A report submitted to the

NATIONAL SCIENCE FOUNDATION SRI LANKA

(RESEARCH GRANT NO. CRG/2001/AG/01B)

on

THE FACTORS AFFECTING THE COST OF RICE IN SRI LANKA

By

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2002

FR1251

ACKNOWLEDGEMENT

The study was made possible through the financial assistance from National Science Foundation and with the close cooperation of Director, staff and the working committee members of NSF. It is our pleasure to acknowledge the valuable contributions, guidance and support provided by Dr. Wijaya Jayatilleke, Director, Sri Lanka Foundation Institute, Colombo 7.

Mr. G. M. Henagedara (Team Leader) and the team members Dr. S. Thiruchelvam, Dr. M. M. Aheeyar and Dr. A. N. Ahmed provided considerable help and encouragement by sharing our knowledge and experiences through many discussions. Without their active cooperation and assistance the study could not have been properly conducted.

Mr. T. A. Wimalasena, Provincial Director of Agriculture, Southern Province, Assistant Directors of Matara and Hambantota districts, AIs and DOs of Ambalantota, Beliatta, Walasmulla, Akurass and Kirinda for their positive approach to the study and participating in field information collection and attending the discussions are greatly appreciated.

We greatly acknowledge Mr. A. Somasiri and non-academic staff of the Department of Agricultural Economics for generous assistance.

Last but not least we greatly appreciate the assistance of our students for collecting and analyzing field data required for the study.

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January 13, 2003

SUMMARY

Sri Lanka produces almost the annual rice requirement by nearly 2 million farmers cultivating 0.78 million hectares of land. In addition to the heavy investment on rice cultivation, the government spends a substantial amount of foreign exchange for the importation of rice to meet the total requirement of the country. Presently, the paddy farmers are tended to abandon their paddy lands due to the rapidly increasing cost of production that leads to poor income they received from paddy farming. This study attempted to examine the impediment factors of the rice sector in the southern dry-zone and wet-zone under different water regimes, and to make suggestions to improve the level of paddy production. In addition to the secondary data and information collected from various sources, primary data and information were collected through field surveys and focus group discussions. Field survey in dry-zone of Hambantota district was conducted in Ambalantota, Beliatta and Walasmulla ASC areas representing major-irrigation, minor-irrigation and rain-fed paddy farming. Kirinda/ Puhlwella and Akurassa ASC areas in Matara district were used for the field survey in major-irrigation and rain-fed paddy farming in wet-zone. It is worthwhile to note that the selection of these ASC areas for the study is being done upon recommendation made by senior officials at the Assistant directors' office in Agriculture in each administrative district. However, the authors always tried minimizing any bias arising from selecting representative samples from each irrigation regime.

The study reveled that the paddy farming under major-irrigation, minor irrigation in the dry-zone as well as major-irrigation in wet-zone are comparatively efficient while somewhat inefficient under rain-fed conditions in both dry and wet zones. The technical efficiency of paddy production is low in rain-fed farming compared to that of under irrigation. Therefore, unless any improvement of the irrigation facilities in minor and rain-fed paddy farming areas, farmers may not be able to attained highest efficiency of production leaving other alternative crops such as other field crops as most promising for those areas.

From the total expenditure for paddy farming farmers spend around 40% for labor, 20% for farm power, and the rest for agro-chemicals, fertilizer, farm-equipments and seeds. High wage rate for labor in paddy farming has become an inhibiting factor for the promotion of paddy production and therefore the technical efficiency. Hence, as expected, the farmers in the major-irrigation regimes make effort to substitute labor with tractors particularly in the land preparation and for harvesting. The paddy farmers particularly who cultivate paddy under major-irrigation conditions prepare own seed requirement by themselves at a low cost compared to the price at the commercial sources. However, they are still required foundation seeds from an improved variety. Prevailing high price of fertilizer at the private sector dominated market has resulted with use of fertilizer by the farmers less than the recommendation. Hence, the poor response to their paddy yields affect negatively on increasing the level of production and therefore the technical efficiency. With the ever-rising cost of weedicides, which cover a large part of total expenditure for agro-chemicals, the farmers are loosing their profit margin from the paddy farming. The farmers cultivate paddy under major-irrigation regime still rely on weedicides due to the high labor wages in paddy farming. Integrated Pest Management

(IPM) is becoming very popular among the farmers who cultivate paddy under irrigated water regimes. The rain-fed farmers face more pest outbreaks due to stagger cultivation, which leads them to bear higher expenses for chemical pesticides. Even though the paddy farmers spend comparatively little money for farm equipment, they can still increase the efficiency of production in paddy farming by utilizing more equipment as a substitution for high wage labor. The farmers particular who cultivate paddy under major-irrigation regime have higher expenditure for farm-power mainly tractor. Their expenditure for tractors except for the major-irrigation farmers in Matara district affects the technical efficiency of paddy farming negatively.

The farmers who produce paddy under major-irrigation regimes have more than 70% of market surplus while rain-fed farmers have only 25% of market surplus. On the other hand, the middlemen in paddy marketing system of the rain-fed paddy production areas obtain higher market margin than in major-irrigation regime. The paddy productions of major-irrigation regimes are distributed through Colombo market. The paddy produced by the rain-fed areas is distributed among local market as well as newly emerged distance markets. Fellow farmers and mass media have become more popular than the extension service in disseminating technical information. The rain-fed farmers could be categorized as regular borrowers who obtain mainly inform credit to cover the seasonal farming expenses. Crop insurance is more popular among farmers in major-irrigation areas. Insurance policy has the potential to increase the paddy production and therefore the technical efficiency but affordable premium and fair compensation schemes needs to be introduced based on the risk involved in each areas rather than one general model. Introduction of this type of insurance schemes will provide answers to the problems arising from 'adverse selection' and 'moral hazards' in the insurance markets. It has been recorded that a substantial amount of water is wasted due to poor water management procedure and lack of maintenance for distribution channels. Farmer organization has a positive role in improving paddy sector.

Based on the findings of the study several policy implications can be drawn. Educate farmers through in-formal educational approaches has become an important strategy to make farmers more innovative. Profitable highland crop cultivation may replace the unprofitable paddy fields especially in the rain-fed areas. Though raising the guaranteed price of paddy increases the profit to producers, it adversely affects the consumers. One possibility is to look for the development of value added production that uses rice as raw material. Raise the price of rice. Replacement of high waged labor with machinery and equipment and absorption of excess labor by agro-based industries or other manufacturing industries may solve the labor problem in paddy sector to some extend. Transfer of responsibility to the farmers for preparation of seed paddy and technology improvement of paddy variety are recommended to produce better paddy seeds. Area specific fertilizer recommendations and farmer education promote the efficiency of fertilizer usage. Mechanical weeding may reduce the expenditure of weedicide if the farmers could adopt paddy transplanting. Popularization of IPM, avoid stagger cultivation and variety improvement are the solution for reduction of pesticide expenditure. Though it is somewhat problematic, provision of fuel subsidies as practiced by some other developed countries or introduction of low cost machinery is required to solve the

problem related with high expenditure on farm power. Farmer organizations or companies with the provision of information system could play a passive role in paddy marketing. Farmer managed credit market, restructured crop insurance scheme, participatory water management system are some of the other main recommendations, which are necessary for the improvement of the paddy sector of the southern Sri Lanka.

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1. INTRODUCTION

1.1. BACKGROUND

Rice, the main staple food crop in Sri Lanka is given the highest priority by the government in agricultural policy issues. The annual paddy production was 2.9 million metric tons with the average of 3,672 kg per hectare harvested from total 0.78 million hectares of lands cultivated by nearly 2 million farmers in two cropping seasons in 1999.

The government makes massive investments to promote the paddy sector through many development projects based on irrigation, settlements, research, extension and supporting services to reduce dependent on import rice. However, the country still imports around 13% of the national paddy requirement in order to cater the per capita consumption of 93.5 kg of rice per year.

At the same time the paddy farming has been severely affected by the rapid increase of cost of production and the low farm gate price. Presently, the average cost of production of paddy has been recorded as Rs. 7.00 to Rs. 13.00 per kg while the farm-gate price remaining at Rs. 10.00 per kg. (Department of Agriculture).

This study intended to be a review of the current economic circumstances faced by paddy growers in Sri Lanka reflecting irrigated and rain-fed production conditions. The study was designed with a view to capture the major trends emerging within this sector as well as to highlight the current and potential problems that would hinder the improvements in paddy farming in Sri Lanka. The study would provide a descriptive account of the key issues affecting the economy of the agricultural households in rural areas.

In view of the changes that have taken place in the agrarian sector during the past few years, a detailed investigation of the prevailing production patterns and the socio-economic situation is considered to be both timely and relevant. Such a study based on farm level data, would provide insights into the economics of paddy cultivation with special reference to inputs used, farm management practices, farm supporting services disposal of outputs and food security. Though some quantitative analyzes have been carried out, qualitative studies on these aspects have hardly been undertaken. Therefore, the proposed study would serve as analysis of the current constraints facing by paddy growers.

1.2. OBJECTIVES

The prime objectives of the proposed study was to identify current social and economic factors faced in paddy farming sector in Sri Lanka. Specific objectives are;

1. To identify and analyze the factors which influence production of rice and their costs including marketing.

2. To determine the average amounts and cost of inputs involved in the production of one Kg. of rice under major and minor irrigation and rain-fed conditions in the dry, intermediate and wet zone of Sri Lanka.
3. Methods of reducing costs of rice to the consumer.

2. LITERATURE REVIEW

A comprehensive body of literature is available on economics of paddy cultivation in Sri Lanka since 1960s. These literatures could be classified under three broad categories.

a. Annual cost of production surveys conducted by the Department of Agriculture and paddy statistics collected by the Department of Census and Statistics. These surveys are conducted island wide using representative samples from each district. Costs of production information are available both in terms of production inputs and operational activities. Thus a detail set of information are publishes annually at district and national level.

b. Descriptive analysis of paddy cultivation and cost of production (Central Bank of Ceylon: 1969; Abeyratne, 1991; Henagedara, 1989; Rupasena, 1998).

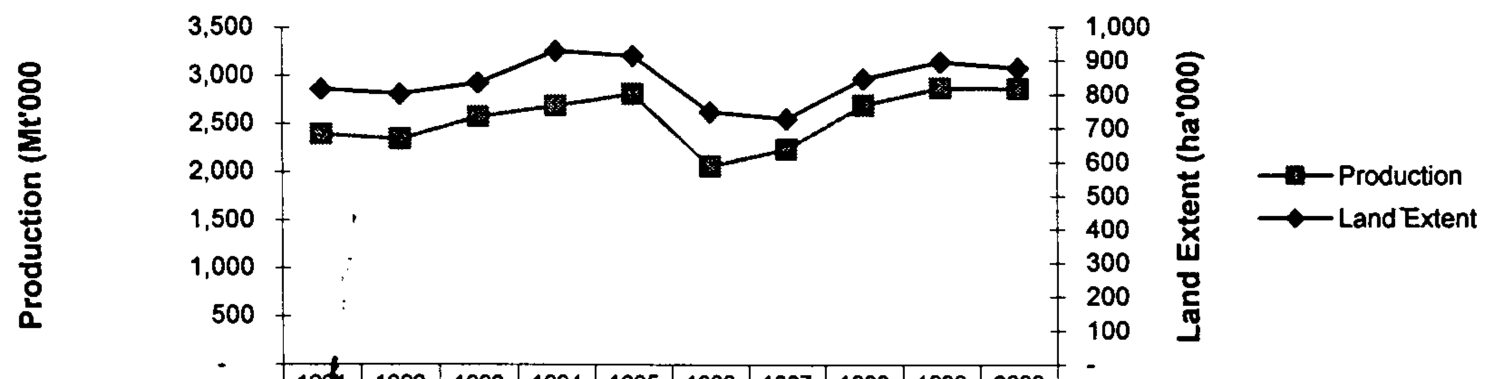
c. Analytical studies focuses on variation in cost of production of paddy in terms of factors of production, normal protection co-efficient (NFC) and Effective Protection Coefficint (EPC) (Gunawardena 1981; Sirisena, 1986; IFPRI & HARTI, 1990; Edirisinghe, 1990; Shipi, 1995; Wickramarachchi, 1996; Fedric Samarathunga and Rafeek, 2000).

There is an apparent dilemma in the rice sector in Sri Lanka. This view is largely based on the poor performance of paddy in recent years in terms of yield, low market price, contraction of area cultivated, part-time occupation with more lucrative off-farm employment, and comparison of rice prices in national and international market. There is a considerable support for each of these assertions in macro data and as well as micro studies. These studies, however, did not evaluate whether yield could be improved further with less input. This makes possible to release some land to other crops while maintaining a high level of rice production for food security reasons.

2.1. PADDY PRODUCTION AND IMPORTS

Rice cultivation in Sri Lanka covers 0.7 million hectares which is 0.4% of the 143.5 million world total paddy lands (De Datta, 1981). The land area under paddy cultivation has been increased from 817,000 to 878,000 hectares during the last decade at a very slow rate (Figure – 2.1). Sri Lanka has 730,000 ha of asweddumized paddy land area where 560,000 ha of land is cultivated during Yala season and 310,000 ha during Maha season under major-irrigation, minor-irrigation and rain-fed water regimes (Department of Agriculture, 2000). The paddy land covers about 34% of the total cultivated land area (Danapala, 1998). However, 255,800 ha of paddy lands are cultivated under major-irrigation schemes. Most of the farmers are small holder that 70% of the paddy holdings are less than one hectare of extent while only 5% are larger than 2 hectares (Central Bank, 1998).

FIGURE - 2.1. PADDY LAND EXTENT AND PRODUCTION



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Production	2,389	2,340	2,570	2,684	2,810	2,061	2,239	2,692	2,868	2,859
Land Extent	817	803	835	930	915	749	730	848	896	878

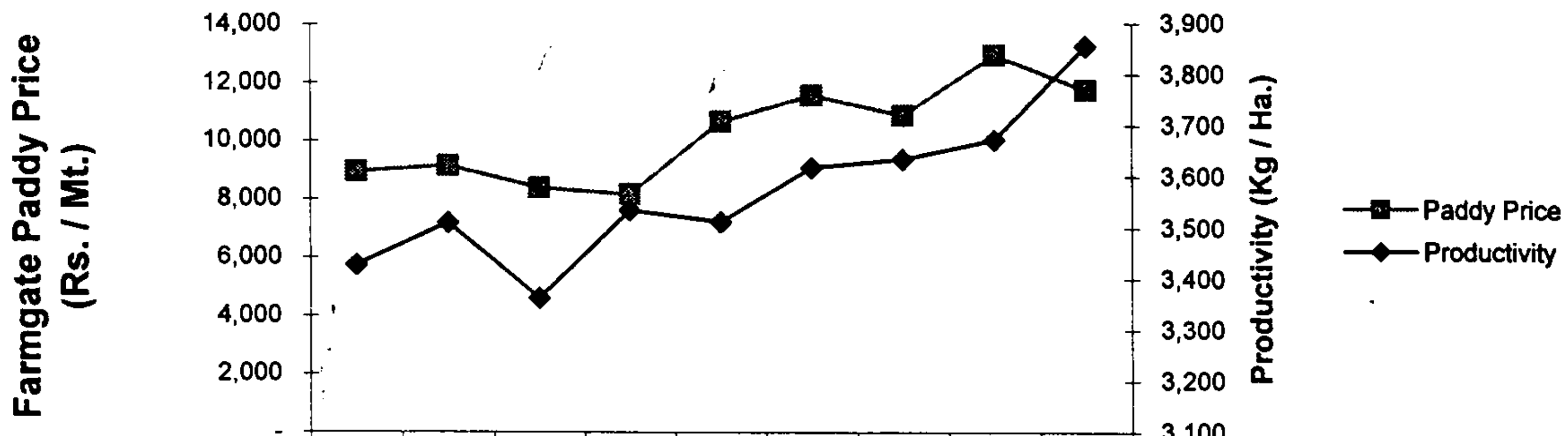
Year

Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

The total rice production has increased rapidly from 19950 after the independence until 1980 due to increase of sawn area and the yield per hectare (Kikuchi, 1999). However, the rice production has not been increased during the last decade significantly (Danapala, 1996). The paddy production has been increased from 2,389,000 to 2,859,000 Mt. during the last decade (Figure – 2.1). The increase of paddy production at a very slow rate follows the same pattern of increasing the land extent under paddy cultivation. Although the paddy grown in island wide, five districts Anuradhapura, Polonnaruwa, Kurunegala, Hambantota and Baticallo produce more than 50% of the total production of the country (Department of Agriculture, 2000).

Average paddy yield in 2001 is recorded as 2.86 MT / ha. The productivity of land has been increased rapidly from 3,428 to 3,856 kilograms per hectare during the last decade (Figure – 2.2). The farm gate price of paddy also has been changed in similar pattern with the change of production during the last decade. Several studies investigated the comparative advantage of rice production using estimated Domestic Resource Cost (DRC) shows mixed and contrasting findings which paddy yield fluctuate year to year significantly (Abeyratna et. al., 1990; Edirisinghe, 1991; Shipi, 1995; and Samarathunga and Raffek, 2000). However, the self-sufficiency of rice had been lifted from 40% in 1950s to 90% by early 1980s and even reaching 100% in some years such as 1984, 1994 and 1995 with the rapid increase of production (Kikuchi, 1999).

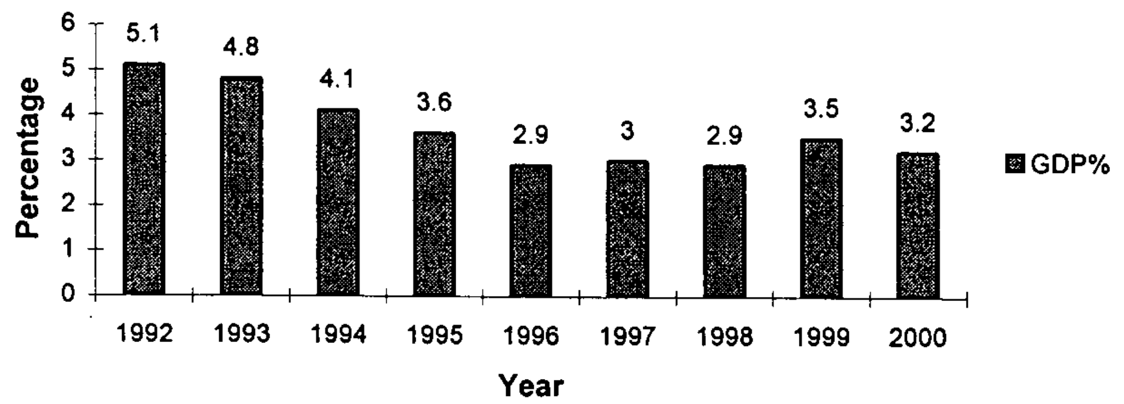
FIGURE - 2.2. PADDY PRICE AND PRODUCTIVITY



	1992	1993	1994	1995	1996	1997	1998	1999	2000
Paddy Price	8,938	9,130	8,382	8,162	10,663	11,555	10,847	12,919	11,719
Productivity	3,428	3,511	3,363	3,535	3,513	3,619	3,634	3,672	3,856

The paddy sector contributes GDP in the range of 2.9 to 5.1 percent in the total GDP (Figure – 2.3). On the other hand, the per capita consumption of rice is recorded as 100 kg in Sri Lanka (Harrison, 1998). Rice provides 37% of per capita calories and 40% per capita protein in the Sri Lanka average daily diet (Rice Congress, 1990).

