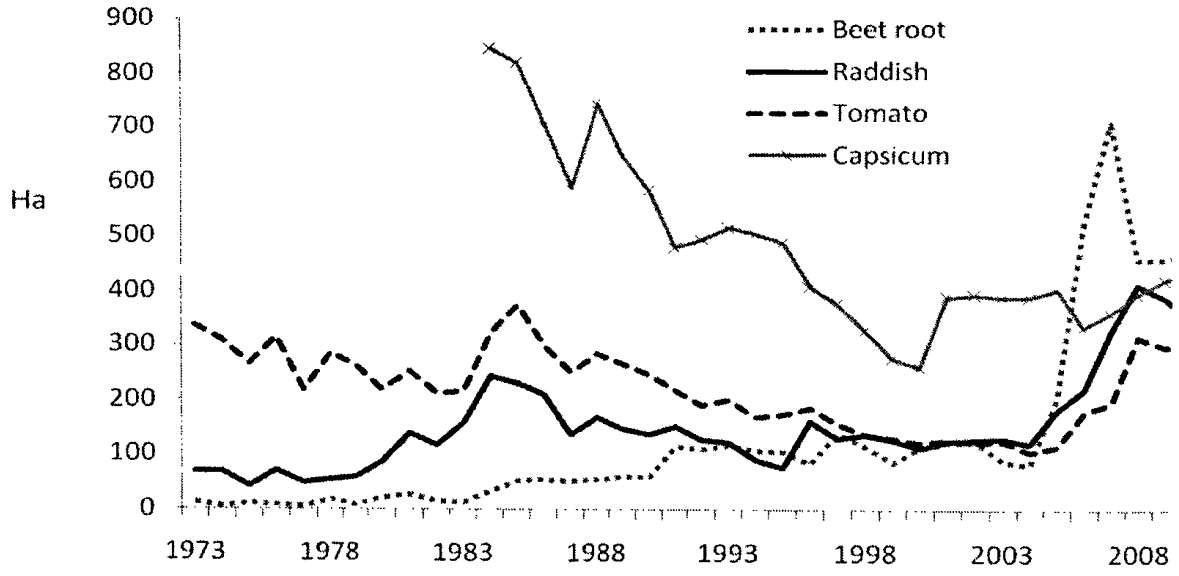
- Yet, extent under capsicum cultivation has dropped and in 2010 some 430 ha had been cultivated with capsicum (Table 3.4 and Figure 3.12).

Table 3.4: Percent Contribution of Up Country Vegetable Cultivated in Kurunegala District to the National Extent

Crop	1972-1980	1981-1990	1991-2000	2001-2010
Capsicum	-	21	15	13
Beet-root	1	3	7	13
Raddish	3	7	5	8
Tomato	6	6	4	3

Source: Department of Census and Statistics

Figure 3.12: Extent Cultivated with Up Country Vegetables



Source: Department of Census and Statistics

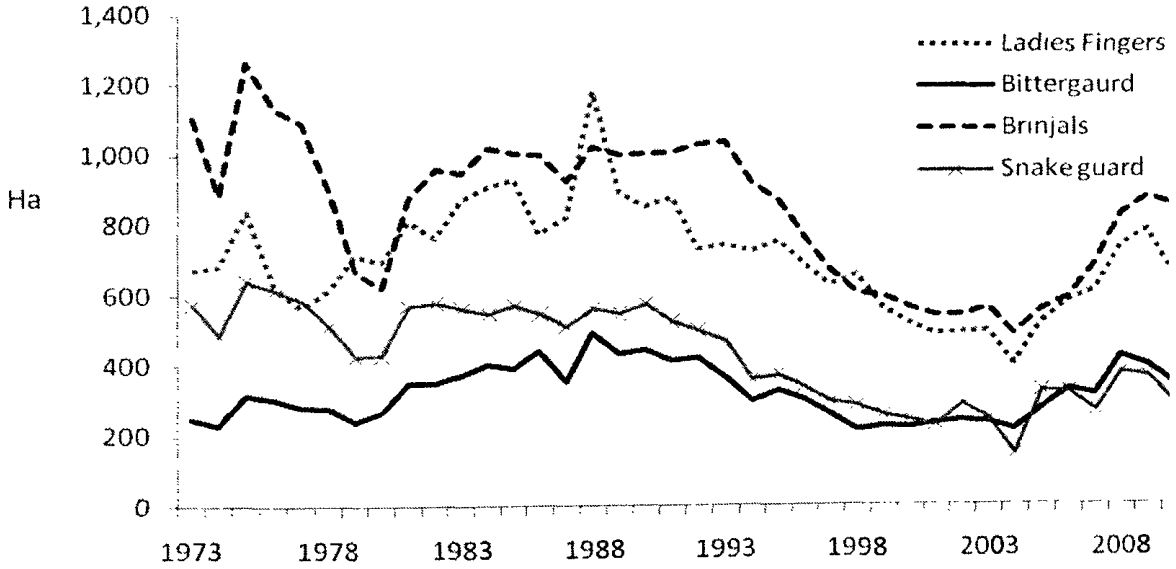
- Among the low country vegetables, pumpkin, cucumber and snake gourd are mainly contributing to the national extent. Yet, in terms of the extent cultivated, brinjal, ladies fingers and cucumber constitutes the largest extent in the district (Table 3.5 and Figure 3.13).

Table 3.5: Contribution of Extent Cultivated with Low Country Vegetables to the National Extent in Kurunegala District

Crop	1972-1980	1981-1990	1991-2000	2001-2010
Cucumber	17	24	21	15
Ash pumpkin	18	19	19	16
Snake gourd	16	18	14	10
Red pumpkin	16	21	16	9
Ash plantain	11	13	10	9
Ladies fingers	9	12	10	8
Bitter gourd	8	12	9	7
Brinjals	8	10	9	6

Source: Department of Census and Statistics

Figure 3.13: Extent Cultivated with Low Country Vegetables



Source: Department of Census and Statistics

3.3 Changes in OFC Cultivation in the Puttalam District

The changes in the cultivated extent during the last 40 years in the Puttalam district are described below by reviewing the data from 70's.

- Cowpea was the extensively cultivated crop in the district during 80's. Extent under cowpea in Puttalam district contributed eighteen percent of the national extent during this period. Its cultivation dropped from its highest cultivation of 8,000 ha in 1981 to some 400 ha in the last few years.

- Green gram, groundnut and sesame cultivation had also dropped in the district after mid 80's.

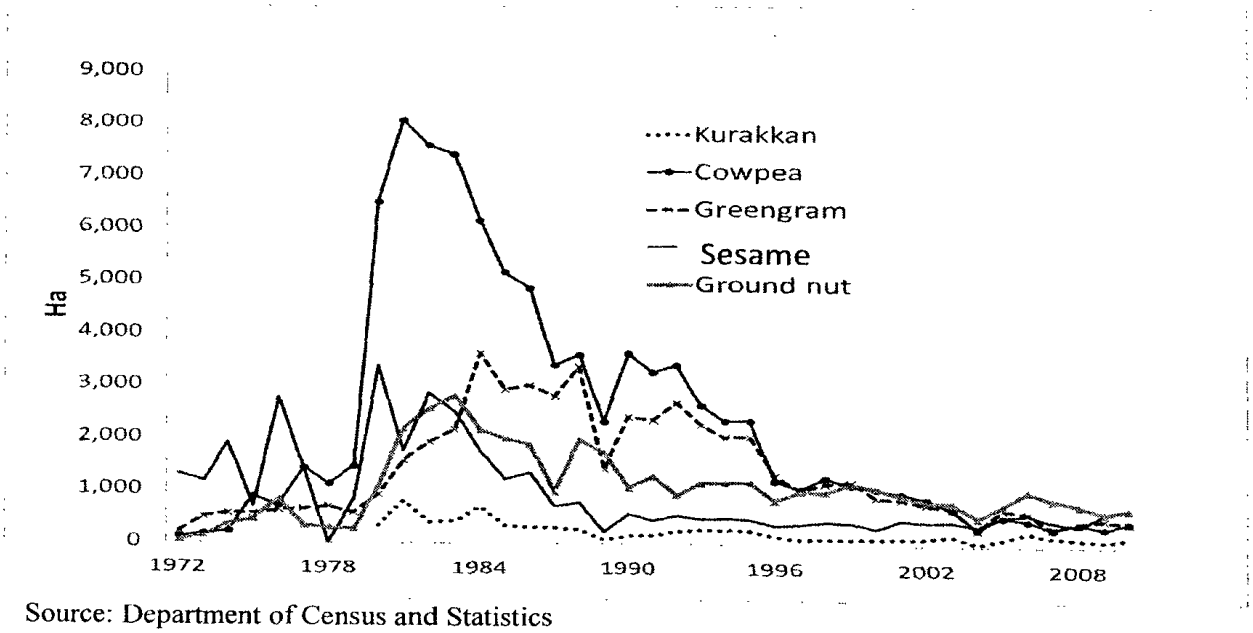
- Currently groundnut is the highest cultivated subsidiary food crop in the Puttalam mainland. In the *Anamaduwa* DS division where both cowpea and green gram were widely cultivated, now the groundnut cultivation has spread. (Table 3.6, 3.7 and Figure 3.14).

Table 3.6: OFC Extensively Cultivated in Puttalam District (ha) and Percent Contribution to the National Extent

Period	Puttalam District				
	Green gram	Cowpea	Red onion	Sesame	Ground nut
1970-1980	584 5%	1399 9%	292 3%	1491 7%	418 4%
1980-1990	2518 11%	5221 18%	624 9%	1366 8%	1927 17%
1990-2000	1696 8%	1970 1%	1383 21%	429 5%	1075 12%
2000-2010	569 6%	548 5%	1633 31%	450 5%	787 8%

Source: Department of Census and Statistics

Figure 3.14: Extent Cultivated with Subsidiary Food Crops in Puttalam District



Source: Department of Census and Statistics

Table 3.7: Cultivated Extent of Greengram, Cowpea and Groundnut by DS Division during 1992/93 and 2009/2010 *Maha* Seasons

DS Division	Green gram		Cowpea		Groundnuts	
	1992/93	2009/10	1992/93	2009/10	1992/93	2009/10
Anamaduwa	787	89.8	609	77.8	67	280
Karuwalagaswewa	225	57.3	461	57.8	31	78.4
Mahakumbukkadawala	359	17.6	304	11.7	240	41.5
Mundel	4		54	1.2	6	3.4
Pallama	38	11	95	10	153	34
Nawagattegama	325	54.4	278	50.4	9	42.3
Puttlam	54	2.1	125	2.2	27	6.9
Vanathavilluwa	17	7.0	32	17.0	-	31.7

Source: Department of Census and Statistics

- At present chilli and red onion are the extensively cultivated crops in the district.

- Red onion cultivation shows a continuously increasing trend in the Kalpitiya peninsula and the highest extent cultivated in the district was recorded in 2006. On average 1633 ha of red onion was cultivated during last ten years and it constituted 32 percent of the national extent.

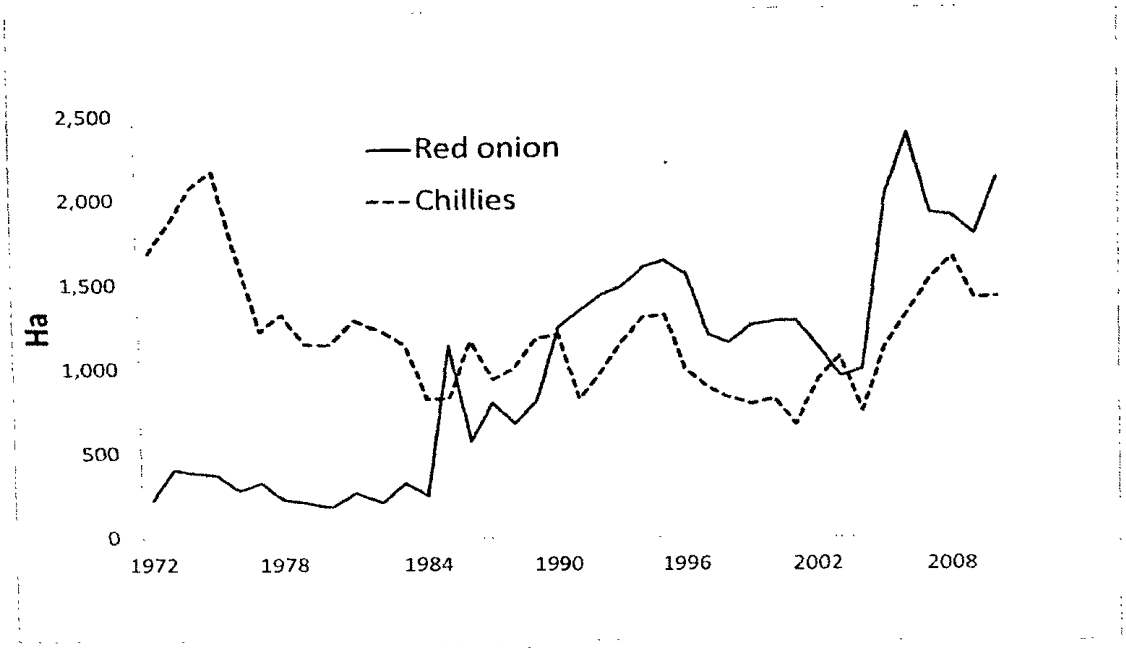
- On average 1175 ha of chilli has been cultivated in Puttalam district during last ten years and it constituted 32 percent of the national extent (Table 3.8 and Figure 3.15).

Table 3.8: Other Field Crops Extensively Cultivated in Puttalam by Extent (ha) and by Percentage of the National Extent

Period	Puttalam District	
	Chilli	Red Onion
1970-1980	1593 3%	292 3%
1980-1990	1076 3%	624 9%
1990-2000	980 4%	1383 21%
2000-2010	1175 8%	1633 31%

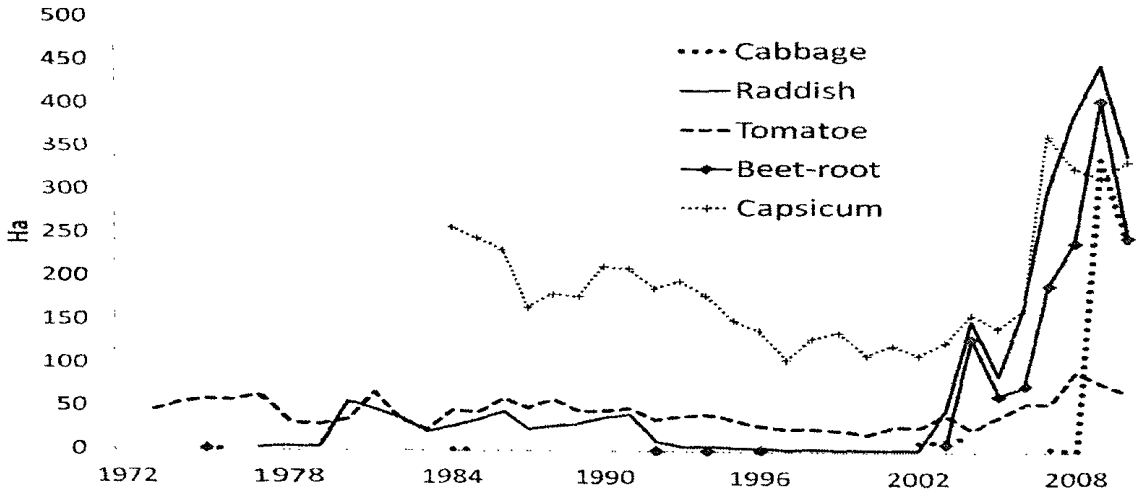
Source: Department of Census and Statistics

Figure 3.15: Extent Cultivated with Subsidiary Food Crops in Puttalam District



Source: Department of Census and Statistics

Figure 3.16: Extent Cultivated with Up Country Vegetables in Puttalam District



Source: Department of Census and Statistics

- Up country vegetable cultivation had spread in Kalpitiya peninsula in the district after 2003. Particularly, raddish, beetroot, cabbage and capsicum are the mainly cultivated crops in the area (Figure 3.16).

CHAPTER FOUR

Factors Affecting Change in Farming Systems in North Western Province

4.1 Evolution of *Chena* Cultivation

The oldest farming system that supplied main food to the ancient Sri Lanka was *chena*. This slash and burn or swidden cultivation was the likely precursor to all cultivation. *Chena* cultivation is an age-old agro forestry system in which forest and food crops are grown alternately in temporal cycle in particular seasons. However, *chena* cultivation has changed considerably over the years that today virtually all fields which are cultivated under rainfed conditions are called *chena* by farmers. *Chena* cultivation during early times was described as follows.

> "In Sri Lanka, the technique of slash and burn or swidden cultivation is known as *chena* cultivation. The technique is a simple two stage process. First an area of forest/jungle is slashed and then burned to clear it of existing vegetation. Seed is then thrown onto this nutrient rich soil and the resulting crop minimally tended – watering, weeding. The number of seasons of crops that can be raised depends on the quality of the initial soil but eventually soil quality is depleted and weeds and other invasive species compete with crops under cultivation. At this stage, the cultivator abandons the plot and moves to another area of forest and slashes and burns the new plot. The former plot is left fallow to allow it to naturally regenerate or may in addition support some fruits, nuts, fibers and medicinal plants. When the plot has recovered productivity it may then be slashed and burned and used again."

> Spittle (1950) describes a *chena* being prepared in the 1930's in Sri Lanka: 'For ten days they worked hard...felling the trees of the virginal jungle. Towards the end of June they fired the clearing and watched the great blaze hiss and crackle in the blinding sun. **Early in September the real work of the *chena* began:** the building of the bark and wattle shacks, the stocktaking around with charred logs, the clearing up of the land leaving only the skeletons of vast trees that had withstood the ravages of the fire, scattered like ghosts to renew their life with the coming rains. They had now only to sow their crops of manioc, kurrakan, maize, green gram, beans, chilli, and melons – and wait and dream of what the year would bring'.

> During the period of the great kingdoms of the Dry Zone, in addition to rice, cotton (*kapu*), sugarcane (*uk*) and sesame (*tala*) were grown on *chena* land, accompanied by the development of three cottage industries of weaving, making jaggery, and extracting edible oil. Finger millet (*Eleusine coracana*) or *kurrukan* was a main cereal substitute for rice, and other cereals were also grown – *undu* (*Phaseolus mungo*), *ma* (Vigna *cylindrica*), *mun* (*Vigna radiata*), *meneri* (*Paspalum*

scrobiculatum) *aba* (*Brassica juncea*), *duru* (*Cuminum cyminum*) and *tana* (*Seteria italica*). Vegetables were also grown including *vambatu* (brinjal/*aubergine/eggplant-Solenum melongena*), *dubai vattaka* (*squash*), *alu puhul (wax gourd - Benincasa hispida)* and other Solanum species (Siriweera, 2000).