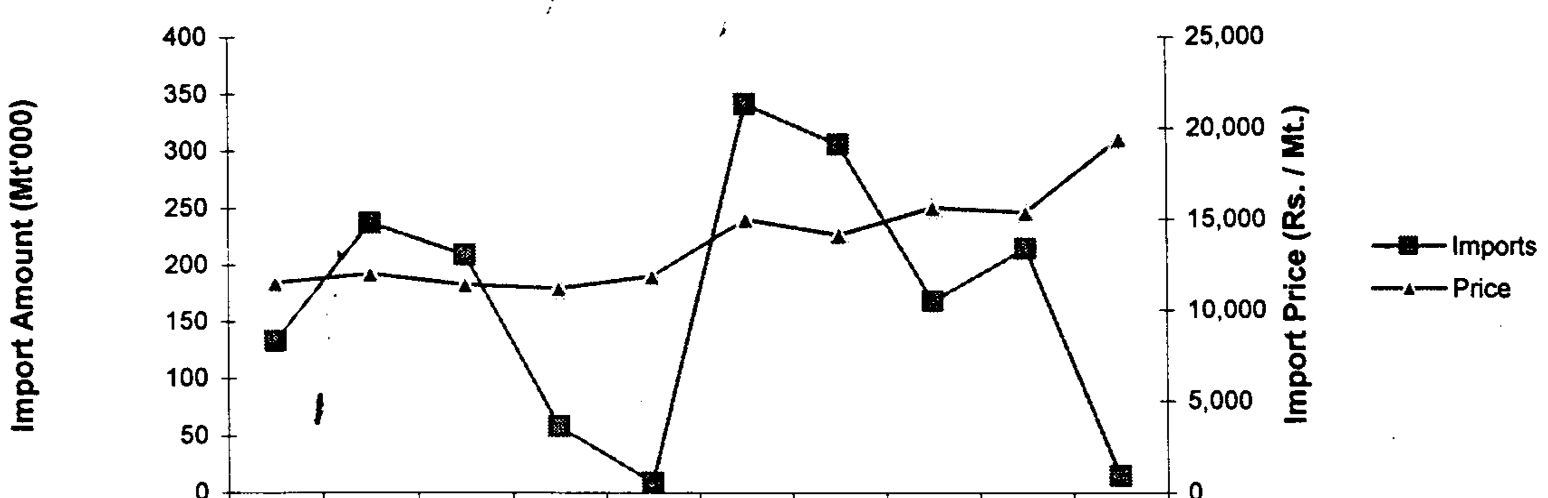
FIGURE - 2.3. CONTRIBUTION OF PADDY FOR GDP



Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

Sri Lanka imports around 13% of the national paddy requirement (Central Bank of Sri Lanka, 2000). The imports of paddy had been drastically changed with the change of trade and agricultural policy of the country during the last decade (Figure – 2.4). The largest amount of 341,000 Metric tons of rice has been recorded in 1996 while the country has imported only 5,000 Metric tones of rice in 1995 during the last decade. However, the import price of rice has been drastically increased from Rs. 11,519 per Mt. in 1991 to Rs. 19,398 per Mt. in 2000.

FIGURE - 2.4. IMPORT AMOUNT AND PRICE



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Imports	133	237	209	58	9	341	306	168	214	15
Price	11,519	12,021	11,426	11,216	11,875	14,999	14,148	15,643	15,358	19,388

Year

Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

2.2. FACTORS OF PRODUCTION

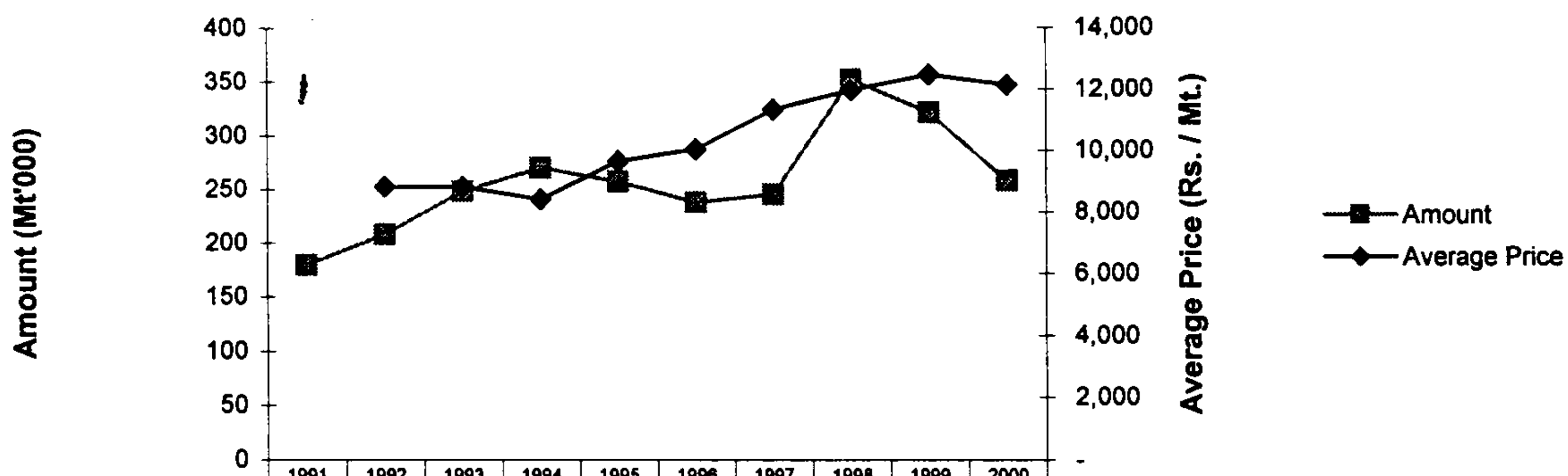
An investigation on long-term perspective of the demand supply balance for rice has revealed that the technological fatigue, scarcity of agricultural inputs such as labor, land and water, and soil degradation are the major courses for poor performance of paddy sector in Asia. It has been suggested a favorable balance with demand on appropriate technologies to address abiotic stress which can help to reduce the large yield gap in the rain-fed ecosystem (Hossain, 1999).

More than 30% of the total agricultural labor force is engaging in the paddy sector (Danapala, 1998). It has been estimated that 0.8 million people are employed directly in paddy sector of the country. The agricultural wage rate of labor is the major factor that is pushing down comparative advantage of rice production in Sri Lanka (Kikuchi et. al., 2001). The paddy production is no more profitable considering cost of production data during the period of 1978 ~ 1980 (Weerahewa and Abegunawardena, 1987). Even in many other Asian countries a similar trend of loosing comparative advantage of rice is apparent due to continuos increase in the real wage rate in the non-rice sector (Estudillo et. al., 1998).

The uncertainty of water supply to a large extent determines the level of investment in rice production (Wjeratne and Hemakeerthi, 1992 and 1994). The rice production in 1980 had comparative advantage and the advantage is eroding during the last two decades. However, the rice production in the major-irrigation schemes is still profitable as long as the investment cost of construction are considered as sunk cost, sharing 70% of the rice production in the country (Kikuchi et. al., 2001).

Usage of fertilizer by the paddy farmers has been increased from 179,000 metric tone in 1991 to 258 metric tones in 2000 (Figure - 2.5). The amount of usage has been highly fluctuated during the last decade. On the other hand the average price of fertilizer considering urea, sulfate and phosphate has been rapidly increased from Rs. 8,831 to Rs. 12, 135 per metric tone during the last decade.

FIGURE - 2.5. USAGE AND PRICE OF FERTILZER



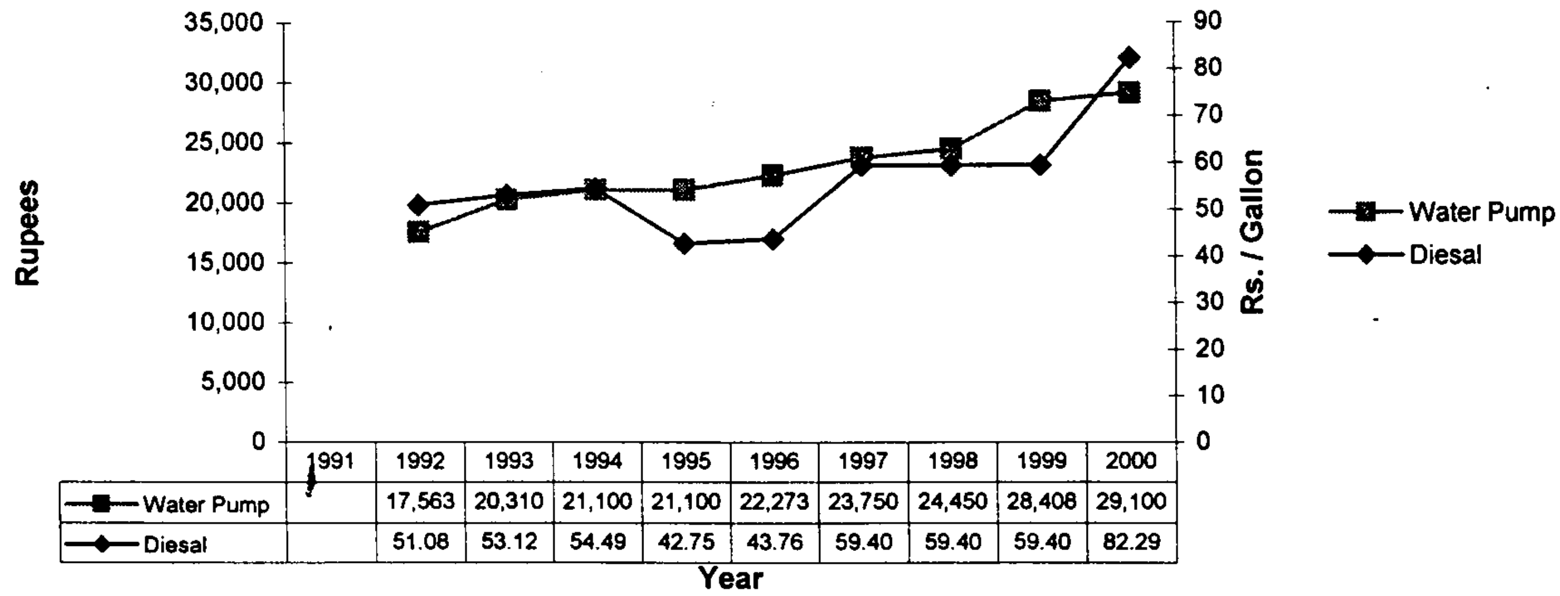
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Amount	179	208	248	270	257	238	245	352	321	258
Average Price		8,831	8,817	8,415	9,650	10,047	11,331	11,967	12,487	12,132

Year

Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

Price of the water pump also has been increased from Rs, 17,563 to Rs. 29,100, which is unbearable for the poor paddy farmers (Figure –2.6). On the other hand the price of diesel also has been drastically increased from Rs 51.80 to Rs. 82.29 per gallon during the last decade. The increasing price of diesel also affects the expenditure on farm power directly.

FIGURE - 2.6. PRICES OF WATER PUMP AND DIESEL



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Water Pump		17,563	20,310	21,100	21,100	22,273	23,750	24,450	28,408	29,100
Diesal		51.08	53.12	54.49	42.75	43.76	59.40	59.40	59.40	82.29

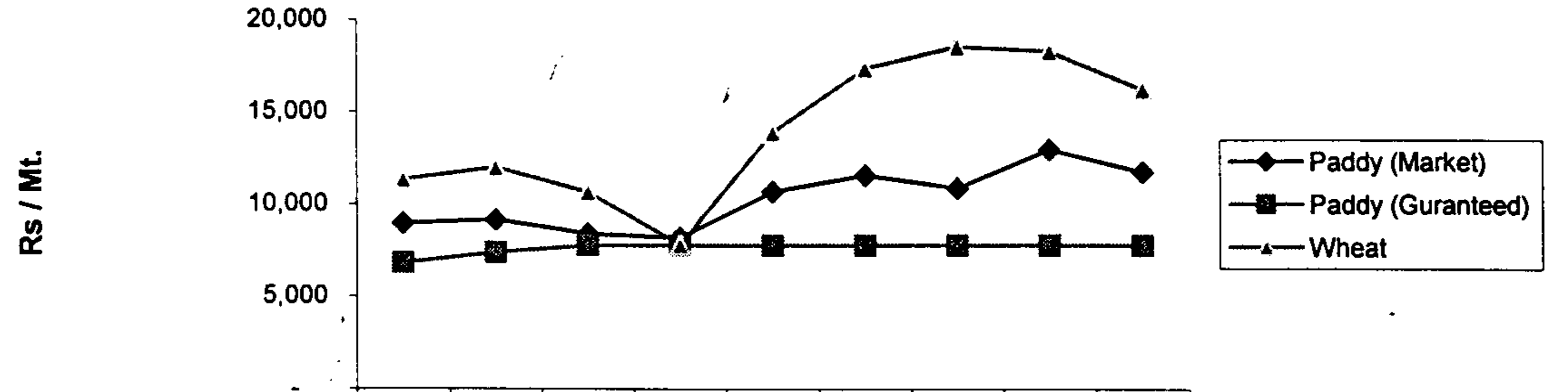
Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

2.3. PRICE AND PROFIT

The increase of market price of paddy from Rs. 8,938 to Rs. 11,719 per metric shows a very slow process with high fluctuations during the last decade (Figure – 2.7). However, the Guaranteed Price of paddy is almost stagnant at Rs. 7,750 per metric tone since 1994. It is noteworthy that the price of wheat has been increased from Rs. 11,325 to Rs. 16,194 per metric tone only with one decline in 1995 during the last decade. Even though the paddy is the staple food in Sri Lanka, compared to the price of paddy, the price of wheat has been increased drastically.

The Figure – 2.8 shows the rapid decline in import price or CIF price of rice from Rs. 18.35 per kg to Rs. 16.14 per kilogram during the last decade. It could be interpreted that the price of rice at the world market is declining continuously. However the price of domestic rice was increased from Rs. 15.53 to Rs 25.00 per kilogram during the period of 1995 ~ 1999. The domestic rice sector therefore, is protected by imposing 35% of import tariff (Department of Agriculture, 2000).

FIGURE - 2.7. PRICES OF PADDY AND WHEAT

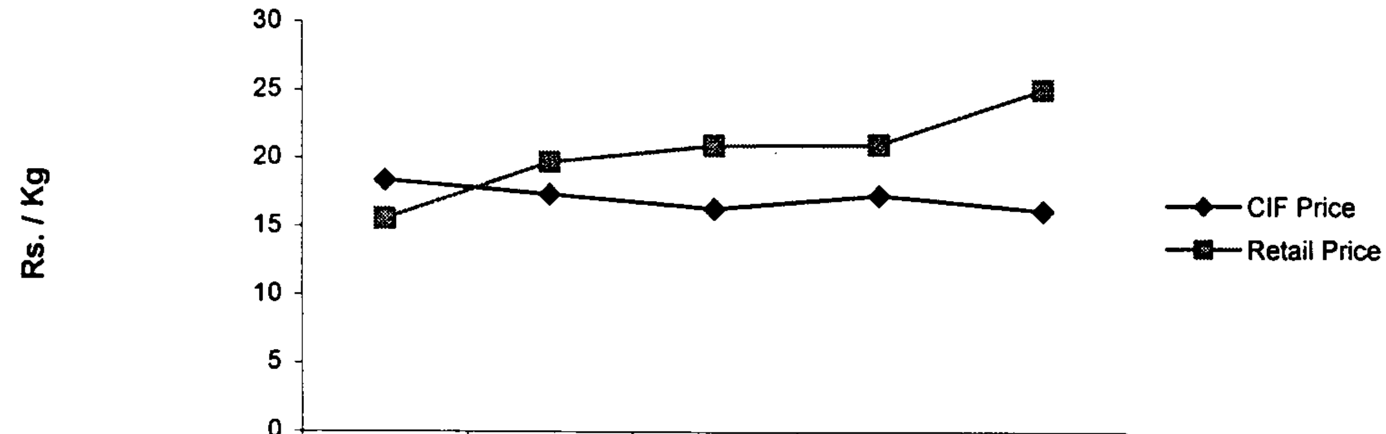


	1992	1993	1994	1995	1996	1997	1998	1999	2000
Paddy (Market)	8,938	9,130	8,382	8,162	10,663	11,555	10,847	12,919	11,719
Paddy (Guranteed)	6,800	7,354	7,750	7,750	7,750	7,750	7,750	7,750	7,750
Wheat	11,325	11,983	10,650	7,804	13,875	17,333	18,500	18,250	16,194

Year

Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

FIGURE - 2.8. IMPORT PRICE AND DOMESTIC PRICE OF RICE



	1995	1996	1997	1998	1999
CIF Price	18.35	17.32	16.3	17.25	16.14
Retail Price	15.53	19.69	20.91	20.98	25

Year

Source: Annual Reports, Central Bank of Sri Lanka, 1993 ~ 2001, and Department of Census & Statistics, 2001

Lower domestic rice prices and rising wage rates and other costs of production made rice farming is far less profitable (Barker and Dawe, 2000). World Bank (1996) has postulated the removal of subsidies by allowing the real cost of production to be covered and operating agricultural market freely. A study on rational utilization of water and land for paddy production has stressed the advantages of concentrating on the more productive rice growing regions (Panabokke and Punyawardena, 2000). Presently, there is a trend towards crop diversification and rotation with other commercially oriented crops in areas outside the predominant paddy growing areas (Silva, et. al., 2001).

2.4. TECHNICAL EFFICIENCY

The Technical Efficiencies of various farms are measured from a single frontier. This method of measuring efficiency ignores differences in the socio-economic and physical environments faced by the farmers. The farmers who use the same technology may have different production possibilities under different environments. Hence, the measure of Technical Efficiency based on production possibilities of each farmer is important rather than to some common frontier. Under homogeneous production environments a set of production functions exists among a group of farmers with different input levels for different technical knowledge at a given time period (Kalirajan, 1982).

A study has revealed that the average technical efficiency was 0.79 of the Basmathi rice producers in Pakistan. The yield was significantly related to the rate of fertilizer, farmyard manure and irrigation water applied, and the soil quality. The more educated households were more technically efficient farmers (Flinn and Ali, 1986). According to Shand and Hafi (1984) there were substantial differences between rice farmers in technical efficiency under major irrigation in Kurunegala. However, there were inter-farm variations in technical efficiency under both minor tank and rain-fed condition. The national average level of technical efficiency in China was 63.6 percent during 1987 ~ 1992 entirely due to growth in inputs. Further, the use of fertilizer and irrigation techniques continue to play an appropriate role in farm production (Lin, 1994).

3. RESEARCH METHODOLOGY

The research designed consisted with three research methods including primary, secondary and participatory data collection techniques. The study conducted in Hambantota and Matara district, two major paddy-growing districts, covering dry-zone and wet-zone respectively of the country as suggested by the National Science Foundation. The study covered a selected sample of paddy growers representing major-irrigation, minor-irrigation and rain-fed areas in the dry zone (Hambantota) and major-irrigation and rain-fed areas in the wet-zone (Matara district).

3.1. STUDY AREAS

The study was conducted in the following areas in Hambantota and Matara districts (Appendix -1). Ambalantota, Beliatta and Walasmulla Agrarian Service Areas were selected from Hambantota district. Kirinda / Puhulwella and Akurassa Agrarian Service Areas were selected from Matara district (Appendix - 2 & Appendix - 3).

Hambantota district - 150 farmers from Agrarian Service Center Areas:
Ambalantota - 55 farmers - Major Irrigation
Beliatta - 21 farmers Minor Irrigation
Walasmulla - 52 farmers Rain Fed; and 22 farmers Minor Irrigation

Matara district - 92 farmers from Agrarian Service Center Areas:
Kirinda / Puhulwella - 42 farmers from Major Irrigation
Akurassa - 50 farmers from Rain Fed

Hambantota district (Dry Zone):

Ambalantota
The field survey was conducted in Ambalantota Agrarian Service Center Area through the interview of 55 paddy farmers selected from major-irrigation water regime in Ambalantota (32) and Gatamanna (23) villages. Ambalantota major-irrigation paddy farmers receive water from Ridiyagama Tank (Wewa) known as Walawa Right Bank. Ridiyagam tank recive water from Walawa River through the Liyangastota Dam. However, the major irrigation paddy farmers in Gatamanna receive water from Walawa River.

Beliatta:
The two Divisional Secretariat Divisions: Beliatta and Tangalle covered by the Belatta Agrarian Services Center area. The field survey was conducted through 21 farmers selected from two villages: Bandarawatta and Ambala (Barawa Kumbuka) where the farmers cultivate paddy under minor irrigation water regime. The main source of water is coming from natural water springs (Bubula - surface water aquifers) in Bandarawatta and Ambala.

Walasmulla
From the total 74 farmers 52 Rain-fed as well as 22 minor-irrigation farmers were selected from Walasmulla Agrarian Service Center area. The rain-fed farmers were

selected from Yahalmulla (11), Mathuwakanda (12), Horewela (15) and Pissubadda (14) villages in Walasmulla ASC area.

The minor irrigation farmers were selected from Palle Julumpitiya (12), and Uda Julampitiya (10) villages in Walasmulla ASC area. Palle Julampitita minor-irrigation farmers receive water from Miriswatta anicut and Katiyadeniya spring. Uda Julampitiya farmers receive water from several water springs mainly Malapalawa, Bubula Kumbura and Amunugawatta Bubula.

Matara District (Wet Zone):

Kirinda / Puhulwalla

Forty-two farmers were selected for the study from major-irrigation water regime in the Kirinda / Puhulwalla Agrarian Service Division. The selected farmers are belonging to Owitigama (9), Malwathugoda (13), and Puhulwalla West (20) villages. They receive water from Allewela wawe through Allewela Project.

Akurassa:

Fifty Rain-fed farmers were selected from Henagama (14), Yakabedda (17) and Lenawa (19) villages in Akrassa Agrarian Service area.

3.2. DATA COLLECTION

a. In-depth File Survey (Sample Survey)

As recommended in TOR, a sample survey was conducted to collect primary information. An in-depth survey using a questionnaire was conducted to collect primary data in relation to production factors of paddy cultivation, other information pertaining to general socio-economics status of farmers and factors affecting production of paddy such as level of input use, yield, income level and many other socioeconomic variables.

The sample was selected on the base of two main criteria:

i. Distribution of Agro-Climatic zones: Matara and Hambantota were selected from the Wet Zone and Dry Zone areas respectively. The University of Ruhuna is responsible for Matara (Low Country Wet Zone - IL_1 and IL_2) and Hambantota (Low Country Dry Zone - DL_1) districts.

ii. Distribution of water regimes: Matara district was selected based on the distribution of two water regimes such as Major Irrigation and Rain Fed areas. Hambantota district was selected based on three water regimes such as Major Irrigation, Minor Irrigation and Rain Fed areas.

iii. Considering financial and time constraints, the team was responsible to select 200 farm families from the two districts. The selection of sample size within two districts was determined on distribution of total extent and production of paddy in Major, Minor and Rain Fed areas. Thus, a total of 242 farmers were selected from both districts. The Enumerators under the supervision of research team interviewed the selected farmers using a pre-tested questionnaire.

150 farmers were randomly selected from 3 Agrarian Service Center Areas: Ambalantota, Beliatta and Walasmulla in Hambantota district representing Major-irrigation, Minor-irrigation and Rain Fed irrigation regimes.

92 farmers selected from 3 Agrarian Service Center Areas: Kirinda and Akurassa in Matara district representing Major and Rain Fed irrigation regimes.

b. Secondary Information

A comprehensive literature review was undertaken to understand the existing policy scenarios, production trends and cost factors in the paddy cultivation. The review of literature included with the collection of data and information from past research reports, journal articles, new paper articles and other forms of publications. Further the secondary information and data were collected from the records available in Office of the Assistant Director of Agriculture in Hambantota District and the Office of the Assistant Director of Agriculture in Matara District. More details were obtained from the office of Agrarian Services Centers in Ambalantota, Beliatta, Walasmulla, Kirinda / Puhulwella and Akurassa.

c. Informal discussion with Focus Groups

The research team visited the sites together with the enumerators and conducted focus group interviews with the farmers and farmer organization representatives. The discussions explored the actual field situation of paddy production, particularly the problems related to paddy cultivation, support services provided, cost of production, marketing and other aspects of the enterprise.

d. Guided Interviews with key informants

This techniques was followed to get the information from the key informants: representatives of Department of Agriculture and Department of Agrarian Services, traders, input supplying agents, marketing agents and other government and private sector individuals.

3.3. DATA ANALYSIS

Both descriptive and statistical analyses were performed on the collected data to achieved the predetermine objectives. Descriptive analysis was done mainly to observe the socio-economic condition of the sample sites. Statistical analyses were performed to examine the cost of production, productivity, technical efficiency, yield and income levels during Yala 2001 Maha 2001 / 2002. The Frontier Production Function was employed to measure technical efficiency of rice production as described below.

Analysis of Technical Efficiency in paddy production

The production function of paddy:

$$Q = f(X_1 / X_{n-1})$$

Q – Output quantity
X_1 – Variable inputs
X_{n-1} – All other inputs

It is also hypothesed that improving the technology presently using as well as improving the production procedures using the available technology could increase the productivity.

The dependant variable (endogenous variable) of the analysis is the production of paddy. The independent variables (exogenous variables) are the inputs in value terms (monetary values). The variables can be measures in quantity form as well as in value terms (Gujarati, 1988).

Technical Efficiency:
Technical Efficiency is defined as the ability to obtain maximum output at a given level of inputs. The Allocative Efficiency represents the ability to obtain the maximum profit from application of inputs with a given set of inputs and output prices and a given technology. Though the conventional production function approach can be used to measure technical efficiency with certain assumptions, the measures so obtained can not be considered as a pure measure of technical efficiency as it also contains random variables. The frontier production function represent the maximum output attainable from a given technology or a given set of inputs. It can be used to measure farm-specific technical efficiency. Therefore, the frontier production function approach provides a better framework to measure the resource use efficiency than the ordinary function that represents only the average situation.

Different researches used different functional forms to estimate the farm specific efficiency (Farrell, 1957; Aigner and Chu, 1968; Timmer, 1970; Aigner, 19777). In this study stochastic frontier approach was used to describe the efficiency of the paddy production in the two sampled areas for the study. The basic idea behind this model is that the error term is composed of two components namely an error component representing statistics of noise and as error component representing the level of technical efficiency. Simplified version of the Timmer's method was used. The efficient production frontiers for the farmers' location were estimated.

A hypothetical field-specific Cobb-Douglas frontier production functions can be written as follows.

$$y_j = \alpha' \prod_{k}^{m} (x_{jk})^{\beta_k} e^{(U_j + V_j)}$$

y_j = Output of the *j*th field

x_{jk} = *k*th input applied to the *j*th field.

α' = Intercept

β_k = Production parameters

U_j = Technical efficiency parameter of jth field

V_j = General statistical random error term of jth field

The distribution function of the of standard normal random variable,

$$\sigma^2 = \sigma_u^2 + \sigma_v^2$$

$$\gamma = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$$

Maximization of the relevant likelihood function gives the maximum likelihood estimated of the production function parameters including the intercept σ^2 and γ. The γ is the ratio of output variation due to technical inefficiency relative to the variation in output. The technical efficiency parameter U_j is zero for any output lying on the frontier and less than zero for any output below the frontier.

FRONTIER Version 4.1, which has been written to provide maximum likelihood estimates of a wide variety of stochastic frontier production and cost functions. The original specification involved a production function specified for cross-sectional data, which had an error term had two components, one to account for random effects and another to account for technical inefficiency. This original specification has been used in a vast number of empirical applications over the past two decades. The specification has also been altered and extended the methodology to cost functions. The program can accommodate cost and production functions. All of the above specifications have been expressed in terms of a production function, with the U_i interpreted as technical inefficiency effects, which cause the firm to operate below the stochastic production frontier. If we wish to specify a stochastic frontier cost function, we simply alter the error term specification from $(V_i - U_i)$ to $(V_i + U_i)$.

Ordinary Least Squares (OLS) regression analysis

The estimated farm-specific technical efficiency were used as dependent variable in the regression models. The OLS estimates were used to determine the factors affecting technical efficiency.

3.4. SCOPE OF THE STUDY

The study covers almost all agro-ecological zones with respect to paddy production in Southern Sri Lanka. Further the coverage will be based on the proportionate representation of major growing areas.

The study focused on three major issues. The first deals factors, which influence production of rice and farm-supporting services. The second deals with the farm incomes, costs and net returns and the third on food security and self-sufficiency in paddy cultivation.

The study component concerning with factors influenced in production will reflect a detail examination of the use of farmer's own inputs such as land, labor, household assets as well purchased inputs and services for farming purposes. Some of the key issues that investigated in this regard are; (a) tenurial status of operational land holding; (b) ownership patterns and distribution of land and other assets; (c) nature of the family labor force and employment patterns and (d) identify the nature of farming practices and production technologies adopted by the farmers. This will help in establishing the actual input intensities associated with current production. A detailed examination of the farm inputs will be made with a view to ascertain the underlying interrelationships between the socio-economic characteristics of the farm households, production methods and output. The investigation on farm supporting services will be focussed on both formal as well as informal services available to farmers for production and marketing. Among the major services that will be examined in this regard are; input distribution, credit supply, disposal of produce, extension and crop insurance.

The second objective of the analysis was centered on farm incomes, costs and net returns. This is expected to provide detailed insights into the operational status of the farm economy with a view to establish the details of the costs incurred and incomes received. The analysis on the production costs will help to identify the relative significance of the cost components, patterns of cost changes in the recent past and their influences on the net farm returns. The investigation on the household expenditure on agricultural production would indicate the liquid cash requirement for farming and the demand for credit facilities at the farm level. This particular investigation was helped to identify the relationship between farm incomes and expenditure and then to relate these to the socio-economic variables of the households. The third issue was highlighted the current status of food security, future trends and the self-sufficiency of rice production.

3.5. LIMITATIONS OF THE STUDY

As with many other cost of production studies this study also faced some difficulties in the presentation of data in terms of cost and market values. One of the major problems was that they were heavily reliance on owned resources such as family labor, and seed paddy. Hence, difficulties emerged in making a realistic assessment of these production inputs.

The farmers in two districts used different units to measure the amount of paddy. They mainly use Kuruni, Amunu, Vee malu and kilograms. However, the same types of measurements are not in uniform different villages in both districts.

Accounting the man-days contributed by the family labor and exchanged labor (mutually sharing labor) make difficulties due to the lack of records. Most of the paddy farmers interpret the labor use in terms of man-days rather than man-hours. The number of hours the labor working in the day and also the wages they are paid in completely different from one village to others.

As with most of the social science research, farmers responding to the questions from their memory rather than using any records kept by the farmers. Needless to say that in Sri Lanka, most of the farmers do not keep farm records either because they do not have required literacy to maintain records or they do not receive any benefit by keeping farm records. However, their memory is not very reliable source that they cannot remember the exact figures after several months. Hence the low reliability in data might affect the final interpretation of the results in to some extent.

The farmers always attempt to hide the real information concerning their income while exaggerating the real expenditure in paddy production. Hence, the enumerators and researchers had to make much effort to collect the data through cross-examining as well as field observations.

Chapter - 1 of the report gives a brief introduction to the study. The introduction consisted with the short background and the objectives of the study. Chapter - 2 review the literature related to the study. Chapter - 3 explains the methodology of the study. The methodology discusses the study area, data collection, data analysis, scope of the study and limitations of the study. The results and discussion of the study is organized in Chapter - 4. The Chapter - 4 consisted with main sub-sections of paddy farming and input use; cost of production; yield, income and profit; institutional setting; and economics of rice production. Finally the Chapter - 5 draws the conclusions and recommendations of the study.

4. RESULTS AND DISCUSSION

The Chapter - 4, results and discussion is arranged in five main sub-sections. The sub-sections are 4.1. - Paddy farming and input use; 4.2 - Cost of production; 4.3. - Yield, income and profit; 4.4. - Institutional setting; and 4.5. - Economics of rice production.

4.1. PADDY FARMING AND INPUT USE

The sub-section of Paddy farming and input use discusses the paddy farmers, highland cultivation, lowland cultivation and use of inputs in paddy cultivation.

4.1.1. PADDY FARMERS

4.1.1.1. Family size and age of farmers

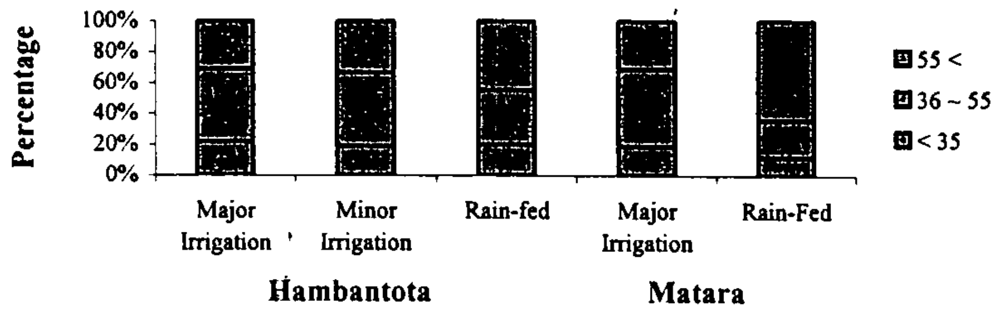
The average family size of the farmers in Hambantota district is 5, which is little higher than the average of 4 in Matara district. The study revealed that the mean of the age of paddy farmers in Hambantota is 49 year while 48 years in Matara district (Table – 4.1.1 and Figure – 4.1.1). The majority of the Major Irrigation (47%) and Minor Irrigation (48%) paddy farmer in Hambantota district (43%) are middle age (36 ~ 55 years) farmers. However, the majority of rain-fed farmers (45%) are old-age (55 < years) farmers. Similarly, majority of major irrigation farmers (50%) are middle age (36 ~ 55 years) farmers while the majority of rain-fed farmers (64%) are old-age (55 < years) farmers also in Matara district.

Table - 4.1.1. Age distribution of the farmers

Age (Years)	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
< 35	12 (22)	8 (19)	11 (20)	31 (20)	8 (19)	6 (12)	14 (15)
36 ~ 55	26 (47)	20 (48)	18 (35)	65 (43)	21 (50)	12 (24)	33 (36)
55 <	17 (31)	14 (33)	23 (45)	55 (36)	13 (31)	32 (64)	45 (49)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)
Mean	47	49	54	49	46	58	48

* Percentages are in parenthesis

FIGURE - 4.1.1. AGE DISTRIBUTION OF FARMERS



4.1.1.2. Education Level

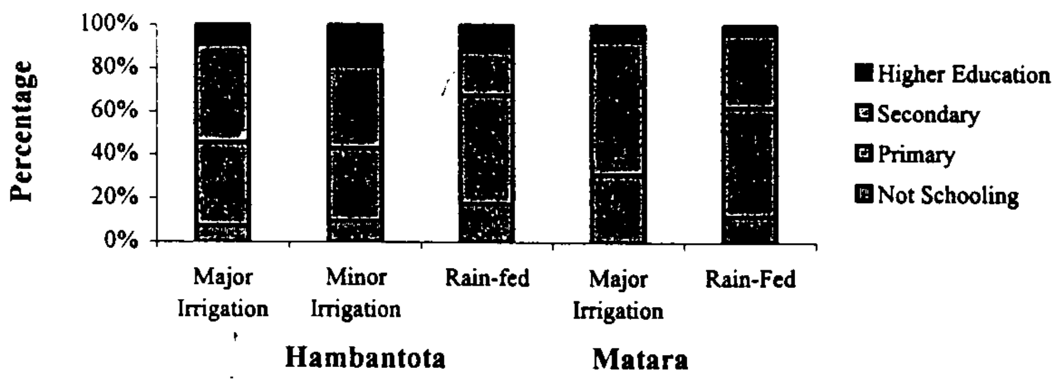
The education level of the paddy farmers in Matara district compared with Hambantota district is high. The majority 51% of farmers in Matara district have secondary education while only 48% of the farmers in Hambantota district above secondary education (Table – 4.1.2. and Figure – 4.1.2). However, the number of paddy farmers who have above secondary education in major (54%) and minor (57%) irrigation is higher than the rain-fed farmers (32%) in Hambantota district. Similarly, majority of major irrigation farmers in Matara district has above secondary education (69) while majority of rain-fed farmers has below primary level (62%).