All *chena* land that had been cultivated by rural peasants became crown land during the British colonial time. They introduced a permit system for *chena* farming and regularized the shifting cultivation in Sri Lanka. However, encroaching state-owned lands by peasants without a temporary permit or definite title to the land for illegal *chena* cultivation largely occurred from by gone days.

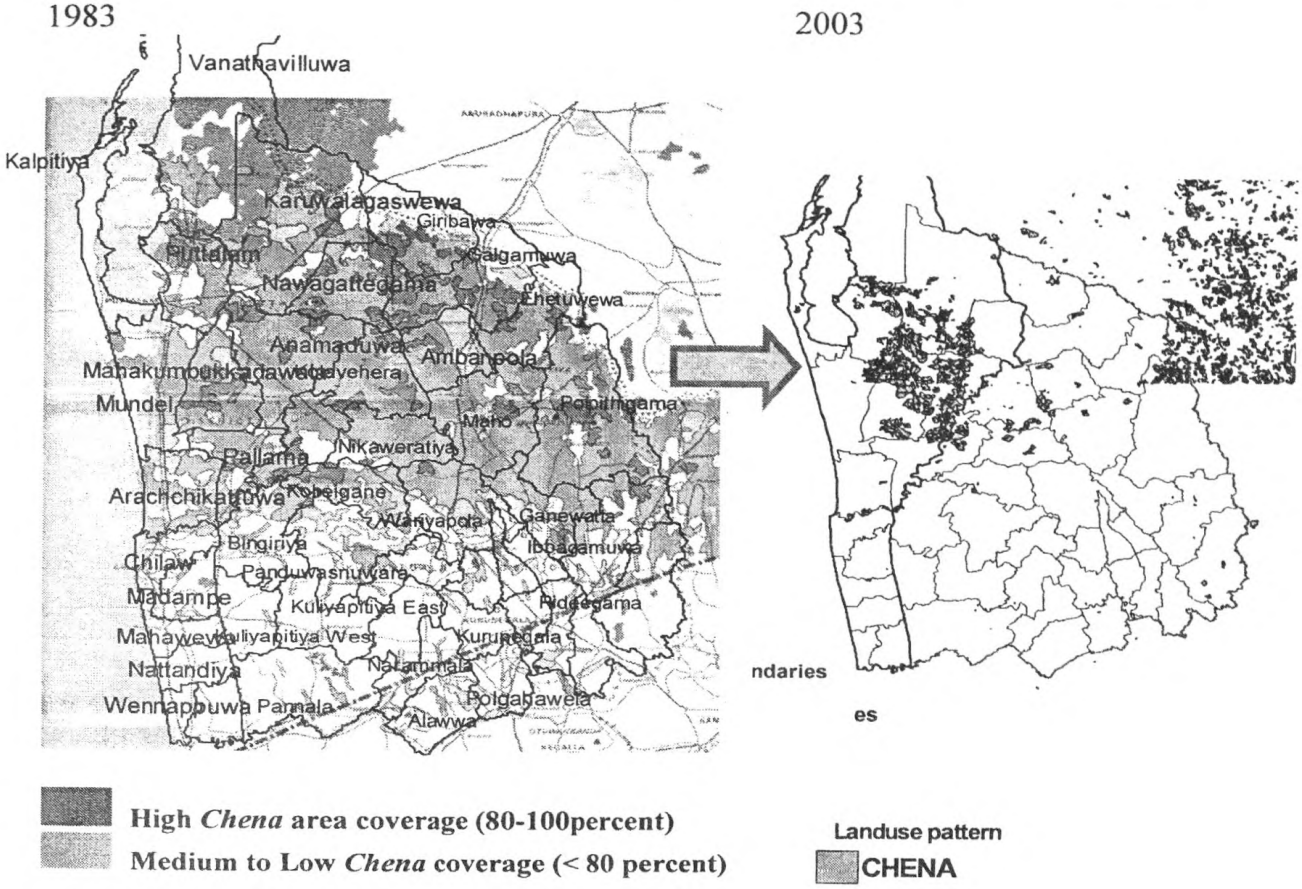
Number of land distribution programs were implemented from British times to address the issues of landless poor, alienated large areas of *chena* lands in the dry zone for distribution. These were major colonization schemes, village expansion programs, highland colonization schemes, middle class schemes which were extensively implemented in 50's, 60's and 70's and were largely responsible for the extensive alienation of highlands in the dry zone. Much of these land allotments were located on the edges of "purana" villages that commonly used for *chena* cultivation (HARTI, 2008). Distribution of land among middle income government officers (Middle class schemes) was one of the large scale land distribution programs implemented until 1969 that brought large extents of dry lands under commercial farming otherwise being cultivated by rural peasants. The purpose of this land alienation program was particularly the expansion of subsidiary food crop production with a private capital. Nevertheless, with the advent of time, these lands got transferred to their family members and became un-irrigated homesteads being mainly cultivated with perennials.

Moreover, large extents of land were opened for irrigated cropping with the implementation of irrigation plans drawn in the latter part of the 1950's and in the 1960's. Subsequently, these rain-fed dry lands came under irrigation settlements. Heavy investments on Mahaweli irrigation scheme after 1976 have brought the dry lands extensively under irrigation.

Following is an integral part of shifting cultivation and it is essential to allow time to restore the soil fertility by growth of secondary vegetation and preparation of new nutrients. This system was sustainable only as long as a reasonably long fallow period (at least 15 years) exists. *Chena* cultivation has good sustainability where there is a low density of population relative to the availability of cultivatable land. However, with population increases and shrinking forest cover in the country, the fallow period has been shortened, resulting in severe land degradation, especially in the dry zone areas of Sri Lanka. Dry zone had large tracts of forest that vanished in the past decades due to uncontrolled and disorganized shifting cultivation and incompatible land use practices.

In 1981, issuing of permits for *chena* cultivation was officially terminated. With the strict enforcement of the regulation, most farmers have withdrawn from *chena* cultivation, as most of the *chena* cultivations were encroachments. Today, only a few illegal *chena* cultivation practices are taking place, especially in remote dry zone areas.

Map 4.1: *Chena* Cultivation in Kurunegala and Puttalam Districts, 1983-2003



Source: Survey Department of Sri Lanka, 1987 & 2003

The land use maps show the area drop under *chena* from 1983 to 2003 in the North Western Province where, large tracts of *chena* cultivation have been abandoned after the 1980's (Map 4.1). Most of the farmers in the dry zone areas in the Kurunegala district are no more practicing shifting cultivation. A study done by Gelbert in 2000 evidences 37 percent of the *chena* are permanent Swidden i.e. stabilized or permanent cultivation with no fallow or no occasional period of fallow, but with slashing and burning. Instead of fallow and shifting, crop rotation is practiced and fertilizer and other inputs are given.

These traditional *chena* lands are now either irrigated settlements, or coconut or cashew plantations, permanently cultivating highlands or homesteads. Therefore the rain-fed uplands or un-irrigated highlands in the dry zone owned by rural farmers now are the former traditional *chena l*ands, where shifting or roving agriculture was practiced by the peasants that supplied finger millet, maize, chilli etc., which were grown as a mixed crop.

Changes and evolution of *chena* farming system as the principle source of food in the recent history brought changes in crops cultivated and their composition. As these unirrigable *chena* lands gradually developed in to permanent settled farmsteads, mixed cropping was replaced by mono cropping. For instance, though cowpea was not a traditional crop in Puttlam, as the unirrigable *chena* lands gradually developed in to permanent settled farmsteads, cowpea has found a suitable place in these

unirrigable high lands in Puttalam (Ragupathy, 1983). Rain-fed uplands in the dry zone and the intermediate zone cultivated during *maha* season continued to provide the bulk of OFC requirement. The main crop cultivated during *yala* season under rainfed condition was sesame. Yet, farmers consider *chena* is the best farming system for finger millet and sesame cultivation. Lately, upland areas under lift irrigation and well-drained rice land under gravity irrigation during the dry season have contributed to an increasing supply of OFCs which will be discussed later in this report.

4.2. Liberalization of the Economy and Its Effect on the Food Crop Situation

Economic factors, chiefly market prices and trade policies, are more important determinants for the expansion of the OFC sector. They are influencing the cost of production, profitability and finally the quantity of local production. Past data shows an increase in cost of production and declining trend in the profitability which led to the widening the gap between demand and local production resulting dependency on more and more imports. This section reviews the economic policies and their effects on the OFC production.

The period of closed economy from 1970 to 1977, quantitative restrictions on imports under import licensing were imposed and the OFC sector received a heavy government intervention to promote this sector to produce supplementary cash crops for the dry zone farmers who are vulnerable to prolonged droughts or shortfall of monsoon rains and at the same to meet the domestic demand. During 1970-77 relative prices were in favour of commercial food crops such as potatoes, chilli, onions, cowpea, green gram compared to paddy (Gunawardana & Somaratne 2000). During 1973-77, imports of chilli and onions were almost totally prohibited, while imports of potatoes were severely curtailed. Chilli, onion, potato were given heavy protection to increase their production. Thus a favourable price was received for these crops that enhanced their cultivation. Highest extent of chilli in the country was recorded in 1976/77.

With the liberalisation of the economy after 1977, most quantitative restrictions on imports were gradually removed. Imports were liberalized. With this shift, the OFC sector became vulnerable to international competition. Crops such as chilli, onion, and potato got directly exposed to import competition especially from neighbouring India. With this initial trade liberalisation measures during 1978-82, large quantities of onions were imported, having an adverse impact on production in the major producing areas in the North and the East of the country (Gunasinghe, 1986). Real imports of chilli increased rapidly during 1978-79 and the real value of imports of potatoes also surged during 1978- 79. Their cultivation dropped gradually.

Although during 1978-93, imports of competing food commodities (except rice) have increased initially for 2-3 years after economic reforms, and thereafter tended to decline as protection was given to domestic producers to alleviate adverse political and social repercussions of trade liberalisation. Pulses were considered as importable that could be produced domestically. In 1984, policy goals were specified as that of achieving self sufficiency in pulses. The price ratios indicate that relative prices were in favour of commercial food crops such as potatoes, cowpea, green gram, red onions and chilli compared to paddy during 1970-77 as well as during 1978-97 (Gunawardana & Somaratne 2000). However, during much of the period 1978-93, the

price ratio shows a general downward trend (except during 1984-86) and during 1978-93, real prices of commercial food crops did not increase faster than the real prices of subsistence food crops such as finger millet.

The nominal tariff on imports was reduced to 45 percent in 1993 and the three band tariff structure was introduced. In 1994 liberalised economic policies were continued; tariff reduction on the imports of subsidiary food and agricultural inputs (especially for tractors), reduction of turnover tax on agricultural inputs. Thereafter, imported pulses started to penetrate the domestic market. After 1996 quantitative restrictions on imports were limited to a narrow list. The import of maize, dry chilli, onion and potatoes remained under license for domestic producer protection. The import licensing on potatoes, onions and chilli was removed in July 1996. The licensing requirement on maize was removed in 2000.

On the other hand, the removal of controls on the importation of agricultural inputs and machinery, favored the importation of seed and planting material and the agricultural machineries. Significant yield increases were evident after 1977 in vegetable production sector due to importation of high yielding varieties. Commercial cultivation with lift irrigation began in areas where cultivation can be practiced throughout the year. OFC cultivation boom in Kalpitiya is one such example.

Government employs a tariff system for food imports, comprising customs duty, duty waivers, surcharge etc. In 1997 the prevailing tariff was reduced to a three-band tariff system with 10, 20, and 30 per cent rates for imports. In 2000, the tariff structure was further consolidated to a two-band structure of ten and 25 percent, keeping a few agricultural products under the 35 percent rate. Import duty on selected agricultural products such as rice, big onion, green gram and cowpea remained at the level of 35 per cent as a temporary measure to allow the domestic agricultural sector to adjust to a lower tariff regime over the medium term. However, during 1994-97, imports of rice, potatoes, onions and chillis generally increased following the relaxation of import restrictions on these food items and the permission granted for the private sector to import such items.

Until late 80's, the Department of Agriculture was the sole supplier of seeds to the farmer. Imports were allowed by the private sector in 1989 and seed and planting materials were allowed to be imported free of duty in 1995. Seed and planting material sector was commercialized and the private sector was involved in production and supply of seeds from 1990. In 1998 government initiated the privatization of government seed farms. Availability of high yielding short duration imported varieties has shifted farmer's choice to such varieties.

4.3. Diversification of Irrigated Rice Fields for OFC Production

Although heavy investments on *Mahaweli* irrigation schemes after 1976 have brought the dry lands extensively under irrigation and rice mono crop, the government introduced crop diversification to the major irrigation schemes realizing the importance of cultivating non-rice crops to obtain the best returns from the resources such as land and water. Also with the reverse trend observed on irrigation investments by international donor after late 80's, with the supply of rice increased and price

declined worldwide, crop diversification has since been assigned a prominent place among avenues available for improving the productivity of land and water.

The new irrigation systems were designed with facilities for irrigation management for crop diversification. Land terrain was developed to cultivate non-rice crops in well drained land classes and rice on poorly drained land classes.

Table 4.1: Extent Cultivated Under Different Crops and Percent Contribution to the Total Extent Cultivated During 1982-1992

	Maha				*Yala*			
	Rain fed RL	Irrigated RL	Rain fed UL	Irrigated UL	Rain fed RL	Irrigated RL	Rain fed UL	Irrigated UL
Anuradhapura								
Chilli	-	-	75	-	-	18	-	7
Greengram	-	-	85	-	-	7	2	6
Cowpea	-	-	95	-	-	1	2	2
Kurunegala								
Chilli	1	4	30	5	9	10	23	18
Greengram	-	-	63	-	3	1	29	4
Cowpea	-	-	65	-	-	2	29	2
Kalawewa								
Chilli	-	3	1	-	-	96	-	-
Grengram	-	5	32	-	-	63	-	-
Cowpea	-	8	37	-	-	55	-	-

RL- Rice Lands, UL- uplands
Source: Wijeratne & *et al*, 1996

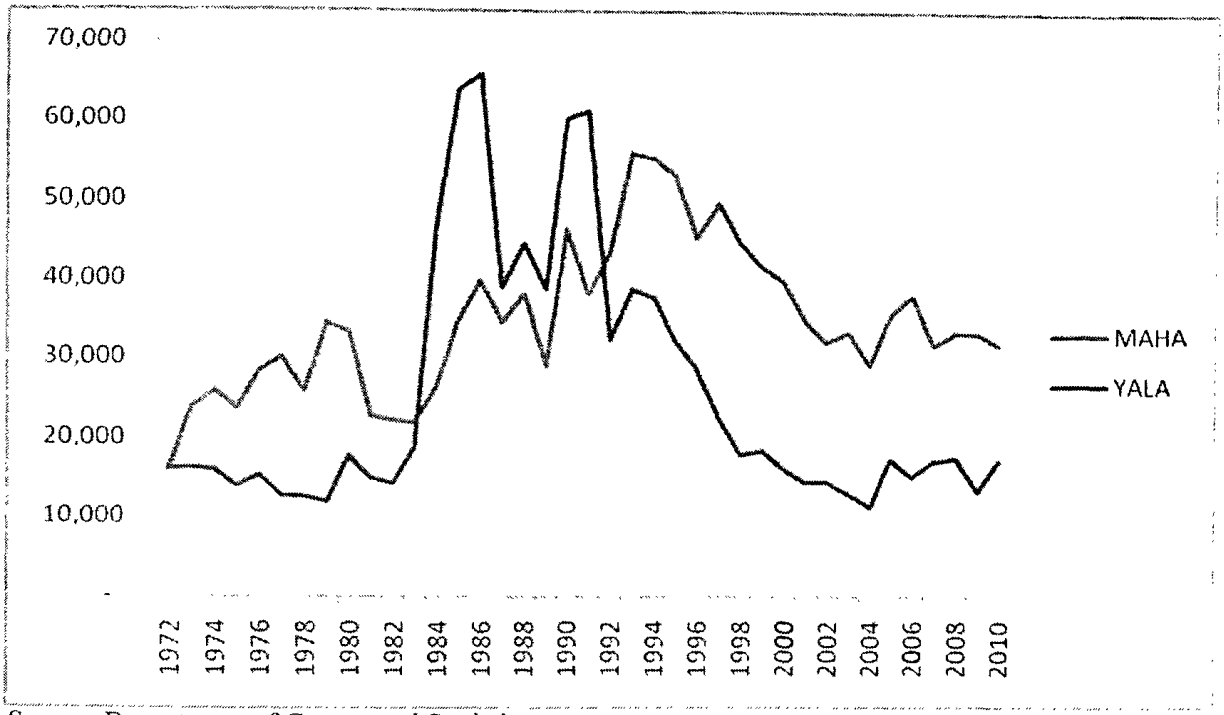
Diversified cropping in rice lands has primarily been centered on OFCs such as chilli, onion (red onion and big onion), green gram, cowpea, black gram, soya bean, groundnut and vegetables. To a lesser extent, banana, sweet potato, sesame and gherkin have gained importance in specific areas (Table 4.1).

Chilli, onion, groundnut, vegetables and grain legumes are the dominant crops cultivated in well drained land classes during dry season (*yala* season). Green gram *(Vigna radiata)* was the crop that could be commonly observed in this farming system in which rice being cultivated in wet and dry seasons and a short duration grain legume in-between the two seasons.

During the decade 1982-92, a clear shift from rain-fed to irrigated chilli in rice fields was evident with irrigated chilli reaching peak production in 1986. This, in turn, had

resulted in **increased crop yields** and in higher total production (Wijeratne & *et al*, 1996). The highest chilli production was recorded in 1986 and 1990 which was amounted to 106 thousand mt (Figure 4.1).

Figure 4.1: Chilli Production in Mt from 1972- 2010



Source: Department of Census and Statistics

Although crop diversification had been widely adopted by Mahaweli H farmers during *yala* season, OFC cultivation in Kurunegala district has been primarily in the rainfed uplands both in *maha* and *yala* seasons.

4.4. Diffusion of Agro-wells and Pumps and the Change in Cropping Pattern

Supplementary irrigation introduced with diffusion of agro wells and pumps offset the OFC cultivation drop occurred with the abandoning of *chena* cultivation to a larger extent in the dry zone. Diffusion of agro wells and pumps was also benefited by the liberalization of trade during late 70's.