Table - 4.1.2. Education levels of the farmers

Level	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Not Schooling	04 (07)	04 (10)	9 (18)	17 (11)	00 (00)	06 (12)	06 (06)
Primary (Grade 1~5)	21 (38)	14 (33)	26 (50)	61 (41)	13 (31)	25 (50)	38 (41)
Secondary (Grade 6~13)	25 (45)	16 (38)	11 (20)	52 (35)	26 (62)	17 (34)	43 (46)
Higher Education (Grade 13 <)	05 (09)	08 (19)	06 (12)	20 (13)	03 (07)	02 (04)	05 (05)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)
Mean (Grade)	10	9	8	9	10	9	10

* Percentages are in parenthesis

FIGURE - 4.1.2. EDUCATION LEVEL OF FARMERS



4.1.1.3. Employment and Income

All the farmers except 6 (4%) are full-time farmers in Hambantota district. The number of part time farmers 13 (14%) are comparatively high in Matara district. Many job opportunities particularly in carpentry, mason, non-agriculture and government sectors are available in Matara district with the rapid urbanization.

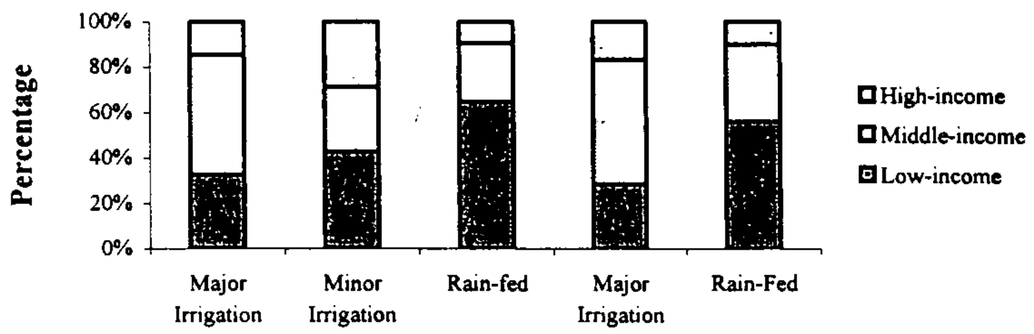
Annual income of the farmers are categorize as Low-income (Rs. < 50,000), Middle-income (50,001 ~ 100, 000) and High-income (Rs. > 100,001) considering the economic status of the farmers and also for the convenience. The mean value of the income of the farmers in Hambantota (Rs. 59,628) is lower than in Matara district (Rs. 52,390) (Table – 4.1.3 and Figure – 4.1.3). In general 47% of the paddy farmers in Hambantota district and 43% in Matara district are low-income farmers. However, most of the major irrigation farmers in Hambantota (68%) as well as in Matara (72%) are middle-income and high-income farmers. Even 58% of the minor irrigation farmers in Hambantota district are middle and high-income farmers. In both Hambantota (65%) and Matara (56%) district, rain-fed paddy farmers could be categorized as low-income farmers.

Table - 4.1.3. Annual income levels of the farmers

Income Rs. / Yr	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Low-income (< 50,000)	18 (33)	18 (43)	34 (65)	70 (47)	12 (29)	28 (56)	40 (43)
Middle-income 50,001 ~ 100,000	29 (53)	12 (29)	13 (26)	55 (36)	23 (55)	17 (34)	40 (43)
High-income 100,001 <	08 (15)	12 (29)	05 (09)	25 (17)	07 (17)	05 (10)	12 (13)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)
Mean (Rs.) US $ 1= SL Rs.95	84,200	61,510	36,840	59,628	89,730	41,460	52,390

* Percentages are in parenthesis

FIGURE - 4.1.3. INCOME OF THE FARMERS



4.1.2. HIGH-LAND CULTIVATION

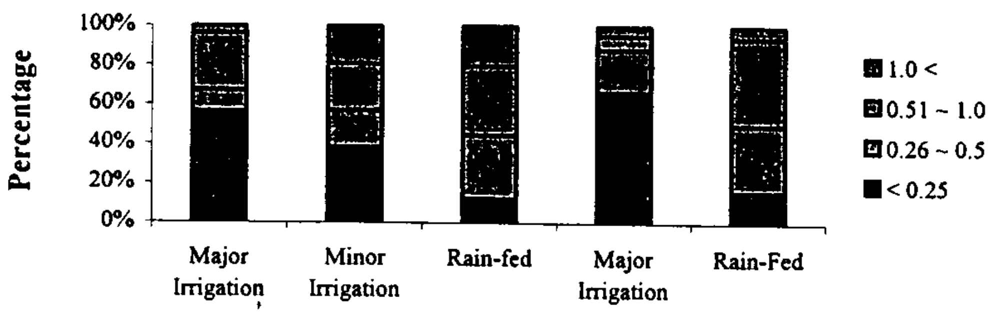
The study revealed that the mean values of the land extent of highland cultivation in Hambantota (0.36 ha.) and Matara districts (0.34 ha.) are almost the same (Table – 4.1.4 and Figure – 4.1.4). The majority of major (67%) and minor (57%) irrigation paddy farmers in Hambantota district have highlands small than 0.5 hectares. Most of these highlands are home-gardens where they cultivate coconut, cinnamon, fruits and other crops as mixed cropping systems. However, 55% of the ran-fed farmers in Hambantota district have highlands larger than 0.5 hectares where they cultivate mainly coconut, cinnamon, citronella and mixed crops for commercial purposes. Moreover, paddy farmers cultivate seasonal crops such as green gram, cowpea etc. during the Maha season in highlands as well as in paddy lands depending on the availability of water. Even in Matara district only 12% of the major irrigation paddy farmers have highlands larger than 0.5 hectares where they cultivate mainly pepper, coffee, cinnamon and cloves. Majority 50% of the rain-fed farmers has highlands larger than 0.5 hectares where they cultivate mainly tea, rubber, coconut, cinnamon and mixed crops as a family income source.

Table - 4.1.4. Cultivation of high-lands by paddy farmers

Land Extent (hectares)	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
< 0.25	31 (56)	16 (38)	06 (12)	54 (36)	28 (67)	08 (16)	37 (40)
0.26 ~ 0.5	06 (11)	08 (19)	17 (32)	31 (21)	09 (21)	17 (34)	26 (28)
0.51 ~ 1.0	16 (29)	10 (24)	18 (35)	45 (30)	03 (07)	22 (44)	25 (27)
1.0 <	02 (04)	08 (19)	11 (20)	21 (14)	02 (05)	03 (06)	05 (05)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)
Mean	0.31	0.33	0.53	0.3	0.27	0.48	0.34

* Percentages are in parenthesis

FIGURE - 4.1.4. HIGHLAND CULTIVATION



4.1.3. LOW-LAND CULTIVATION

4.1.3.1. Size of the lands

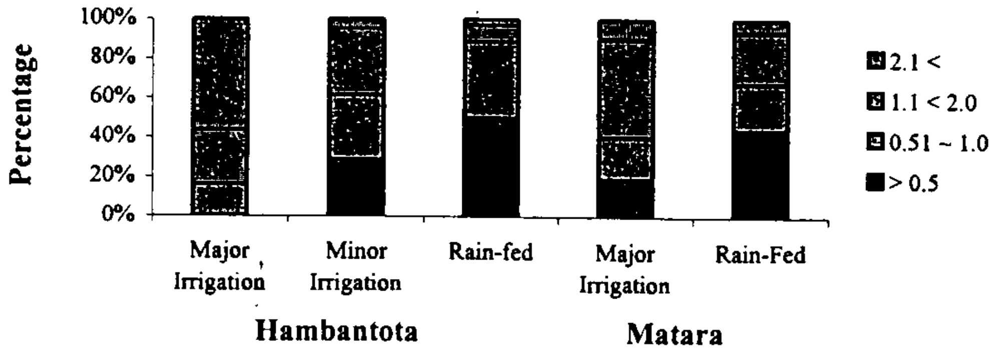
The average size of paddy lands in Hambantota district (mean – 1.83 ha.) is larger than in Matara district (mean – 1.18 ha.) (Table – 4.1.5. and Figure – 4.1.5). In Hambantota district, all major irrigation paddy farmers have more than 0.5 hectares of lowlands while 56% have even more than 2 hectares. From the minor irrigation paddy farmers 71% cultivate the lowland more 0.5 hectares. On the other hand 50% of the rain-fed farmers in the district cultivate smaller than 0.5 hectares and 89% have lands extend smaller than one hectare. However, 90% of the major irrigation paddy farmers in Matara district cultivate smaller than 2 hectares of lowlands while 81% have lowland extends larger than 0.5 hectares. Among the rain-fed farmers majority (44%) have less than 0.5 hectares of lowland and 68% have even less than 01 hectare.

Table - 4.1.5. Size of the low-lands of paddy farmers

Land Extent (hectares)	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
> 0.5	00 (00)	12 (29)	26 (50)	38 (26)	08 (19)	22 (44)	30 (33)
0.51 ~ 1.0	09 (16)	14 (33)	20 (39)	44 (29)	09 (21)	12 (24)	21 (23)
1.1 < 2.0	15 (27)	14 (33)	04 (08)	34 (22)	21 (50)	13 (26)	34 (37)
2.1 <	31 (56)	02 (05)	01 (03)	34 (23)	04 (10)	03 (06)	07 (08)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)
Mean	2.45	0.98	0.61	1.83	1.79	0.52	1.18

* Percentages are in parenthesis

FIGURE - 4.1.5. SIZE OF LOWLANDS



4.1.3.2. Ownership

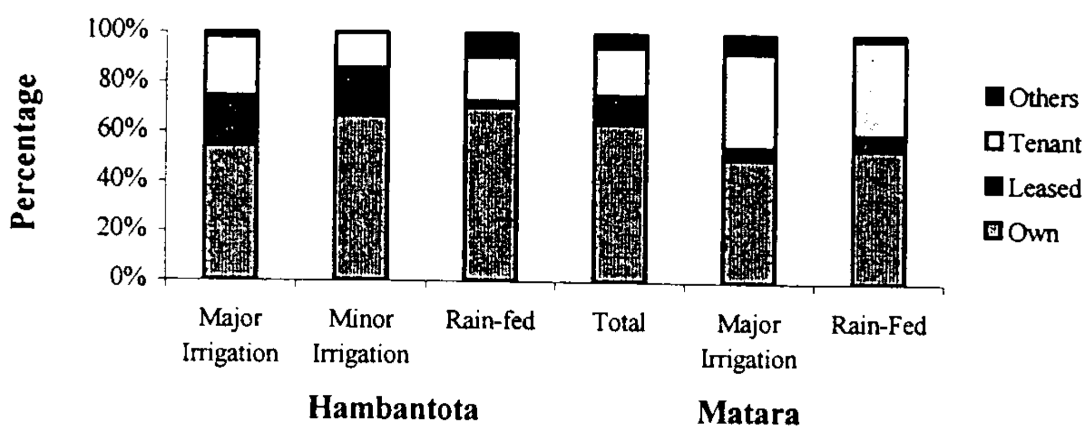
Majority of the paddy farmers in both Hambantota (63%) and Matara (52%) have their own lowlands (Table – 4.1.6 and Figure – 4.1.6). Among the paddy farmers in Hambantota district, most of the rain-fed farmers (70%) are the owners of their lowland while 55% major and 67% minor irrigation farmers own the lowlands. Even in Matara district majority of the farmers cultivate paddy under major (50%) and minor (54%) irrigation systems are the owners of their lowlands. In addition to the owners tenant farmers are also a prominent category of paddy farmers in Hambantota (19%) and Matara (38%) districts. Tenant farmers have to give 25% of the production to the landlord. Even 14% of the paddy farmers in Hambantota district posses leased paddy lands.

Table - 4.1.6. Ownership of the low-lands of paddy farmers

Ownership	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Own	30 (55)	29 (67)	37 (70)	95 (63)	21 (50)	27 (54)	48 (52)
Leased	11 (20)	08 (19)	01 (03)	21 (14)	02 (05)	03 (06)	05 (05)
Tenant	13 (24)	06 (14)	09 (18)	28 (19)	16 (38)	19 (38)	35 (38)
Others	01 (02)	00 (00)	05 (09)	06 (04)	03 (07)	01 (02)	04 (04)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

FIGURE - 4.1.6. OWNERSHIP OF LOWLANDS



4.1.3.3. Cultivation of Paddy

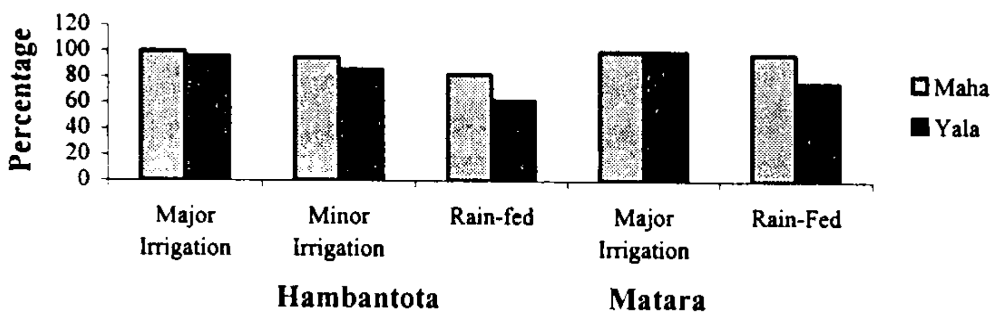
Almost all the paddy farmers in Hambantota (92%) and Matara (90%) cultivate paddy in their lowlands during Maha season (Table – 4.1.7. and Figure - 4.1.7). Hambantota and Matara district receive abundant rainfall during Maha season (September ~ March) through Southwest monsoons. All the paddy farmers (100%) in major irrigation schemes in both districts cultivate paddy in Maha Season. Although all the paddy farmers (100%) in major irrigation schemes in Matara districts cultivate paddy also in Yala season, 4% in Hambantota do not cultivate paddy due to personal reason other than problems directly involve with farming. In Yala season (March ~ August), the number of farmers cultivate paddy in their low land is less than Maha season in both Hambantota and Matara (87%) districts mainly due to the irrigation problems with limited water supply. The number of rain-fed paddy farmers cultivate paddy in Yala season is comparatively low in Matara (76%) and very low in Hambantota (62%). During the Yala season Hambantota district not only receive less rain but also face drought conditions. Even minor irrigation farmers 95% cultivate paddy in Maha season but only 86% cultivate in Yala season. Finally 260 (87%) farmers from 300 could be counted in Hambantota as the responded paddy farmers considering the cultivation of Yala and Maha season per year. In Matara district also, the responded number of paddy farmers is 163 (89%) from 184 considering both Yala and Maha. Total 423 farmers are counted for Yala and Maha for both districts.

Table - 4.1.7. Cultivation of paddy in low-lands of paddy farmers

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Yala	53 (96)	37 (86)	32 (62)	122 (81)	42 (100)	38 (76)	80 (87)
Maha	55 (100)	41 (95)	43 (82)	138 (92)	42 (100)	41 (98)	83 (90)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

FIGURE - 4.1.7. PADDY CULTIVATE IN LOWLANDS



4.1.3.4. Cultivation of other crops

Major irrigation paddy farmers in both Hambantota and Matara neither Yala nor Maha cultivate other field crops in their lowlands (Table – 4.1.8). Only few farmers (05%) cultivate other field crops in their lowlands only in Maha in minor irritations in

Hambantota districts. A considerable number of rain-fed farmers (28%) cultivate other file crops in lowlands during Maha season and 14% in Yala season in Hambantota district. Some rain-fed paddy farmers in Matara district grow other field crops in both Yala (16%) and Maha (22) seasons.

Table - 4.1.8. Cultivation of other crops in low-lands of paddy farmers

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Yala	00 (00)	00 (00)	07 (14)	07 (05)	00 (00)	08 (16)	08 (09)
Maha	00 (00)	02 (05)	15 (28)	17 (11)	00 (00)	11 (22)	11 (12)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

It is note worthy that 38% of the rain-fed farmers in Hambantota do not cultivate paddy in Yala season. Only 28% rain-fed cultivate other field crops Maha season and 10% do not cultivate any crop in their lowlands during Yala season. However, among the rain-fed paddy farmers in Matara district, only 24% do not cultivate paddy but 22% cultivate other field crops leaving lowlands uncultivated only by 2% farmer.

4.1.4. USE OF INPUTS IN PADDY CULTIVATION

4.1.4.1. Seed Paddy

4.1.4.1.1. Varieties

All the responded farmers (100%) who cultivate paddy in Hambantota and Matara use new improved paddy varieties. The major irrigation farmers in Matara district cultivate mainly (87%) BG 379 / 2 variety and the rest (23%) cultivate BG 357, 350 paddy variety. The rain-fed farmers in Matara district cultivate different varieties such as BG 379/2, BG 352, AG 353, BG 350, 3.5 Var, AT. 362 and BG 94/1.

The paddy farmers in Hambantota cultivate number of different varieties such as AG 353, AT 354, BG 351, BG 379-2, BG 400-1, BG 300, AT 353 and AT 303. They need approximately 5 bushels of seed paddy to broadcast for one hectare of land. The farmers cultivate recommended varieties for different areas by the Agricultural Department. According to them there is no much impact of the present varieties they cultivate on paddy yield in both districts.

4.1.4.1.2. Sources of Supply

Majority of the farmers in both Hambantota and Matara districts use the paddy seeds which are produced by themselves during Yala (55% and 56%) and Maha (51% and 55%) seasons (Table – 4.1.9 and Figures – 3.8A & 3.8B). Second main source of seed paddy in Hambantota is the neighbors both in Yala (23%) and Maha (26%) while Department of Agriculture (DOA) has become the third source in Yala (18%) and Maha (20%). Department of Agriculture distributes seed paddy through the Agrarian Service

Centers (ASC – Krushikarma Kendra). However, in Matara district the second main source of seed paddy is the DOA both in Yala (21%) and Maha (24%) while neighbor has become the third source in Yala (20%) and Maha (18%). Generally, the private sector contribution in seed paddy supply is negligible both in Hambantota and Matara districts.

It could be revealed that most of the major irrigation paddy farmers in Hambantota use self-produced seed paddy both in Yala (72%) and Maha (69%) seasons. Only very few major irrigation paddy farmers purchase seed paddy from DOA in Yala (06%) and Maha (05%). Some of the minor irrigation paddy farmers purchase seed paddy from DOA in Yala (17%) and Maha (20%). However, the main source of seed paddy is the DOA of the rain-fed farmers in the district both in Yala (41%) and Maha (39%). Similarly, in Matara district the main source of seed paddy for major irrigation farmers is self-produced seed both in Yala (74%) and Maha (71%) seasons. The main source of seed paddy for the rain-fed farmers is the DOA both in Yala (56%) and Maha (55%) seasons. From the farmers who purchase seed paddy from the DOA counting two seasons (87 or 21%) complain about the poor supply (71% or 62), irregular supply (59% or 51) and insufficient amount (53% or 46) due to lack of distribution centers. Further, low purity of seed, which are mixed with different varieties, discourages 46% (40) of the buyers of DOA seeds.