In the context of the dry zone in Sri Lanka, agro-wells can be classified into at least three types: lined dug-wells, unlined dugwells and tubewells. For all three types of wells, water is usually lifted up by a 2-inch pump, operated by diesel or kerosene engine of 2.5 to 5 HP—the most popular size being around 3.5 HP-with which a 2-inch pipe is used for distributing water to the field. Unlike the tubewell for domestic purposes which is usually operated by a manual pump, the tubewell for agriculture always has an engine or a motor driven pump. Besides lifting groundwater, farmers use pumps for lifting water from rivers, canals or tanks (dead storage in particular) to irrigate their crops. More than 70 percent of lined dug-wells are found in minor irrigation schemes. Unlined dug-wells are found only in major irrigation schemes, while tubewells are found mostly in minor schemes. In the case of irrigation pumps, more than 60 percent are owned by farmers in minor schemes. About ten percent of

farmers in irrigation schemes, both major and minor, own agro-wells, while about fifteen percent own irrigation pumps (Kikuchi *et al.* 2003).

The lined dug-well was first reported in 1975 in a survey of major schemes in Kurunegala, and in 1980 in a survey of minor schemes, also in Kurunegala. However, the diffusion of the lined dug-well became significant only in the late 1980s. Since 1989, the government has been making efforts to promote lined dug-wells in both major and minor irrigation schemes in the dry zone through extending a subsidy to farmers. Both in major and minor schemes, the distribution of agro-wells between the command and the highland is about 30:70 - more agro-wells are set up in the highland than in the command. In major and minor schemes alike, farmers use pump water mostly for irrigating OFCs (Kikuchi *et al.* 2003).

It should be mentioned that the type of well that has been promoted by the government and non-profit making organizations through subsidies is the lined dug-well. In contrast, the unlined dug-well and the tube wells have been diffused entirely under farmers' own initiative.

The tube well first appeared in 1980 in a minor scheme of the Deduru Oya basin, and later in 1990s in other minor schemes of the basin. The unlined dugwell has an even shorter history of diffusion, starting in the late 1980s. The use of irrigation pumps has a much longer history than agro-wells. Its adoption by individual farmers in the sample schemes dates back to the mid-1960s, but pumps owned by some agricultural cooperatives were used for irrigation even earlier, in the 1950s. Farmers say that a series of intense drought periods around 1970 triggered the adoption of irrigation pumps. The diffusion of the pump increased toward the mid- 1980s, and has been further accelerated since then just as agro-wells have diffused. It was especially after 1989 when the government commenced the well subsidy program that the investments in agro-wells and pumps raised sharply. The investments in agro-wells and pumps showed rapid increases again in the mid-1990s. However, the rate of increase seems to have been declining since then. Such trends have been brought about mainly by the deceleration of the increase in lined dug-wells and pumps.

In major and minor irrigation schemes alike, the cropping pattern in the command area before the adoption of agro-wells and pumps had been simple; either paddy in *maha* and *yala* seasons (major and minor cultivation seasons, respectively) in case surface water is available in both seasons, or paddy in *maha* and fallow in *yala* in case surface water is available only in *maha* season. There were irrigation schemes where OFCs were planted in *yala* season, but the extent planted with OFCs was negligible in spite of government efforts to promote crop diversification. The introduction of agro-wells and pumps has changed this cropping pattern in the command area to one with higher cropping intensity through planting OFCs in the command area hitherto left fallow in the *yala* season. Popular OFCs planted in the command area with water from agro-wells are chilli, red and big onion, various pulses, banana and many kinds of vegetables such as eggplant, cucumber, okra, bitter gourd, brinjals, etc. Paddy is rarely selected as a *yala* season crop to be irrigated by well water. Crops grown on the highland part of irrigation schemes differ between major and minor schemes, as the size of highland is different. On the small highland area in major schemes, even from the times before the introduction of agro-wells, farmers have been planting OFCs in *maha* season, similar to those OFCs they plant in the command in *yala* season with

well water. The much larger tract of highland in minor schemes has typically been planted in *maha* season with such crops as finger millet, maize and tobacco, in addition to the OFCs planted in major schemes. It was common in major and minor schemes that almost no cultivation was done on the highland during *yala* season before the adoption of the agro-well and pump-without irrigation, it is difficult to grow crops in *yala* season under the climatic conditions of the dry zone. The only exception was sesame, planted in *yala* season, only on a small part of the highland, particularly in minor schemes (Kikuchi *et al.* 2003).

With agro-wells and pumps, the cropping pattern in the highland in *yala* season has changed significantly in both major and minor schemes. Fallow or extensive cultivation with sesame has been replaced by intensive OFC cultivation in the area irrigated by well water (Kikuchi *et al.* 2003).

4.5 Low Rate of Technological Innovations and Sustainability of Farming Systems

Although research on technology innovations in the 80's and 90's focused on productivity, labour saving technologies and sustainable farming systems, most of the varieties that released during 60's and 70's are widely adopted by farmers until now (Table 4.2).

According to a study done in the Anuradhapura district on cowpea and greengram by Hewavitharana *et al* (2010), it has been observed that greengram and cowpea extents in Sri Lanka have been declining over the years despite several high yielding varieties of both crops have been released in the recent past. 'Bombay' and 'Arlington', two indeterminate cowpea varieties that have been released before 1976 are the most popular varieties. They outperformed (in terms of yield) more than recently released varieties 'Dhawala' and 'Waruni', which are less popular among farmers who cultivate these crops under rain-fed conditions. Greengram varieties MI 06, MI 05 and Ari outperformed the variety 'Harsha' and other local varieties. The variety MI 06 was the most popular greengram variety among farmers in the Anuradhapura district.

According to the same study (Hewavitharana *et al*, 2010), the semi-subsistence orientation of the crops that give low profits, having limited family labour and poor performance of recently released varieties of cowpea and below-potential yield performance of green gram variety such as MI 06 are the major constraints for expansion of these crops. Research should be geared towards releasing a high yielding greengram variety with indeterminate growth pattern.

Labour is a critical factor determining crop selection and the land area under the crop. For the crops like cowpea and greengram that are semi-subsistence income avenue crops giving a marginal additional farm income, the limited family labour is critical determining cultivated land area of crops.

Due to shortage of labour, farmers would go for labour saving crops such as cowpea for which slack family labour can be used for harvesting. Ground nut is a one pick crop requires labour at once whereas cowpea, greengram are harvested several times (3-4 picks to 7-8 picks per season) that requires labour in intervals. But if commercial

cultivation is practiced using machineries, crop with different maturities that requires harvesting labour in intervals would limit its scales of expansion. Therefore depending on the nature of the farming, varieties must be developed.

Table 4.2: List of Varieties Released by the Department of Agriculture

Crop	Name of Variety	Year Released	Adoption
Cowpea	Local Bombay MI 35 Arlington Waruni Dhawala	 1931 1969 1976 1989 1997	Bombay, Arlington, MI 35 are the mostly adopted varieties
Greengram	Local MI –1 MI-2 Type 51 MI-3 MI- 4 MI-5 harsha MI-6	 Before 1964 Before 1964 1969 1971 1974 1982	MI 6 is most popular followed by MI5 and harsha.
Groundnut	Red Spanish Tissa Walawe V 87	1961 1993 1993	
Chilli	MI 1 MI 2 Arunalu MI hot MI Green Green chilli KA 2 Galkiriyagama Weraniya MI CH 03	1962 1973 1996 2002 2008 1991 2011 2012 2012	

Source: Department of Agriculture

Very few varieties were available except for 1998 Walawe (ground nut) and pacific Maize after 1980's. Improved access to the technology and inputs by the farmer and the liberalised output market had a positive effect on the growth of the vegetables sector that new farming systems have been evolved that will be described in next chapter. Chilli cultivation was severely affected due to endemic viral infections.

4.6 Institutional Factors on OFC Promotion

Promotional programs and contractual agreements for cultivation of crops in particular regions have changed the landscape in the dry zone to some extent. Due to the promotion of cashew cultivation and coconut cultivation in the dry zone, the un-irrigable *chena* lands gradually developed in to permanently settled farmsteads

In 1996, a promotion program was implemented in the dry zone under "Saruketha" project implemented by CARE International in collaboration with the ministry of agriculture. Some of the promotional programs and contractual agreements that were implemented and are under implementation are listed below:

- Thriposha program- maize cultivation
- Animal feed industry, Prima – maize cultivation
- Village seed programs by the DOA
- Community based seed production programs -OFC
- Contractual agreements – Government
  Private CIC, hayles - OFC
  IFAD – Big Onion
  NGO

Under these programs, extension services on technology, management issues and input supply and marketing were part and parcel. These programs have been largely influential and given incentives to farmers to continue cultivation of such crops. Most of the farmers interviewed had been benefited by one of the above programs.

4.7 Other Factors

With siltation of beds of many small tanks in the dry zone, tank water retention capacity has reduced. It is one of the factors that led to reduce OFC cultivation in dry season due to lack of water for upland cultivation.

Jaffna is the main market for black gram and sesame. With the disruption of transportation of food commodities to Jaffna market, the supply of black gram and sesame to the region was curtailed. This affected the black gram and sesame production in the South.

Urbanization and changing food habits have also influenced the cultivation pattern of farmers. During the recent past demand has increased for up country vegetables.

Demand increased for Beet root and up country vegetables made it to develop farming systems in Irudeniyawa, Kalpitiya region.

According to the farmers interviewed, the new fertiliser subsidy on paddy after 2005/06 has also been effective in increasing the area under OFC as paddy farmers had received fertiliser subsidy for their OFC cultivation during *yala* season.

CHAPTER FIVE

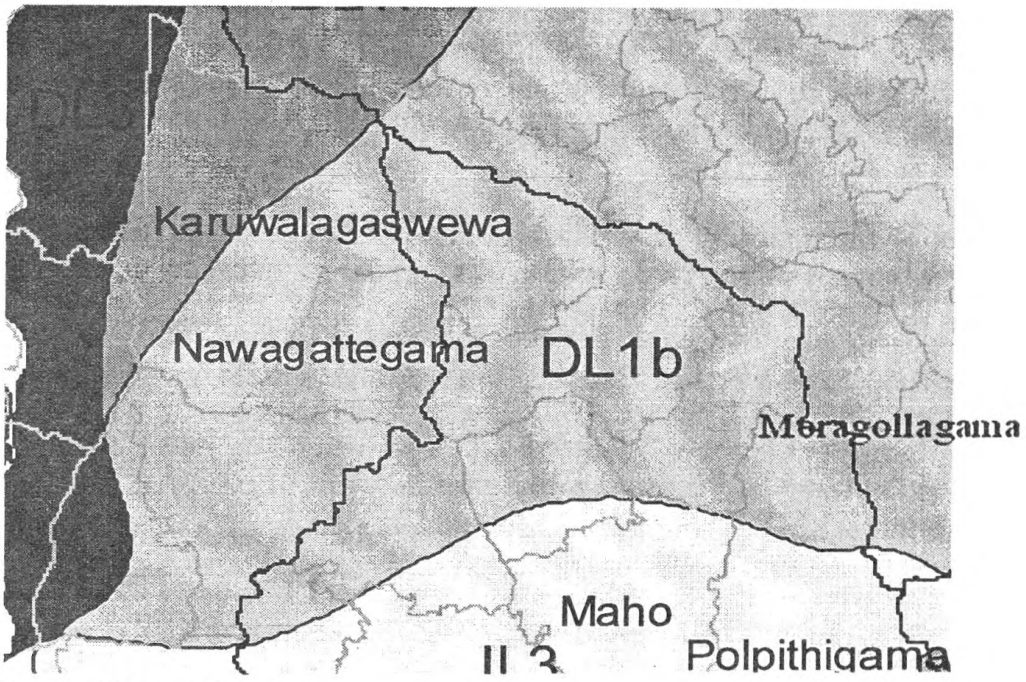
OFC Farming Systems in North Western Province

This chapter describes the existing farming systems in the NWP, its cropping pattern and varieties adopted and the marketing environment under which farmers taking cultivation decisions that influence the OFC cultivation in the NWP.

5.1 Case Study 1: Dry Land Farming System/ *Goda Hena*

This system is spread in both the dry zone of Kurunegala and Puttalam.

Map 5.1: Sample Area under Dry Land Farming



Source: Survey Department

Goda hena is the permanently cultivated *chena* lands owned by people either on a title or by having some legal permission. It is cultivated during both y*ala* and *maha* seasons. During *maha* season, cultivation begins with north east monsoons. The *yala* season mainly depends on the availability of supplementary water. In its older practice, when cultivating *chena*, at least twenty five farmers get together to prepare the land for cultivation. First of all, they burn and clean the land. Then they build "*Pela" or watch hut* which is a central cottage located in the field. After that, farmers cultivate certain crops as a mark of the boundary of the shared land, usually, one farmer receives one acre for cultivation.

The farmers mix different varieties of seeds and broadcast on the land. They select seed mixture according to the duration of the crops, finger millet, maize, white sesame, black gram, mustard, cucumber, pumpkin, brinjal are cultivated in *maha* season. In the past *chena* farmers cultivated traditional paddy varieties such as Murungakayan and H_4 (Ma-wee) in their *chena* lands. During y*ala* season, farmers, broadcast the seeds of black sesame, finger millet (2½ months short term variety),

maize, cowpea and green gram. After cultivating 3-5 consecutive cropping seasons, they move into adjutant land and start to prepare new *chena* for next cultivation season.

Due to strict implementation of restriction on *chena* cultivation and land reservation process, *chena* cultivation has been severely affected. As a result, nearly 500 acres of lands which were earlier used for *chena* cultivation have now been abandoned.

The consequences of the drop of *chena* cultivation are:

* A significant reduction of cultivating chilli, finger millet, cowpea and green gram
* Total extinction of traditional paddy varieties (e.g Murungakayan and H_4 (Ma-wee) and traditional chilli varieties (e.g. Wanni miris) from *chena*.

Farming System in Moragollagama

Moragollagama, Rambe, and Madahapola are major agrarian centers in Polpithigama DS division. Moragollagama is located in both IL3 and DL1 Agro-ecological regions. So, the environmental condition is somewhat closer to arid condition. Sufficient rain fall is received through North-East monsoon. Farmers cultivate crops both in *yala* and *maha* seasons (Map 5.1).

When colonization in the region is considered, inherited lands are divided among middle income group. Hence, many outsiders have colonized in the region. They have permits for their lands. Each farmer has five acres or more.

The crops cultivated in *yala* and *maha* seasons in the past and present are illustrated in the Table 5.1.

Table 5.1: Cropping Pattern in the Moragollagama Sample Area

	Upland		Lowland	
	Maha	***Yala***	***Maha***	***Yala***
Past	Finger millet, chilli, blackgram, pumpkin	Sesame, finger millet, green gram, cowpea	paddy	paddy
Present	Maize, black gram, sesame , groundnut	Maize, groundnut, vegetables	paddy	paddy, ground nut, maize, water melon

In ancient times, farmers cultivated traditional varieties of pumpkin, chilli, ridge gourd and tomatoes. Currently those traditional verities have been extinct as continuous giving up of cultivation of those varieties and shifting farmers to cultivate seeds that are imported with high yields. Eg:- Moragollagama pumpkin, chilli (wanni miris).

Changes of the cropping system mainly depend on rainfall. Crops which are cultivated are decided according to the amount of rainfall they receive. There is a tendency to grow OFCs during *yala* with minimum rainfall. However if they receive sufficient amount of rainfall, they prefer to grow paddy. There are a few rain fed tanks in this region. The water from these tanks are pumped by most of the farmers for irrigation purposes. There are also few number of agro wells which they use to

irrigate OFCs on a small scale. According to the above mentioned details this farming system is in between a well developed system and *chena* cultivation system.

Recently few deviations could be seen in traditional cultivation. The farmers tend to grow commercial crops as well. Climatic changes spread of disease conditions, decrease of cultivable land area are the main reasons for such changes in cropping pattern. Due to lack of rainfall they have to face uncertainties and ultimately they end up with economic losses. Under such risky conditions there is a tendency to grow perennial crops by farmers as a remedial measure eg. Cultivation of coconut, and cashew nuts (Projects launched by Cashew Corporation).

On the other hand land fragmentation has occurred among farming family. Because of that lands for cultivation have been limited.

Few years ago farmers have started to grow commercial crops such as watermelon, maize and vegetables instead of green gram, cowpea and black gram.

5.2 Case Study 2: Farming System in Nagollagama (Maho DS Division)

Nagollagama is located in IL3 agro-ecological zone and a minor irrigation system is found in this region. The farmers in this area had obtained their water requirement through few tanks and agro wells. They have "Jaya Bumi" and "Swarna Bumi" deeds for their lands.

Gradually the cropping pattern had changed from traditional system to commercial system during the last few years. In the past they cultivated sesame, chilli, green gram, and finger millet in up lands during *yala* season while they cultivated finger millet, green gram and cowpea in *maha* season. Otherwise they cultivated paddy in low lands both in *yala* and *maha* seasons. When the present situation is considered, there are changes in the cropping systems. Most of the farmers cultivated ground nuts, water melon and vegetables in up lands during *yala* season and ground nut, maize in *maha* season. Most of the farmers prefer to cultivate paddy if they have sufficient water. Otherwise their preference is to go grow OFCs. In *maha* season almost all the farmers grow paddy in low lands.

Instead of OFCs, farmers currently cultivate perennial fruit crops such as guava, pomegranate, papaya, passion fruit and banana. Other than that they cultivate water melon too. There is a developed marketing channel in this region with the participation of outside companies.

5.3 Case Study 3: Farming System in Neelabemma Project

Neelabemma project was commenced in 1980's. This project area belongs to agro-ecological zone of DL-1. To implement this project, inheritant lands were taken off from Ihalapulliyankulama villagers and redistributed among villagers and outsiders.

During the land fragmentation process, first priority was given to outsiders in 1992. Therefore, Ihalapulliyankulama villagers received limited extent of land for cultivation purposes. It was resulted significant reduction of *chena* cultivation in this area by this land fragmentation process.

Lack of water availability was the major limiting factor for cultivation. Neelabemma project was begun to provide continuous water supply for cultivation. Neelabemma farmers cultivate paddy as their major crop in both *yala* and *maha* season. Further, they cultivate upcountry vegetables (eg. beetroot), low country vegetables (eg. pumpkin, cucumber, ladies fingers, brinjals, ela batu, Ma, bitter-gouard), fruits (eg. melon, banana, guava, Bibile orange, papaw and OFC (eg. maize, chilli).

However, some farmers do not like to grow chilli because of intensified leaf curl complex disease that affects chilli cultivation. But they cultivate sesame, finger millet and mung bean due to lack of *chena* lands. Cultivation of cowpea and b'onion also have abandoned because of less profitability and nature of the cultivations.

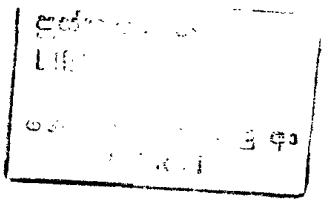
Therefore, now they have been encouraged to grow cash crops (vegetables and fruits) because of short term and high income potential crops that gives an income security for a long period due to lengthy harvesting period crops. Cash crops have a good market linkage with Manning market, Colombo. They can earn a relatively high profit margin due to low number of intermediaries. Colombo demand directly affects the supply of crop production by Neelabemma farmers. When there is a high demand for crops, these farmers can produce more and more crops to fulfill the market demand. According to farmers' experience and opinion, cash crop can cover the cost of production even under conditions of fluctuated market prices. This can be considered a strength for farming in Neelabemma area. Nevertheless they have pest and disease problems such as fruit fly damage, mealy bug attack and leaf curl disease.