Table - 4.1.9. Sources of seeds for paddy farmers

Sources	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Self	38 (72)	16 (44)	13 (39)	67 (55)	31 (74)	14 (37)	45 (56)
Neighbors	10 (19)	12 (33)	06 (17)	28 (23)	08 (19)	08 (21)	16 (20)
Private	02 (04)	02 (06)	01 (02)	05 (04)	01 (02)	01 (03)	02 (03)
DOA	03 (06)	06 (17)	13 (41)	22 (18)	02 (05)	15 (39)	17 (21)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Self	38 (69)	16 (40)	16 (38)	71 (51)	30 (71)	16 (39)	46 (55)
Neighbors	12 (22)	14 (35)	09 (21)	36 (26)	09 (21)	06 (15)	15 (18)
Private	02 04)	02 (05)	01 (02)	05 (03)	01 (02)	01 (02)	02 (02)
DOA	03 (05)	08 (20)	17 (39)	28 (20)	02 (05)	18 (44)	20 (24)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

FIGURE - 4.1.8A. SOURCE OF SEED PADDY - YALA

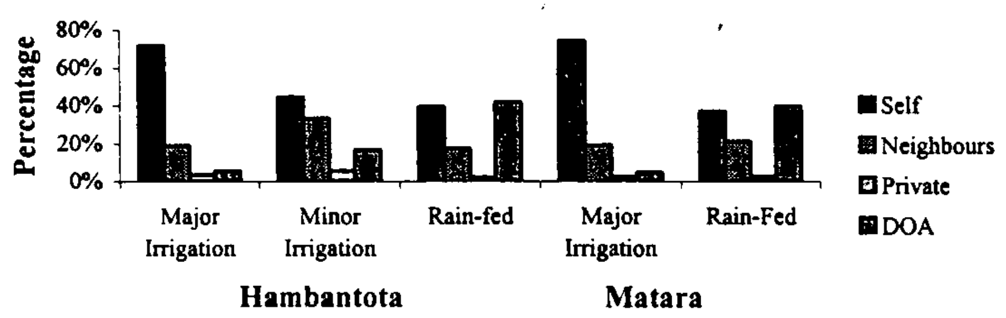
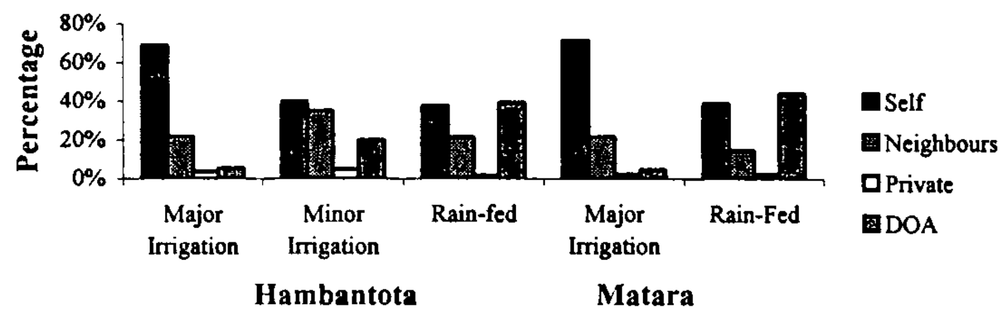


FIGURE- 4.1.8B. SOURCE OF SEED PADDY - MAHA



4.1.4.1.3. Main Problems

All the farmers as usually require further improvement of the paddy variety. Low yield is the main common problem of all the respondents despite the irrigation method, season and the district (Table – 4.1.10 and Figure 4.1.9A & 4.1.9B). Most of the paddy farmers in Hambantota and Matara districts expressed their problem of low yield given by the available seed paddy variety. The next main problem of the paddy farmers in Hambantota Yala (75%) and Maha (69%) as well as in Matara Yala (69%) and Maha (70%) is the susceptibility of the variety for pest and disease that destroy a considerable amount of paddy from the expected yield. All those farmers complain about the very often pest out break and the unbearable expenditure for pest control. However, the problems of pest damage is very severe in Yala season under rain-fed condition in Hambantota. Therefore, the utmost important problem of the 91% farmers is the severe pests damaging their crop hopefully due to the variety characteristic. Some of the paddy farmers in Hambantota particularly the major irrigation farmers (40%) and rain-fed farmers (44%) in Maha complain about the low suitability of the paddy varieties recommended for their paddy fields.

Table - 4.1.10. Problems of seed paddy variety by paddy farmers

Problem	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Low Yield	41 (77)	29 (78)	19 (59)	89 (73)	31 (74)	28 (74)	59 (74)
Low Suitability	16 (30)	12 (32)	06 (17)	34 (28)	08 (19)	08 (21)	16 (20)
Pest & Diseases	38 (72)	24 (65)	29 (91)	91 (75)	24 (57)	31 (82)	55 (69)
Inconvenience	11 (21)	06 (17)	02 (06)	19 (16)	02 (05)	03 (08)	05 (06)
Others	07 (13)	03 (08)	02 (06)	06 (05)	02 (05)	01 (03)	03 (04)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Low Yield	46 (84)	33 (80)	39 (91)	118 (85)	37 (88)	33 (80)	70 (84)
Low Suitability	22 (40)	16 (39)	19 (44)	57 (41)	13 (31)	06 (15)	19 (23)
Pest & Diseases	37 (64)	28 (68)	31 (72)	96 (69)	29 (69)	29 (71)	58 (70)
Inconvenience	12 (22)	08 (20)	04 (09)	24 (17)	08 (19)	04 (10)	12 (14)
Others	08 (15)	05 (12)	02 (05)	15 (11)	02 (05)	03 (03)	05 (06)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

FIGURE - 4.1.9A. PROBLEMS OF SEED PADDY - YALA

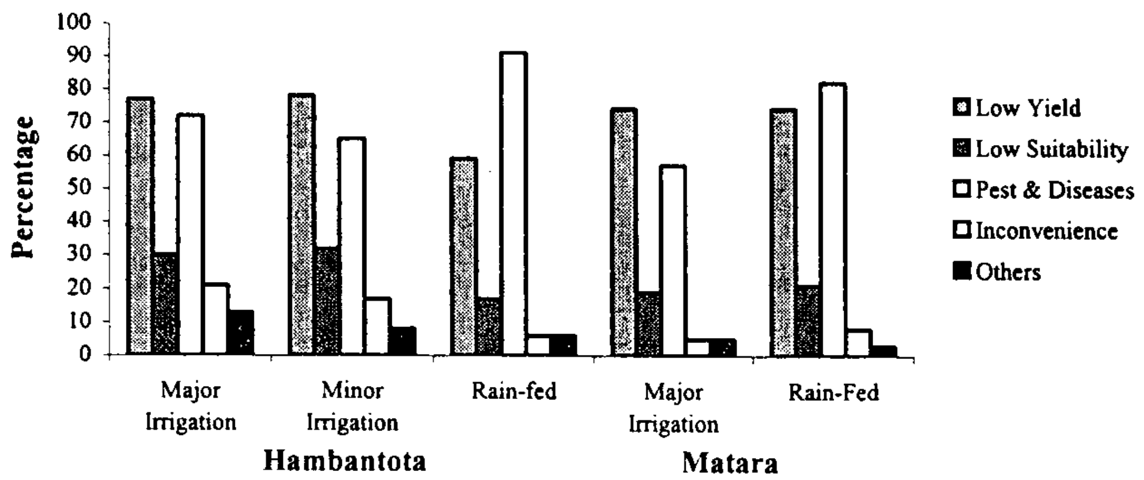
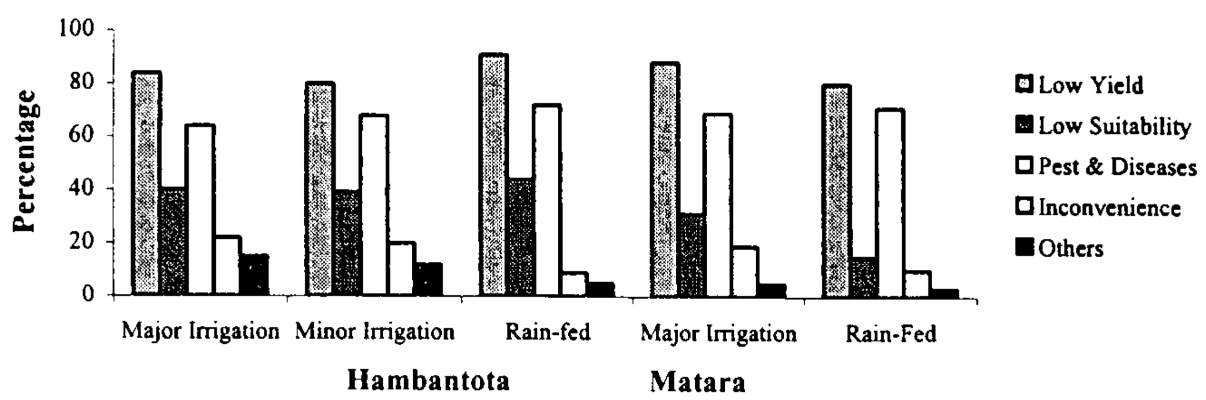


FIGURE - 4.1.9B. PROBLEMS OF SEED PADDY - MAHA



4.1.4.2. Fertilizer

4.1.4.2.1. Types

All the responded farmers (100%) in both districts use inorganic fertilizer for their paddy cultivation. They usually apply basal mixture (V mix), urea and TDM as the fertilizers recommended by the Department of Agriculture. The farmers in Hambantota district apply average 148 kg of Basal Mixture, 150 kg of Urea and 144 kg of TDM during the Yala season while 152 kg of Basal Mixture, 151 kg of Urea and 148 kg of TDM during the Maha season per hectare of land (Table - 4.1.11). The farmers in Matara districts also apply the almost same amount of fertilizer. They apply average 156 kg of Basal Mixture, 151 kg of Urea and 154 kg of TDM during the Yala season while 156 kg of Basal Mixture, 151 kg of Urea and 158 kg of TDM during the Maha season per hectare of land. However, only 3 (06%) rain-fed farmers in Hambantota district and 2 (04%) rain-fed farmers in Matara use organic fertilizer together with inorganic fertilizer to their paddy field. They apply straw with average one Mt of cow-dung as organic manure. They themselves do not satisfy with the amount they apply due to unavailability in required quantity of organic fertilizer.

Table - 4.1.11. Type and amount of fertilizer (kg / ha) used by paddy farmers

	Hanbantota				Matara		
	Major	Minor	Rain-fed	Average	Major	Rain-fed	Average
Yala							
Basal Mixture	150	140	155	148	166	145	156
Urea	155	138	156	150	157	145	151
TDM	145	140	148	144	158	150	154
Maha							
Basal Mixture	153	144	158	152	164	148	156
Urea	155	140	157	151	156	145	151
TDM	145	145	155	148	160	155	158

4.1.4.2.2. Sources

The main source of fertilizer for the paddy farmers in Yala (63%) and Maha (63%) in Hambantota; and Yala (55%) and Maha (54%) in Matara district is the private sector (Table – 4.1.12 and Figures 3.10A. & 3.10B). The second source of fertilizer supply is recorded as the ASC. ASC is the source of fertilizer for 26% farmers during Yala and Maha in Hambantota district while 30% farmers in Yala and 29% in Maha in Matara district. However, the majority of rain-fed farmers purchase fertilizer from ASC during both Yala (47%) and Maha (44%) in Matara district and Yala season (47%) in Hambantota district. The farmers who purchase fertilizer from ASC state the reason that the price at ASC is less than the private sector. The farmers who purchase fertilizer from private sector (253 for both seasons) consider the convenience (83% or 210), reliability (58% or 147) and availability (39 or 99) as the main reasons. The numbers of farmers purchase fertilizer through farmer organization and fertilizer stores are less than 11% and 08% which are negligible under all three irrigation conditions in both districts.

Table - 4.1.12. Sources of fertilizer for paddy farmers

Sources	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Fertilizer Store	04 (08)	02 (05)	00 (00)	06 (05)	03 (07)	00 (00)	03 (04)
Private shop	42 (79)	23 (62)	12 (38)	77 (63)	32 (76)	12 (32)	44 (55)
ASC	06 (11)	11 (30)	15 (47)	32 (26)	06 (14)	18 (47)	24 (30)
Farmer Org.	01 (02)	01 (03)	05 (16)	07 (06)	01 (02)	08 (21)	09 (11)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Fertilizer Store	04 (07)	03 (07)	00 (00)	07 (05)	05 (12)	00 (00)	05 (06)
Private shop	44 (80)	25 (61)	18 (42)	87 (63)	29 (69)	16 (39)	45 (54)
ASC	06 (11)	11 (27	19 (44)	36 (26)	06 (14)	18 (44)	24 (29)
Farmer Org.	01 (02)	02 (05)	06 (14)	09 (06)	02 (05)	07 (17)	09 (11)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

FIGURE - 4.1.10A. SOURCES OF FERTILIZER - YALA

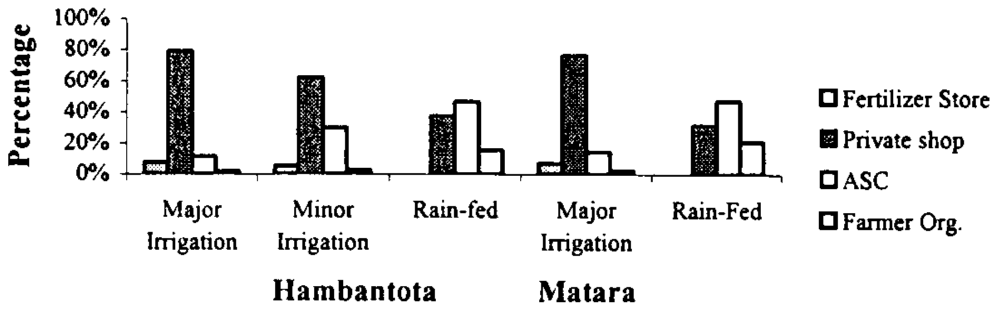
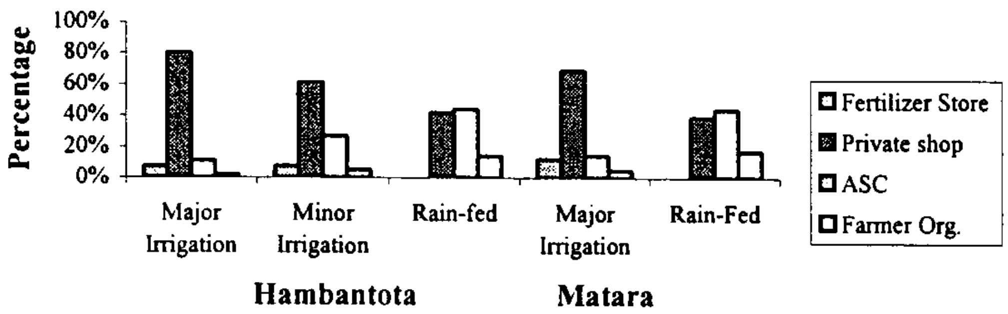


FIGURE - 4.1.10B. SOURCES OF FERTILIZER - MAHA



4.1.4.2.3. Problems

All the responded farmers (100%) feel that the price of fertilizer is very high and unbearable (Table - 4.1.13 and Figures 4.1.11A & 4.1.11B). On the other hand most of the paddy farmers in major irrigation (76%) and ran-fed (78%) cultivation in Matara district have the opinion that their paddy yield is not properly responded to the application of fertilizer. Moreover, paddy farmers for rain-fed Maha (63%) and Yala (69%), minor irrigation Maha (54%) and Yala (62%), and major irrigation Yala (55%) in

Hambantota district also face the same problem of poor yield response of fertilizer in paddy yield. The responded farmers (62% or 157) believe that the fertilizer recommendations are not suitable for the soil of their paddy field, soil is less fertile (54% or 137) and 48% (121) farmer has the doubt about the quality of their recommended fertilizer. Irregular supply of fertilizer is also a considerable problem particularly for the rain-fed farmers in Hambantota (Yala – 44%and Maha – 40%) and Matara (Yala – 34% and Maha – 32%). According to the farmers, supply of fertilizer by the ASC in many cases is irregular due so much formalities. Only few paddy farmers even less than 12% face the problem of insufficient supply of fertilizer.

Table - 4.1.13. Problems related to fertilizer faced by paddy farmers

Problem	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
				Yala			
High price	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
Poor response	29 (55)	23 (62)	22 (69)	74 (61)	31 (74)	30 (79)	61 (76)
Insufficient	08 (15)	04 (11)	04 (13)	16 (13)	04 (10)	03 (08)	07 (09)
Irregular supply	11 (21)	08 (22)	14 (44)	33 (27)	04 (10)	13 (34)	17 (21)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
				Maha			
High price	55 (100)	41 (100)	43 (100)	139 (100)	42 (100)	41 (100)	83 (100)
Poor response	26 (47)	22 (54)	27 (63)	75 (54)	31 (74)	32 (78)	63 (76)
Insufficient	08 (15)	04 (10)	05 (12)	17 (12)	04 (10)	03 (07)	07 (08)
Irregular supply	11 (20)	08 (20)	17 (40)	36 (26)	04 (10)	13 (32)	17 (20)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

FIGURE - 4.1.11A. PROBLEMS OF FERTILIZER - YALA

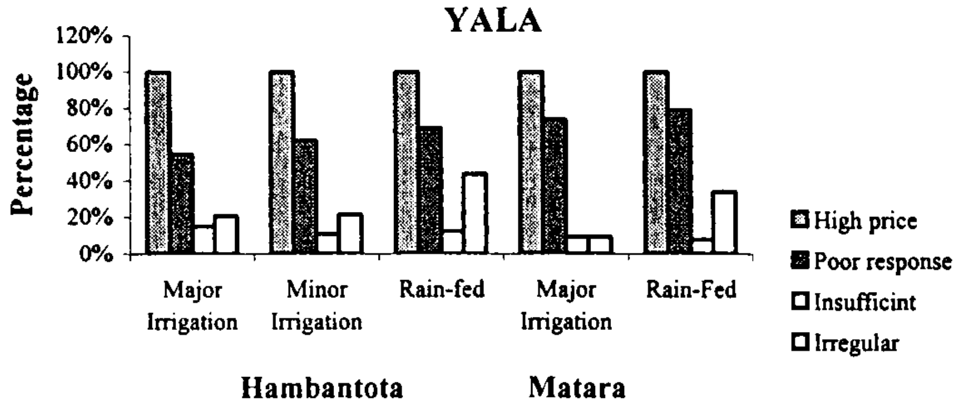
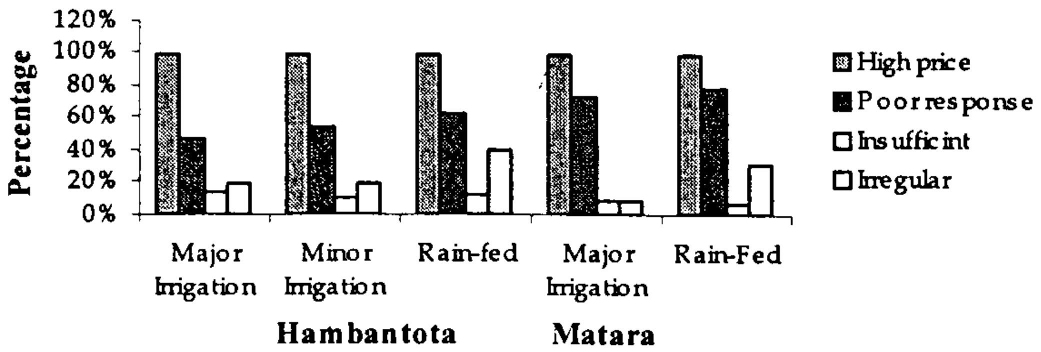


FIGURE - 4.1.11B. PROBLEMS OF FERTILIZER - MAHA



4.1.4.3.Agro-chemicals

4.1.4.3.1. Weed Control

4.1.4.3.1.1. Methods

The main weed control method in both Hambantota and Matara districts is a combination of manual weeding (Ma) and weedicide application (We) with water management (Wa) techniques. Nobody use any single methods to control the weeds. They usually use 3-4 DPA as a popular weedicide for their paddy fields. The selection of the combination is varying with the method of irrigation and the season they cultivate paddy. The combination of water management and spraying of weedicide (Wa + We) is the most popular weed control method in Hambantota (Yala – 48% and Maha – 44%) and Matara (Yala – 51% and Maha – 49%) districts (Table - 4.1.14 and Figures – 4.1.12A & 4.1.12B). However, the majority of paddy farmers uses the combination of all three methods (Wa + Ma + We) in rain-fed (Maha – 51%) and minor irrigation (Yala – 46% and Maha – 41%) in Hambantota district. Even in Matara district the most popular weed control method is the same combination under rain-fed (Yala – 42% and Maha – 41%) condition. The combination of water management and manual weed control method is the least popular method in both Hambantota (Yala – 15% and Maha – 17%) and Matara (Yala – 11% and Maha – 13%) districts. However under minor irrigation conditions in Hambantota district the combination of water management and manual weed control method (Yala – 35% and Maha – 37%) is much popular than the combination of water management and spraying of weedicide method. Even under rain-fed condition, considerable number of farmers use the same combination in Hambantota (Maha – 20%) district.

Table - 4.1.14. Methods of controlling weeds by paddy farmers

Requirement	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Wa+Ma	02 (04)	13 (35)	03 (09)	18 (15)	03 (07)	06 (16)	09 (11)
Wa+We	37 (70)	07 (19)	15 (47)	59 (48)	25 (60)	16 (42)	41 (51)
Wa+Ma+We	14 (26)	17 (46)	14 (44)	45 (37)	14 (33)	16 (42)	30 (38)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Wa+Ma	02 (04)	15 (37)	06 (14)	23 (17)	03 (07)	08 (20)	11 (13)
Wa+We	37 (67)	09 (22)	15 (35)	61 (44)	25 (60)	16 (39)	41 (49)
Wa+Ma+We	16 (29)	17 (41)	22 (51)	55 (40)	14 (33)	17 (41)	31 (37)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

*Percentages are in parenthesis

FIGURE - 4.1.12A. WEED CONTROL METHODS - YALA

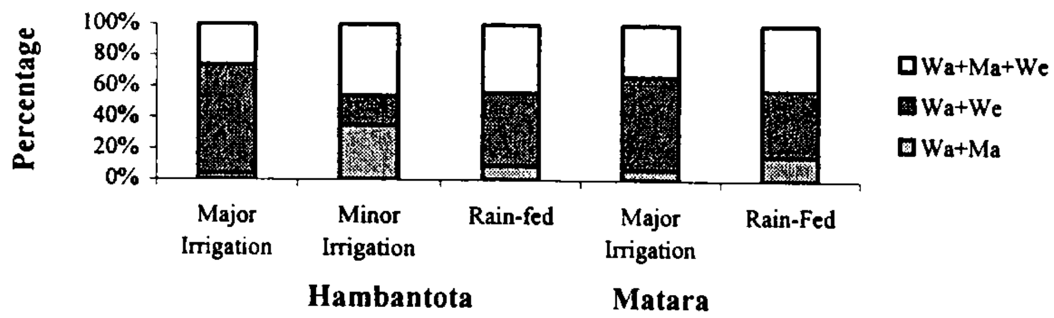
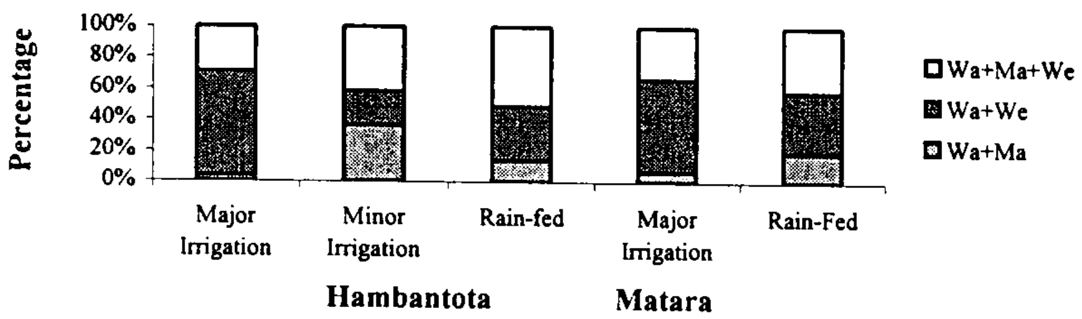


FIGURE - 4.1.12B. WEED CONTROL METHODS - MAHA



4.1.4.3.1.2. Main Problems

All the paddy farmers who apply weedicide as a mode of weed control for both seasons in Hambantota and Matara districts (363 or 100%) have disappointed with the very high and unbearable price of weedicides (Table - 4.1.15). The majority of rain-fed farmers in Hambantota have complained about the poor response of purchased weedicides on the weeds in both Yala (59%) and Maha (51%) seasons. Even the majority of rain-fed paddy farmers in Matara district also have the problem of poor response of weedicide during the Yala season (56%). Generally, a considerable number of the paddy farmers in

Hambantota (Yala – 41% and Maha – 38%) and Matara (Yala and Maha – 32%) districts feel that the weedicides are not responsive as they expect. Insufficient and irregular supply of weedicides are not being a problem for the paddy farmers in both districts. They are able to by the required weedicide in required quantity when they required and if the money is available.

Table - 4.1.15. Problems related to weedicide faced by paddy farmers

Requirement	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
High price	51 (100)	24 (100)	29 (100)	104 (100)	39 (100)	32 (100)	71 (100)
Poor response	17 (33)	09 (38)	17 (59)	43 (41)	07 (18)	18 (56)	23 (32)
Insufficient	00 (00)	01 (04)	00 (00)	01 (01)	00 (00)	01 (03)	01 (01)
Irregular supply	00 (00)	01 (04)	00 (00)	01 (01)	00 (00)	01 (03)	01 (01)
Total	51 (100)	24 (100)	29 (100)	104 (100)	39 (100)	32 (100)	71 (100)
			Maha				
High price	53 (100)	26 (100)	37 (100)	116 (100)	39 (100)	33 (100)	72 (100)
Poor response	16 (30)	09 (35)	19 (51)	44 (38)	07 (18)	16 (48)	23 (32)
Insufficient	00 (00)	01 (04)	01 (03)	02 (02)	00 (00)	01 (03)	01 (1)
Irregular supply	00 (00)	01 (04)	01 (03)	02 (02)	00 (00)	02 (06)	02 ((3)
Total	53 (100)	26 (100)	37 (100)	116 (100)	39 (100)	33 (100)	72 (100)

* Percentages are in parenthesis

FIGURE - 4.1.13A. PROBLEMS IN WEEDICIDES - YALA

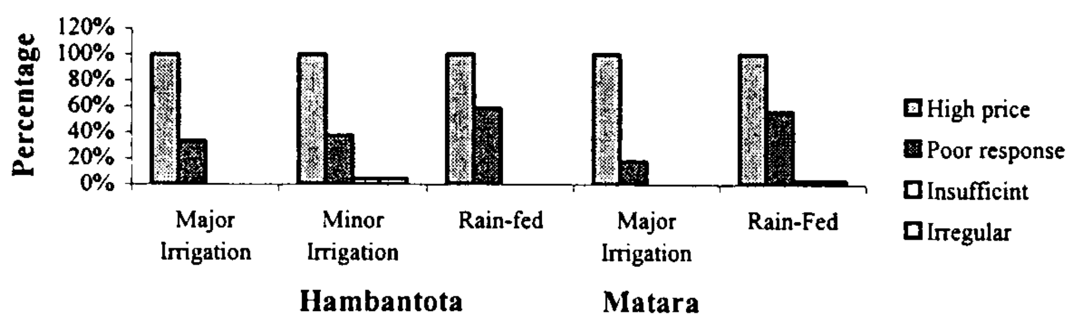
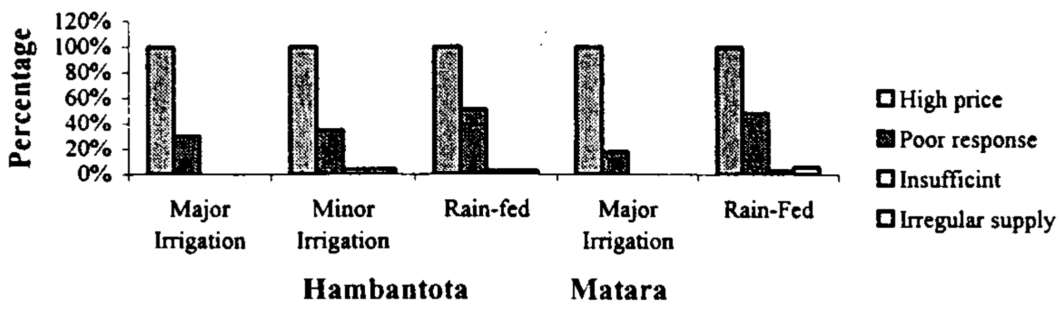


FIGURE - 4.1.13B. PROBLEMS IN WEEDICIDES - MAHA



4.1.4.3.2. Pest control

4.1.4.3.2.1. Method

The common pests mainly Leaf Eating Caterpillar cause a considerable damage to the paddy crop in Hambantota and Matara districts during both Yala and Maha seasons while Brown Plan Hopper (BPH) mainly damage in Maha season unless it is controlled properly in time. Trips and Mites are gradually disappearing from the paddy fields. Integrated Pest Management (IPM) has become the most popular method of pest control in Hambantota (Yala – 50% and Maha – 49%) and Matara (Yala – 46% and Maha – 48%) districts (Table – 4.1.16. and Figures – 4.1.14A & B). Even though the IPM is the most popular pest control method in major and minor irrigated paddy fields, chemical pest control method is the most prevalent method in rain-fed paddy farming in both Hambantota (Yala – 69% and Maha – 63%) and Matara (Yala – 63% and Maha – 59%) districts. They prefer the application of chemical as a very convenient method. IPM indeed needs some skills and the farmers have to follow the procedures as they are instructed. Manual pest control is very rarely practicing even less than 10% in both districts.

Table - 4.1.16. Methods of controlling pests by paddy farmers

Requirement	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Manual	01 (02)	01 (03)	01 (03)	03 (02)	03 (07)	04 (11)	07 (09)
Chemical	20 (38)	16 (43)	22 (69)	58 (48)	12 (29)	24 (63)	36 (45)
IPM	32 (60)	20 (54)	09 (28)	61 (50)	27 (64)	10 (26)	37 (46)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Manual	01(02)	02 (05)	02 (05)	5 (04)	03 (07)	04 (10)	07 (08)
Chemical	21 (38)	18 (44)	27 (63)	66 (48)	12 (29)	24 (59)	36 (43)
IPM	33 (60)	21 (51)	14 (33)	68 (49)	27 (64)	13 (32)	40 (48)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

*Percentages are in parenthesis

FIGURE - 4.1.14B. PEST CONTROL METHODS - MAHA

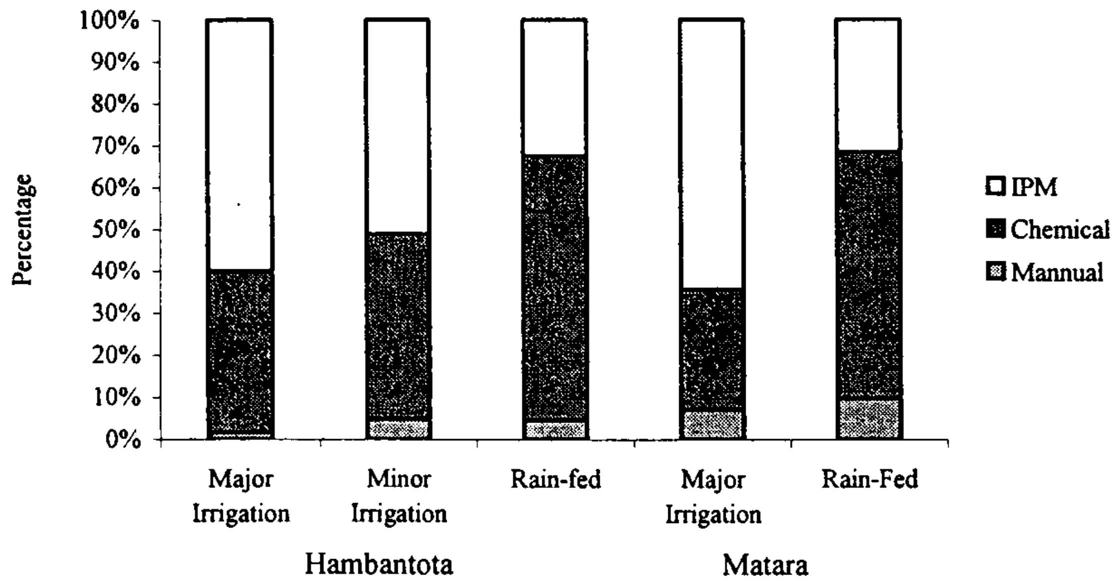
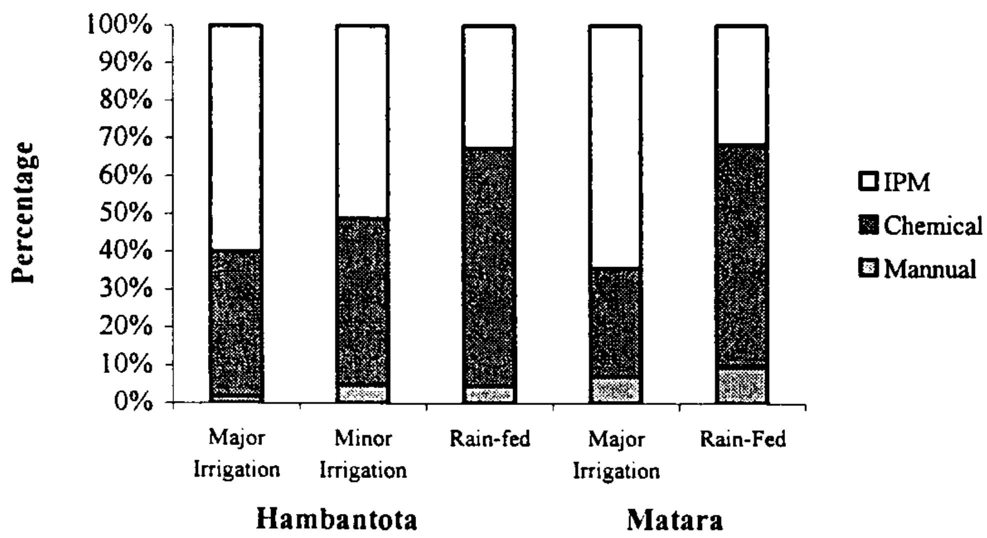


FIGURE - 4.1.14A. PEST CONTROL METHOD - YALA



4.1.4.3.2.2. Main Problems

All the paddy farmers who use pesticides to control pest (402 or 100%) have a problem of very high price of pesticide in paddy farming (Table – 4.1.17. and Figures – 4.1.15A & B). However, comparing the expenses for weedicides, pesticide expenditure is very less which requires about 20% of the expenses for weedicides. The other main problem of the paddy farmers in relation to pesticides is the poor response of pesticide on pests. Some farmers in Hambantota (Yala – 25% and Maha – 22%) and Matara (Yala – 23% and Maha – 22%) districts are considering the poor response of pestcide to control pest as a problem. The problem of poor pesticide response on pest is comparatively high in rain-fed farming in Hambantota (Yala – 39% and Maha – 32%) and Matara (Yala – 32% and Maha – 30%) districts. The farmers consider resistance of pests for pesticides as a problem. Further, the problem is higher in Maha (Hambantota – 23% and Matara – 25%) season than in Yala (Hambantota – 22% and Matara – 22%) season. The pest problem is so severe in Yala season due to less rain and other climatic condition than in Maha season. There is no any problem of insufficient and irregular supply of pesticides in the both districts. Pesticides are readily available at the village boutiques in most of the areas.