5.4 Case Study 4: Farming System in the Kalpitiya Peninsula

Kalpitya peninsula is spread over 92 km^2 of land extent. This region belongs to Agro-ecological zone of DL_3. Temperature of the region ranges from 28°C - 35°C and rain fall is 25`-30`. Prominent soil type is Regasol which is made of sand (96.61percent), organic matter (0.45percent) and potash (2.5percent) p^H value of the soil is 6.5.

Kalpitiya agrarian service region consists of eleven grama niladhari divisions. Muslim refugees are the major ethnic group which represents 55percent of the population in Kalpitiya region. Sinhalese and Tamils are the next prominent ethnic groups and they are 28 percent and thirteen percent of the population respectively. Agriculture and fishery industries have become major livelihoods of Kalpitiya people. There are 22,048 farmers who come from 7500 farm families (Personal communication with Divisional Officer, Kalpitiya).

Total cultivated land extent is 5000 ha. Land ownership is either inherent or rented. Sandy land is prepared for cultivation after adding cow dung. In general, one tractor load of cow dung is added to one acre. In the Kalpitiya region, ground water is the major water source of crop cultivation. Technologically improved sprinklers and engine powered water pumps are employed to supply water. Although, water supply is available year round, it is difficult to cultivate and gain a higher yield during March-April-May due to high night temperature, increased soil temperature and reduced wind speed. Red onions, chilli and certain up country vegetables are the most dominant crops in this region (Table 5.2, Figure 5.1).



5.4.1 Change of Farming Systems

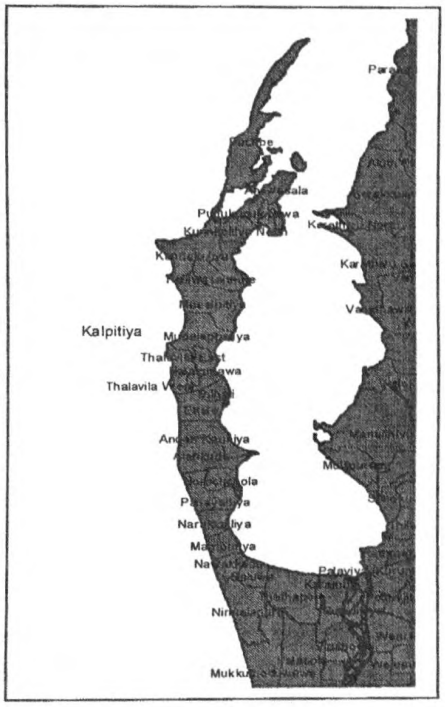
Farming system began with the cultivation of onion as a leafy vegetable along with tobacco and chilli. Time to time, changes have occurred with crop diversification shifting to other crops or shifting to new varieties and due to changes of cultivated land extent. The table 5.2 shows how cropping pattern in the peninsular has changed over time from 90's to date. Particularly onion - chilli - tobacco cropping system has evolved to a commercial cultivation of up country vegetable with more land under cultivation. Perennial crops cultivated are papaw, guava, pomegranate and grapes.

Table 5.2: The Change in Extent (Ha) Cultivated during *Maha* Season in Kalpitiya Peninsula

Crop	Cultivated Extent	
	1992/93	2009/10
Chilli	35	559
Red Onion	919	1053
Beedi/Cigar Tobacco	87	136
Low country vegetable	86	871
Up country Vegetables		522
Cabbage		200
Beetroot		151
Raddish		171
Manioc		104
Sweet Potatoes	3	31

Source: Department of Census and Statistics

Map 5.2: The Change in Extent (Ha) Cultivated during *Maha* Season in Kalpitiya Peninsula

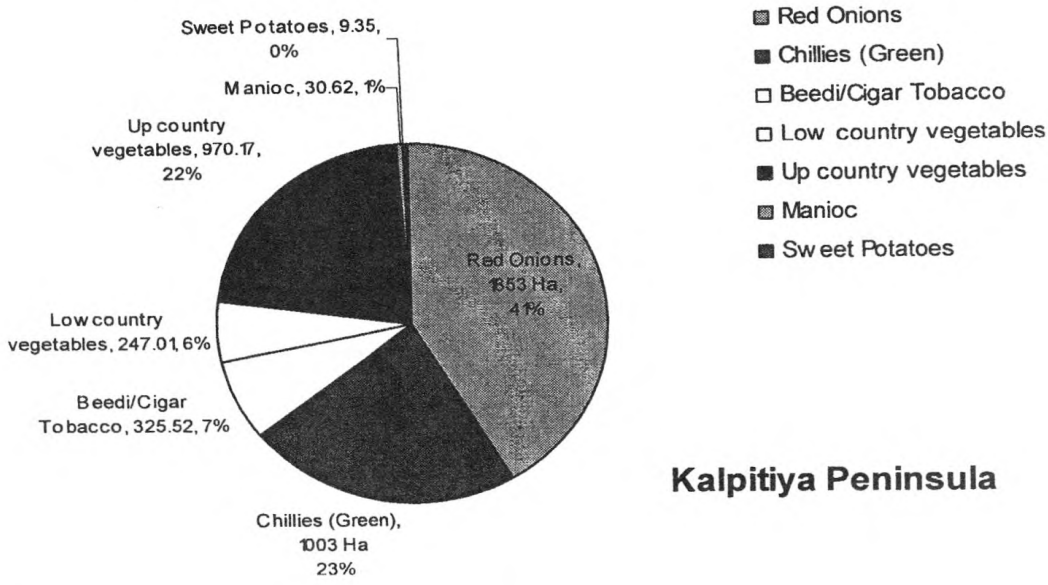


There are recent shifts in cultivation as recorded below.

1. **Shifting from One Crop to Another**

- Some farmers shift from cultivating OFC (e.g onion, chilli) to perennial crops (e.g papaw, guava and grapes) due to several reasons i.e year round high income, high net profit, low cost of cultivation, less labour requirement.
- Majority of carrot farmers experience fork formation and the crop has a low demand in the market place.
- Certain farmers have stopped cultivating potatoes because of rubber structure formation.
- Some farmers gave up the tobacco cultivation due to its high initial capital investment, long crop duration, need of more time and high cost for processing.
- One of the reasons to give up the Ela-batu (hybrid) by some farmers was allergic reaction during harvesting due to powdery nature of the fruit.

Figure 5.1: Cultivated Land Extent (ha) of Prominent Crops in Kalpitiya Peninsula, 2010



Source: Department of Census and Statistics

2. Giving up Cultivation of Certain Crops

- Some farmers have given up cultivation of onion because of the huge loss that they had to bear over six consecutive seasons due to heavy rains, as a result of weather changes.
- Some farmers have stopped the cultivation of onions because of high expenditure they had to bear for seeds and difficulty in obtaining onion seeds.
- Certain farmers have given up the cultivation of chilli because of the huge yield losses due to leaf curl complex.
- Some farmers have given up the cultivation of guava because of yield loss due to fruit fly attack.
- Due to heavy pest attacks, certain farmers have stopped the cultivation of pomegranate.
- Due to following reasons certain farmers have given up the cultivation of tobacco.
    - Crop losses due to an unknown disease.
    - Long duration for processing and high initial capital investment.
    - Market uncertainty because of poor leaf quality.
    - Low return because of the presence of intermediaries in market channel.
    - The decrease of soil fertility as a result of which farmers have to bear huge cost to fertilize the soil again and again.

3. Changes in the Extent of Crop Cultivation

- Some farmers have shifted to perennial crops such as guava, papaw from OFCs because they can earn a continuous income for several years.
- Due to land fragmentation cultivated land extent was decreased.

5.4.2 Decision Making Process of the Farmers in the Region

1. Based on experience

- Based on own cultivation experience, majority of farmers do their decision making in the choice of crops for cultivation. They determine the crop to be cultivated in the next season based on crops which they cultivated in the previous season. In addition to that, the decision depends on what other farmers cultivated in the previous season and what are the crops going to be cultivated by neighboring farmers.

- This type decision making process helps minimize the competition among neighboring farmers during the same cropping season because of not cultivating the same crop in the region. Cultivation of different crops minimizes the spreading of pests and diseases. Crop rotation also helps to improve the soil fertility. Finally, all the reasons lead to have a good yield with a higher bargaining power.

2. Based on Market Information

- Depending on current market demand and market prices, farmers decide the crop to be cultivated in the next season. For instance harvesting stage of onion is determined based on the market demand and prices for bulbs and onion leaves as a vegetable.

5.4.3 Constraints and Challenges

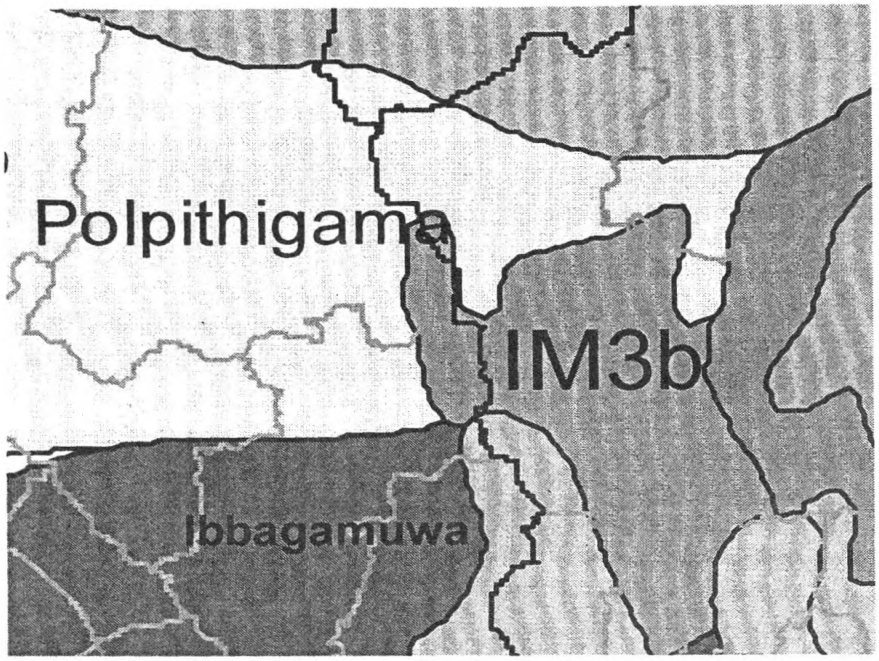
1. Higher initial capital investment for sprinklers and water pumps.
2. Higher cost of cultivation for agro-chemicals, fertilizer, cow dung and seeds.
3. Pests and diseases eg:- leaf curl complex in chilli, leaf curl in red onion which is known as disco by local people, fruit fly attack in guava and pomegranate.
4. Due to increased crop cultivation in Jaffna vegetable supply has been rapidly increased. This has been a main challenge for Kalpitiya farmers. However, the severity of this challenge is low as Kalpitiya farmers cultivate crops year round whereas Jaffna farmers do seasonal cultivation.
5. Most of the hired labours in Kalpitiya area are refugees who came from Mannar. However, now they have started to migrate back to Mannar region. This could result in labour shortage in future.
6. At present, Sri Lankan government imports red onion to fulfill the local demand. This could discourage local red onion farmers in Kalpitiya area because of high competition.

5.5 Case Study 5: Farming System in Irudeniyaya

Irudeniyaya is located in the IM 3/IL3 agro-ecological zone. All most all the lands are reservations of Kahagalla reservation. Cultivation in these areas began during 70's and expanded gradually. As the soil fertility was very high at the beginning farmers obtained higher yield per land area.

Farmers tend to grow during intermediate season other than *yala* and *maha* season. Some farmers cultivate paddy in uplands in *maha* season. Rest of them cultivate vegetables mainly beet root. Other vegetables are raddish, knoh-khol and cabbage. They prefer to grow vegetables as they get a short term income.

Map 5.3: Sample Area under Irudeniyaya Farming System



Source: Department of Survey

Most of the farmers are not permanent residents. They have come from outside areas and temporarily settled in the area for cultivation. Most of the farmers own two acres or more. Though many farmers have established in the area before ten years, they have no any legal rights to their lands as these lands belong to the department of wild life conservation. Infrastructural facilities of this area are very poor (solar energy is the only means of power supply).Wild elephant threat is a severe problem in this region.

There was no any minor or major irrigation systems in this area. Farmers use high technology for cultivation purposes such as sprinkler irrigation, use of hybrid seeds etc. They mainly focused on commercial crops to earn a rapid income. Developed marketing channels can be identified in this region. Harvest is collected by the middlemen and they supply the loads to Dambulla economic center. Some farmers directly supply their harvest to the economic center without the involvement of middlemen. In this marketing channel farmers have to pay commission for middle men as well as to the traders in economic center. Competition from Jaffna market has also badly affected the farmers.

CHAPTER SIX

Findings Issues and Recommendations

Chena cultivation was the principal source of food other than rice particularly in the dry zone of Sri Lanka and it continued to be an important food source in the dry zone until recent past. Abandoning of *chena* cultivation has significantly decreased the area under millet, sesame, green gram and cowpea. With the abandoning of *chena* cultivation due to legal restrictions and bringing large tracts of dry zone land under irrigation, several OFC farming systems had evolved in the province. Today, there are few illegal *chena* cultivation taking place, especially in remote dry zone areas. Population pressure and legal restriction have caused people either to abandon *chena* or to grow their *chena* plots with perennials. Coconut, cashew and banana are the main perennial crops cultivated. Permanently cultivating homestead with mono-crops without fallowing *(Goda hena)*, cultivation of OFC in irrigated rice fields, OFC cultivation in supplementary irrigated uplands are the existing OFC farming systems that contribute to the national production. However, cultivation of OFC under main farming systems found in the province i.e, *chena,* diversified rice fields and the dry and irrigated uplands has been in the decline.

Significant drop in the cultivated extent of crops such as sesame, finger millet, chilli is observed from mid 70's and from early 80's at national level. National extent under sesame, chilli, finger millet, red onion, manioc and sweet potato has been continuously declining. Abandoning of *chena* cultivation has significantly influenced the area under finger millet and sesame. According to farmer's practices *chena* is the main farming system for finger millet and sesame cultivation. Hence farmers are not used to other cultivation methods and the adoption of such methods is also insignificant.

Economic factors, chiefly market prices and trade policies, have been important in determining factors for the expansion of OFC cultivation in the country. During the closed economy period, due to the ban on the import of pulses and the increased cost of imported pulses, and the research advancement resulting in the breeding of high yielding varieties of shorter duration and better grain types, OFC production received a new impetus. The favourable prices received for these crops enhanced their cultivation. Highest extent of chilli in the country was recorded in 1976/77.

However with the liberalisation of the economy, output as well as input markets influenced the farmer's decision that commercial cultivation gained impetus in the direction of increasing cultivation of vegetable and cash crops such as big onion, whereas semi-subsistence low income farming received a setback.

Cultivation of OFCs under irrigated lands during *yala* season is one of the main promotional programmes that government brought to increase the OFC cultivation. With the irrigation of rice fields, rice lands had been brought under cultivation of OFC during *yala* season, hitherto cultivation during *yala* season had been confined to crops such as sesame and finger millet. Upland areas under lift irrigation contributed to an increasing supply of OFCs with the diffusion of pumps and dug wells after

1980's. Thereby rain-fed uplands in the dry zone and the intermediate zone continued to provide the bulk of OFC requirement.

Though diversification programs during the late 80's had made an impact on cultivation of green gram, cowpea and other subsidiary crops in the rice fields, liberalization of trade has reversed the trend that continuous decline of these crops are evident after mid 90's. There has been a continuous decline in total extent under OFC from late 80's and from early 90's nationally and at district level. Particularly in the Kurunegala district, *yala* season cultivation of sesame and chilli has drastically dropped.

Yet, cultivation of certain crops has increased in certain areas. Particularly extent under upcountry vegetables has increased to meet the demand expansion that cannot be supplied through imports. Several farming systems have evolved for vegetable cultivation in the province. Extent under upcountry vegetables such as beetroot, capsicum and radish has increased. Kalpitiya peninsula and the region under intermediate mid country in Kurunegala district are main up country vegetable growing areas that came under cultivation after 80's and 90's. Along the Kalpitiya belt, onion-chilli-tobacco farming system has changed to high-tech mixed crop cultivation. Several vegetables and guava are also cultivated.

Liberalization of seed industry has caused significant influence in the farming systems with the abundance of imported hybrid seeds in the market. It is predominant that farmers moving away from long aged traditional varieties to monthly income earning short term crops in the region. Due to availability of hybrid seed imports new crops such as water melon particularly, Malaysian varieties are commonly cultivated. Crops like, papaw are also gown. Some diseases have caused to wipe out some crops from the fields (chilli). Currently farmers depend totally on seeds from outside as they do not have a seed stock.

Uncertainty and irregularity of rainfall, problems of catchment, filling of tank beds caused water scarcity for cultivation during *yala* season. Also diversification has been constrained during *yala* season in irrigation assured areas as farmer community decision making get influenced by large farmers to grow paddy during *yala* season due to labour shortages.

Extension services and other promotional programs have made an impact for promotion of some OFCs, nevertheless that collapse as the promotion is withdrawn.

Recommendations

OFC sector is still predominantly a semi-subsistence family labour dependant farming system in the NWP although few farming systems have evolved as sub-commercial systems based on market signals. Therefore less input and less labour demanding innovative farming methods are still needed to be developed to the dry zone farmer. Genetic improvement of local varieties that are resistant to local conditions is also vital.

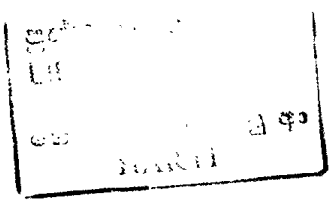
Assuring of water for cultivation during *yala* season is important. Therefore improving water security by micro irrigation methods and tank rehabilitation could assure farming during *yala* season.

Extension services, promotional programs and marketing agreements can promote farmers to cultivate OFCs. Extension service, promotional program, contractual agreements on marketing and school nutrition programs link to production program are important in this regard.

It is a prerequisite to improve local seed production and the genetic potential of local varieties and maintain a seed stock in the region by promoting seed growing farmers. In the region by promoting seed growing farmers for the sustainability of the sector, as currently farmers depend totally on seeds from outside.

Research on innovative farming systems should be undertaken that takes productivity, labour saving and sustainability into consideration.

Research is needed to be undertaken to explore the feasibility of mechanized large scale commercial cultivation of OFCs and the required institutional setup to be recommended to the dry zone.



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