Table - 4.1.17. Problems related to pesticides faced by paddy farmers

Requirement	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
High price	52 (100)	36 (100)	31 (100)	119 (100)	39 (100)	34 (100)	73 (100)
Poor response	11 (21)	07 (19)	12 (39)	30 (25)	06 (15)	11 (32)	17 (23)
Insufficient	00 (00)	01 (03)	00 (00)	01 (01)	00 (00)	01(03)	01 (01)
Irregular supply	00 (00)	01 (03)	00 (00)	01 (01)	00 (00)	01 (03)	01 (01)
Total	52 (100)	36 (100)	31 (100)	119 (100)	39 (100)	34 (100)	73 (100)
			Maha				
High price	54 (100)	39 (100)	41 (100)	134 (100)	39 (100)	37 (100)	76 (100)
Poor response	10 (19)	07 (18)	13 (32)	30 (22)	06 (15)	11 (30)	17 (22)
Insufficient	00 (00)	01 (03)	01 (02)	02 (01)	00 (00)	01 (03)	01 (01)
Irregular supply	00 (00)	01 (03)	01 (02)	02 (01)	00 (00)	02 (05)	02 (03)
Total	54 (100)	39 (100)	41 (100)	134 (100)	39 (100)	37 (100)	76 (100)

* Percentages are in parenthesis

Figure - 4.1.15A. PROBLEMS OF PESTICIDE

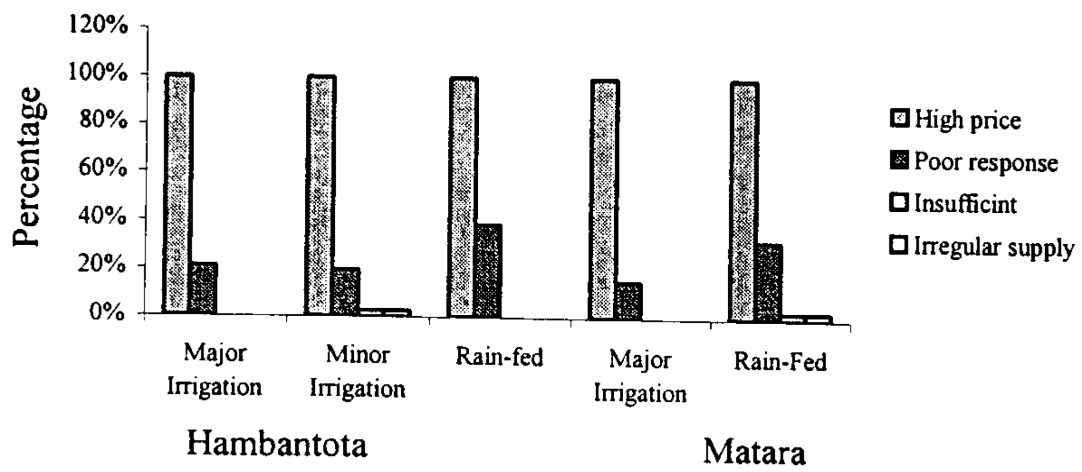
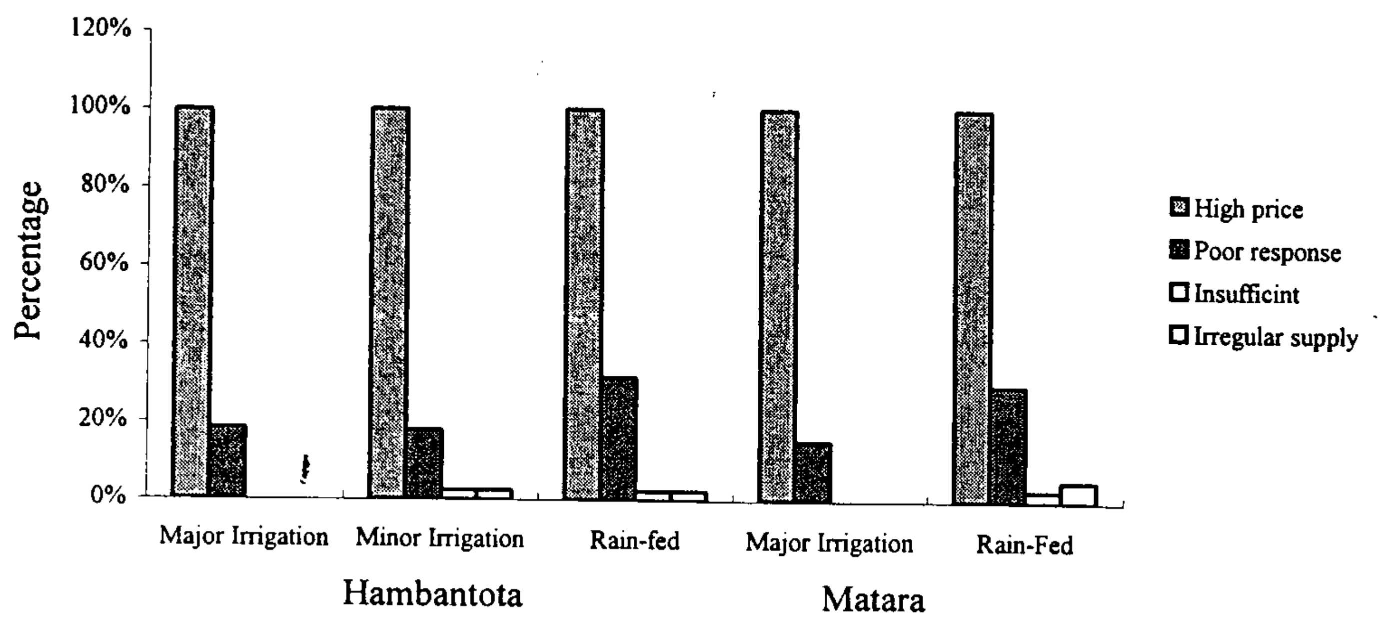


FIGURE - 4.1.15B. PROBLEMS OF PESTICIDE - MAHA



4.1.4.4. Labor

4.1.4.4.1. Usage and Composition

Paddy farming is very labor consuming production system. Family and hired labor are the main two types of labor available in paddy farming. In both district labor is utilized in main activities of clearing of land, preparation of bunds, land preparation, broadcasting seeds, harvesting, collecting and, also for application of chemicals and fertilizer. Average Yala and Maha – 77 labor days per hectare per season is used in paddy farming in Hambantota district while Matara distract use (Yala – 82 and Maha – 80) somewhat higher in average (Table – 4.1.18. and Figures – 4.1.16A & B). The highest labor days per hectare per season is recorded under rain-fed farming conditions in Hambantota (Yala – 106 and Maha – 105) and Matara (Yala – 101 and Maha – 98) districts. Minor irrigation paddy farming in Hambantota (Yala – 70 and Maha – 69) use a moderate number of man-days per hectare per season. They use labor for all the above activities in combining with tractors and other equipments. The lowest number of labor is used for paddy farming under major irrigation conditions in both Hambantota (Yala and Maha – 56%) and Matara (Yala – 62% and Maha – 61%) districts. Under the major irrigation systems in both districts labor is not used for land preparation particularly for ploughing. The use of family labor in Hambantota district (Yala – 79% and Maha – 78%) is higher than in Matara district (Yala – 63% and Maha – 67%). There is no any significant different in use of number of labor or the labor composition between each season in both district. The use of family labor is very high in rain-fed farming in both Hambantota (Yala – 79% and Maha – 78%) Matara districts (Yala – 68% and Maha – 76%). They mainly use their family labor in paddy cultivation. Comparatively use of hired labor is highest in major irrigation paddy farming in both Hambantota (Yala – 43% and Maha – 44%) and Matara districts (Yala and Maha – 45%).

Table - 4.1.18. Average usage (labor days) and composition of labor in paddy farming per hectare per season

Composition	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
			Yala				
Family labor	32 (57)	51 (73)	84 (79)	56 (72)	34 (55)	69 (68)	52 (63)
Hired labor	24 (43)	19 (27)	22 (21)	22 (28)	28 (45)	32 (32)	30 (32)
Total	56 (100	70 (100)	106 (100)	77 (100)	62 (100)	101 (100)	82 (100)
			Maha				
Family labor	31 (56)	50 (72)	82 (78)	54 (71)	34 (55)	74 (76)	54 (67)
Hired labor	25 (44)	19 (28)	23 (22)	22 (29)	28 (45)	24 (24)	26 (32)
Total	56 (100)	69 (100)	105 (100)	77 (100)	61 (100)	98 (100)	80 (100)

* Percentages are in parenthesis

FIGURE - 4.1.16A. USE OF LABOR DAYS - YALA

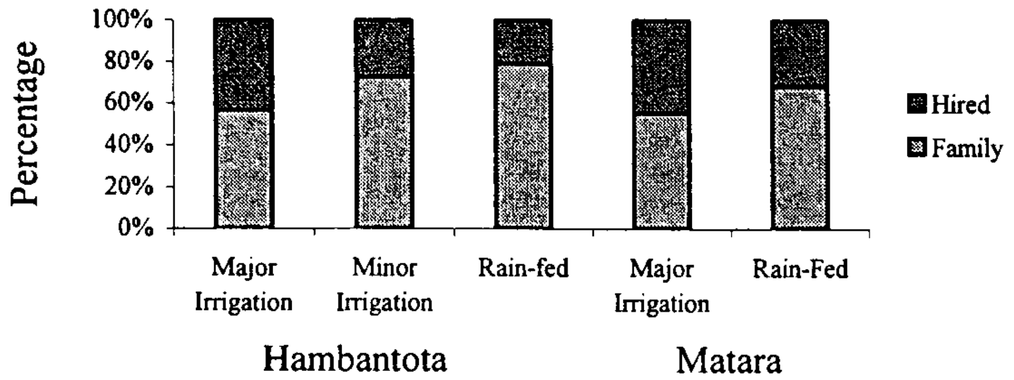
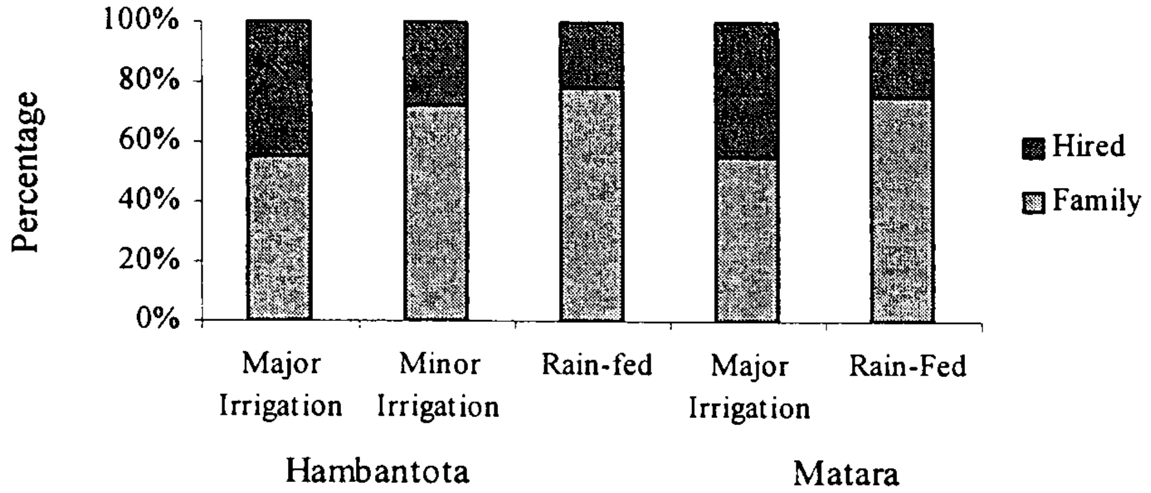


FIGURE - 4.1.16B USE OF LABOR DAYS - MAHA



4.1.4.4.2. Main Problems

All the paddy farmers during both seasons (423 or 100%) have the most severe problem of very high wage rate of labor (Table – 4.1.19. and Figures – 4.1.17A & B). However, compared to other non-agricultural sector labor wage is quite high as Rs. 200.00 ~ 400.00 per day. Due to the low rate of return from paddy farming the farmers feel that the labor wages are unbearable. Further, lack of skilled labor, insufficient supply of labor in the farming areas and irregular supply of labor particularly during the required labor peeks are considered as very important problems in both districts under all irrigation methods during the both seasons (Table - 3.4.15). The lack of skilled labor is a remarkable problem in rain-fed paddy farming in both Hambantota (Yala – 69% and Maha – 65%) and Matara (Yala and Maha – 76%) districts. The family labor, which makes the major contribution, has no much knowledge and experience in farming. Insufficient supply of labor in paddy farming (Yala and Maha – 36%) is recorded highest in Matara district mainly due to opening up of non-agricultural occupations with the rapid urbanization. Insufficient supply of labor is considered as the least problem in ran-fed paddy farming in Hambantota (Yala – 13% and Maha – 14%) where they have less job opportunities in non-agricultural sector. Irregular supply of labor is also a common problem in major irrigation paddy farming both in Hambantota (Yala – 45% and Maha – 47%) and Matara (Yala and Maha – 40%) districts particularly in peak period such as harvesting time. Major irrigation paddy farming in both districts depends more on hired labor than the family labor.

Table - 4.1.19. Problems of labor in paddy farming

Sources	Hambantota District Major Irrigation	Hambantota District Minor Irrigation	Hambantota District Rain-fed	Hambantota District Total	Matara District Major Irrigation	Matara District Rain-Fed	Matara District Total
			Yala				
High wage rates	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
Lack of skills	10 (19)	05 (14)	22 (69)	37 (30)	06 (14)	29 (76)	35 (44)
Insufficient	11 (21)	10 (27)	04 (13)	25 (20)	15 (36)	11 (29)	26 (33)
Irregular supply	24 (45)	14 (38)	05 (16)	43 (35)	17 (40)	12 (32)	29 (36)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
High wage rates	55 (100)	41 (100)	43 (100)	139 (100)	42 (100)	41 (100)	83 (100)
Lack of skills	11 (20)	06 (15)	28 (65)	45 (32)	06 (14)	31 (76)	37 (45)
Insufficient	12 (22)	12 (29)	06 (14)	30 (22)	15 (36)	12 (29)	27 (33)
Irregular supply	26 (47)	15 (37)	08 (19)	49 (35)	17 (40)	14 (34)	31 (37)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

FIGURE - 4.1.17A. PROBLEMS OF LABOR - YALA

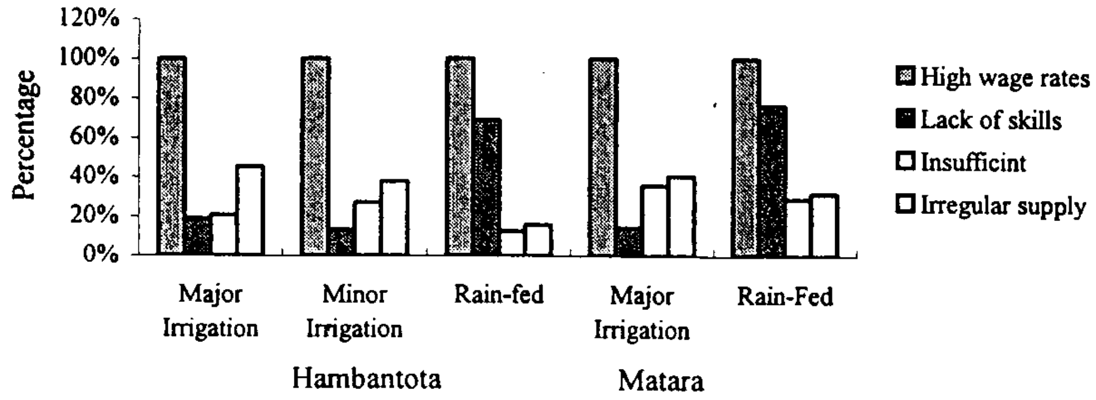
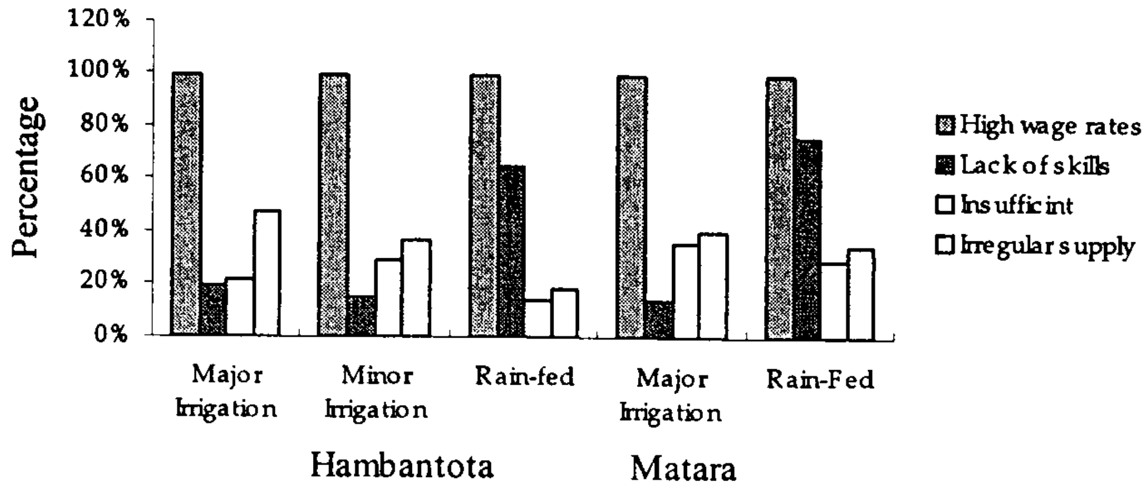


FIGURE - 4.1.17B. PROBLEMS OF LABOR - MAHA



4.1.4.5. Farming equipment

Paddy farmers have to hire some basic equipment required for paddy cultivation. Most of respondents in both Hambantota and Matara districts considering both seasons (92% or 389) mainly hire sprayers for application of agro-chemicals. Generally, Rs. 1000 is charge as a rent of sprayers for the application of agro-chemicals. The rest 08% (34) use own sprayers. No any farmer who has responded is using seeders, harvesters or any other equipment for paddy farming.

4.1.4.6. Farm Power

The main farm power utilized by the paddy farmers is the tractor in spite of their irrigation method and the season in both Hambantota and Matara districts. They use four wheel or two-wheel tractor for ploughing and land preparation as well as for threshing and winnowing the paddy harvest. Only few farmers use own tractors for 26 seasons (06%). The rest of the farmers use hired tractors.

4.2. COST OF PRODUCTION

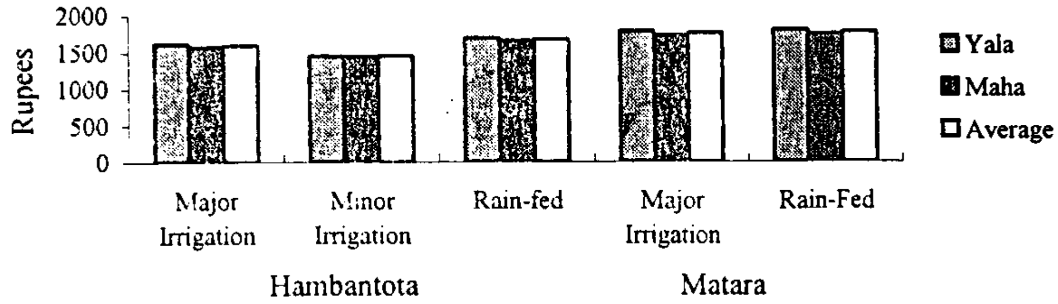
4.2.1. SEED PADDY

The highest average cost of seed paddy Rs. 1, 792 per hectare is recorded from rain-fed paddy farmers in Matara district during the Yala season (Table – 4.2.1 and Figure – 4.2.1). They mainly purchase the paddy from DOA in addition to their self-produced seeds. Most of them (93% or 81) have the experience that the price of seed paddy at the farm gate is higher than the expenditure to produce by them. However, they often face the risk of seed germination and physical lost due to unexpected drought spell. On the other hand, the lowest cost of seed paddy Rs. 1,442 per hectare is recorded from minor irrigation farmers in Hambantota district during the Yala season. These farmers receive the seed paddy from different sources and mostly cultivate paddy in lands of average holding size in the district. Therefore, they minimize the wastage and manage the seeding in most efficient manner. Generally, the average expenditure for seeds is higher in Matara (Rs. 1,756 / hectare / season) compared to Hambantota district (Rs. 1,570 / hectare / season). According to the farmers, Hambantota paddy farmers have economies of scale in seed paddy production systems as well as they collectively produce seeds with the neighbors. The average cost of seed paddy is higher in Yala season than the Maha season in both Hambantota (Rs. 1,585 and Rs. 1,555 /ha. /season) and Matara districts (Rs. 1,783 and Rs. 1,729 /ha. /season) respectively. A significant amount of seeds are wasted during the Yala season due to the uncertainty of regular water supply during the germination and seedling stage. In most cases they have practice the refilling with new seeds or seedlings during the Yala season. It is noteworthy that the average cost of paddy seed in major irrigation farmers is lower than the rain-fed farmers in both Hambantota (Rs. 1,596 and 1,667 / ha. / season) and Matara (Rs. 1,749 and Rs. 1,756 / ha. / season) districts. The major irrigation farmers mainly produce their seed or produce seeds together with neighbors and also use seed for large extent of lowlands. Paddy farmers in Hambantota and Matara districts broadcast seed as the method of sowing. Therefore, the seed production is very efficient and sowing is more effective in major irrigation, which leads to minimize the expenditure.

Table – 4.2.1. Cost of seed paddy per hectare / season – (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	1,618	1,451	1,686	1,585	1,774	1,792	1,783
Maha	1,574	1,442	1,648	1,555	1,724	1,734	1,729
Average	1,596	1,447	1,667	1,570	1,749	1,763	1,756

FIGURE - 4.2.1. EXPENDITURE FOR SEEDS / HA.



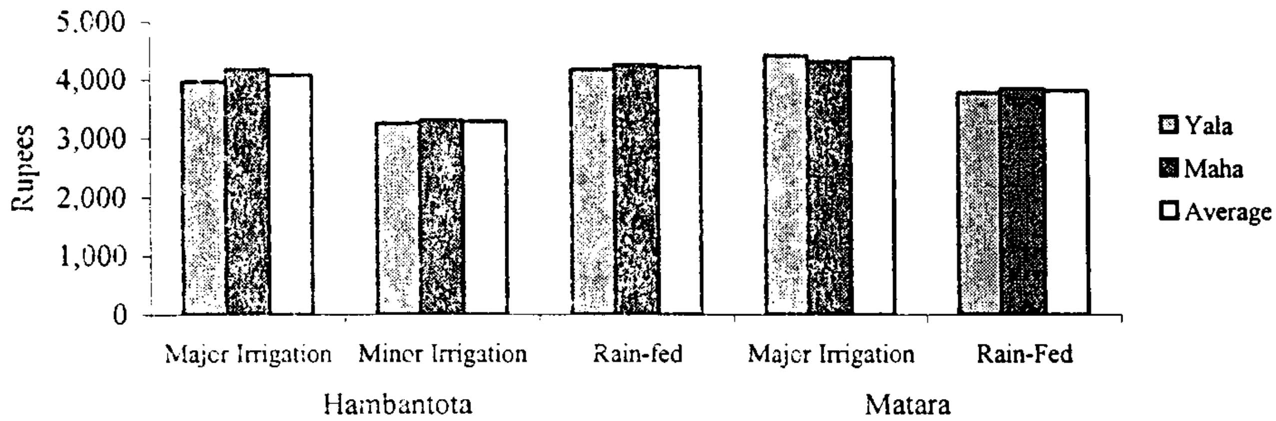
4.2.2. FERTILIZER

The farmers use different amount of fertilizer under different irrigation systems and seasons in Hambantota and Matara districts (Table – 4.2.2. and Figure – 4.2.2). The mean average expenditure for fertilizer per hectare per season in Yala (Rs. 3,801) and Maha (Rs. 3,911) in Hambantota district are comparatively less than in Yala (4,093) and Maha (Rs. 4,075) seasons in Matara district (Table - 3.4.5). The highest expenditure for fertilizer is recorded in both Maha (Rs. 4,308) and Yala (Rs. 4,412) under major irrigation systems in Matara district. On the other hand the lowest average expenditure for fertilizer is recorded as Rs. 3,260 per hectare per season from minor irrigation farmers in Hambantota district during the Yala season.

Table – 4.2.2. Expenditure for fertilizer of paddy farmers per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	3,974	3,260	4,168	3,801	4,412	3,774	4,093
Maha	4,178	3,308	4,248	3,911	4,308	3,842	4,075
Average	4,076	3,284	4,208	3,856	4,360	3,808	4,084

FIGURE - 4.2.2. EXPENDITURE FOR FERTILIZER / HA.



4.2.3. AGRO-CHEMICALS

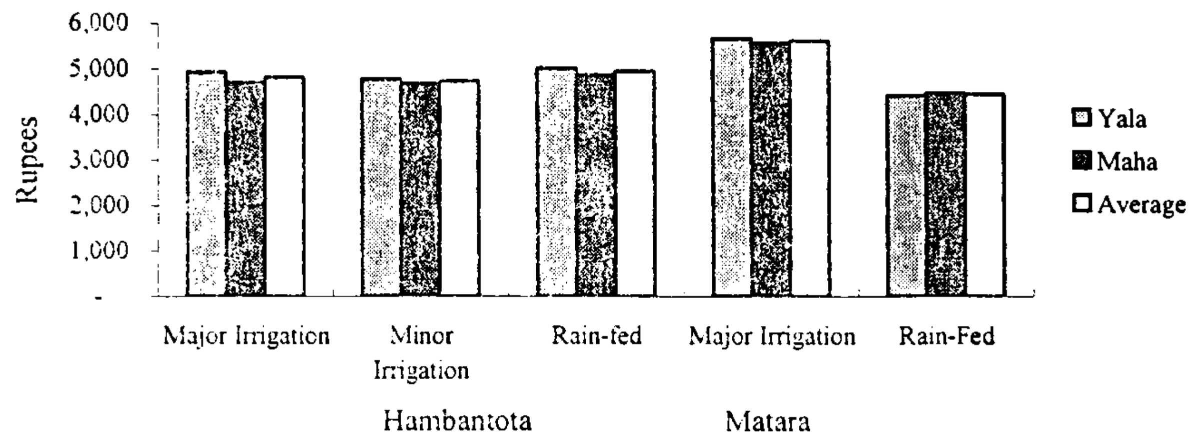
4.2.3.1. Weedicide

It could be revealed that 86% (362) of the paddy farmers in Hambantota and Matara district use chemical weedicides also as a controlling agent of weeds. The popular weedicides are 3-4 DPA for grass while MCPA for broad leaves. Every farmer who uses agro-chemicals uses the recommended dosage as written in the label. They purchase weedicides from the nearby agro-chemical dealer or the village boutique as the only source. The average expenditure for weedicide is varies with the irrigation method, district, the season and economic condition of the paddy farmer. The highest average expenditure for weedicides per hectare per season Rs. 4,701 is recorded in major irrigation in Matara district during the Maha season (Table – 4.2.3 and Figure – 4.2.3). On the other hand, the lowest expenditure for weedicides Rs. 3,672 per hectare per season is recorded in rain-fed paddy farming in Matara district during Yala season. Compared to Maha season, expenditure for weedicide is high in Yala season due to high usage in order to cope the limited availability of water. Even the rain-fed condition in Hambantota district requires more expenditure for weedicide Rs. 4,109 than the average due to the limitation to weed control through water management. However, minor irrigation farmers in Hambantota spend minimum Rs. 3,928 per hectare per season because of their high involvement in manual weeding. Rain-fed farmers in Matara district have the least expenditure for weedicide Rs. 3,697 per hectare per season, as they do not properly control weeds in their paddy field particularly during the Yala season.

Table – 4.2.3. Expenditure for weedicides of paddy farmers per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	4,089	3,969	4,170	4,076	4,701	3,672	4,187
Maha	3,908	3,888	4,047	3,947	4,620	3,722	4,171
Average	3,998	3,928	4,109	4,012	4,660	3,697	4,179

FIGURE - 4.2.3. EXPENDITURE FOR FERTILIZER / HA.



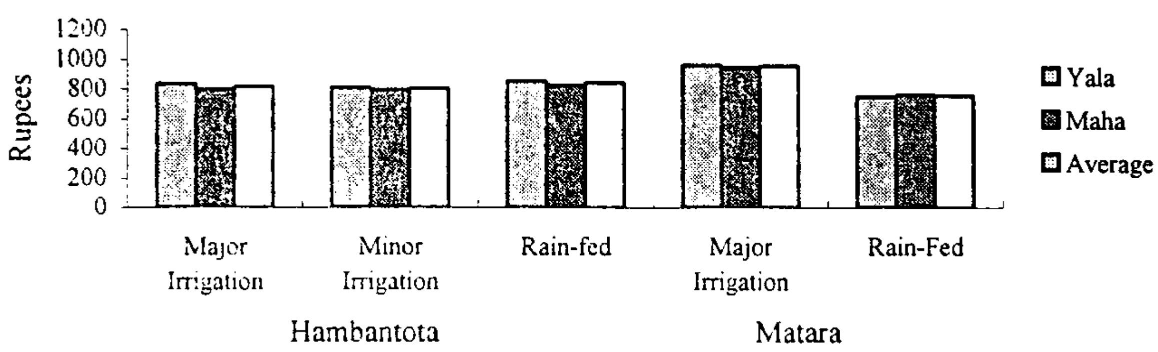
4.2.3.2. Pesticide

The farmers in Hambantota and Matara districts use many pesticides available in the market under different commercial names. The only source of pesticide is the private sector, which sell their pesticides through country dealers or the village boutique. The farmers utilize the chemical based on the instruction written in the label pasted on the bottle or based on the instruction of dealers. The average expenditure for pesticides used in paddy cultivation is generally higher in Matara district (Rs. 856.00 / ha. /season) than in Hambantota (Rs. 822.00 / ha. /season) district (Table – 4.2.4. and Figure – 4.2.4). Moreover, the mean average expenditure for Yala season both Hambantota (Rs. 835.00 / ha. /season) and Matara (Rs. 857.00 / ha. /season) districts are high than the Maha (Rs. 854.00 / ha. /season) season. More pest outbreaks are experiencing during Yala season with the common dry spell. Further, some paddy farmers practice stager cultivation in order to avoid the dry spell and broadcast seeds with sufficient water during the Yala season. Therefore, due to uneven age paddy cultivation in the same field, provide better condition for pest outbreak. The highest expenditure is recorded as Yala – Rs. 963 and Maha – 946 Rs. / ha. /season in major irrigation paddy farming in Matara district. Again, the lowest expenditure for pesticide is recorded in rain-fed farming in Matara district during as Yala – Rs. 752 and Maha – 762 Rs. / ha. /season.

Table – 4.2.4. Expenditure for pestcides of paddy farmers per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	837	813	854	835	963	752	857
Maha	800	796	829	809	946	762	854
Average	819	805	842	822	955	757	856

FIGURE - 4.2.4. EXPENDITURE FOR PESTICIDES / HA.



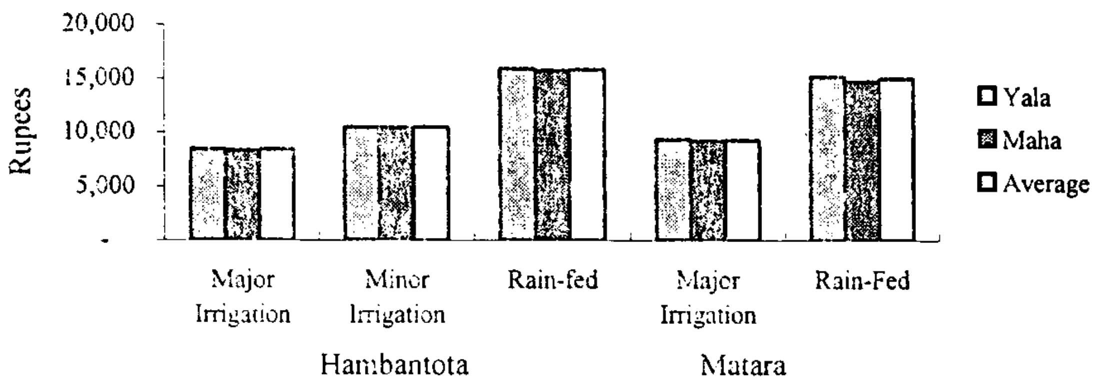
4.2.4. LABOR

Labor cost of paddy farming is varying with the different activities performed by the farmers under different irrigation methods in different district. The labor wage per day is varying from Rs. 125.00 to Rs. 300.00 according to the respondents. The family labor has also valued similarly so as the hired labor. The agricultural labor particularly working in paddy farming has the lowest opportunity cost in both Matara and Hambantota districts. According to the farmers labor wages of female labor also has increased with the opening up of job opportunities in garment sector. The mean average cost of labor per hectare per year in Matara district (Rs. 12,091) is higher than in Hambantota district (Rs.8,407) (Table – 4.2.5 and Figure – 4.2.5). One of the main reasons is that the number of labor used per hectare per season is higher in Matara district. The highest cost of labor Rs. 15,777 per hectare per year is recorded in Hambantota district under rain-fed condition where they use the highest number of labor particularly the highest contribution of family labor. The major irrigation farmers in Hambantota and Matara districts have the lowest cost Rs. 8,407 and Rs. 9,261 per hectare per year respectively for the labor. According to the farmers, they utilize tractors instead of labor for land preparation, which requires very large number of labor days. They even utilize the hired labor in very efficient and effective manner. Further, the efficiency of family labor is low under rain-fed condition while hired labor is very efficient under major irrigation paddy farming.

Table – 4.2.5. Cost of labor of paddy farming per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	8,472	10,478	15,848	11,599	9,312	15,166	12,239
Maha	8,341	10,424	15,706	11,490	9,210	14,676	11,943
Average	8,407	10,451	15,777	11,545	9,261	14,921	12,091

FIGURE - 4.2.5. EXPENDITURE FOR LABOR / HA.



4.2.5. FARMING EQUIPMENT

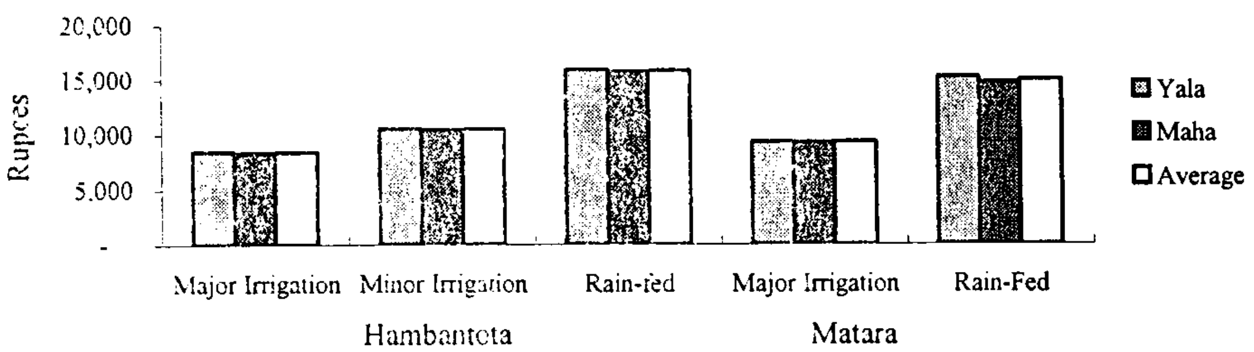
Average expenditure for equipment by paddy farmers in Matara district Rs. 3,005 per hectare per year is comparatively higher than that of Rs. 2,681 in Hambantota district (Table – 4.2.6. and Figure – 4.2.6). There is no a considerable difference in average cost of equipments between the seasons under each irrigation methods. The rain-fed farmers of Hambantota (Rs. 3,987) and Matara (Rs. 4,288) spend the highest amount for the equipment per hectare per season. Most of them hire the equipment as poor farmers and do not conduct farming activities systematically in order to reduce the expenditure. Their small sizes of holding are not with economies of scale for efficient use of equipment.

However, the major irrigation paddy farmers in Hambantota (Rs. 1,774 per / ha. / season) and Matara (Rs. 1,722 per / ha. / season) have the lowest expenses for equipment. Some of them (08%) use their own equipment for paddy farming. The farmers in minor irrigation areas in Hambantota have the average Rs. 2,282 per hectare per season expenditure, which is less than the district average. On the other hand major and minor irrigation farmers conduct all the practices compared to rain-fed farmers in efficient manner in order to minimize the expenses. The farmers have no any divided opinion on the expenditure for equipment. They feel that the expenditure could be justified as far as the price and services are concerned.

Table – 4.2.6. Cost of equipment hired for paddy farming per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	1,844	2,298	4,002	2,715	1,768	4,336	3,052
Maha	1,704	2,266	3,972	2,647	1,676	4,240	2,958
Average	1,774	2,282	3,987	2,681	1,722	4,288	3,005

FIGURE - 4.2.6. EXPENDITURE FOR EQUIPMENTS / HA



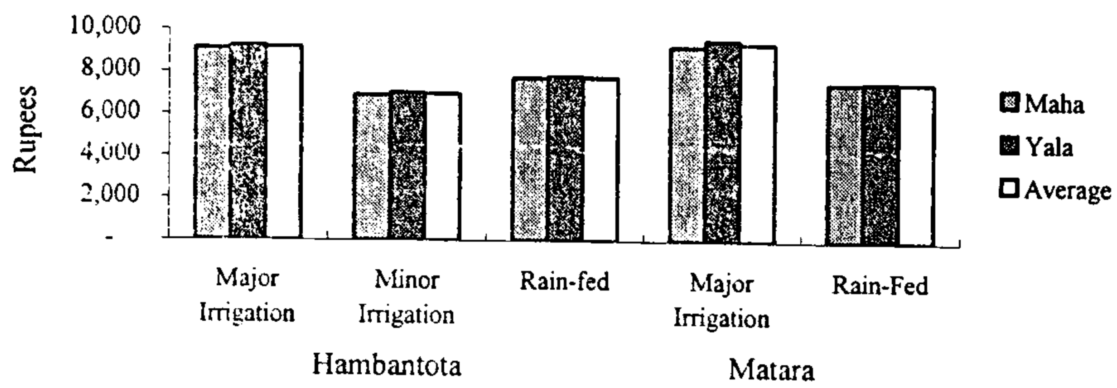
4.2.6. FARM POWER

The average expenditure for farm power per hectare per season for paddy cultivation is low in Hambantota (Rs. 7,976) than in Matara (8,456) districts (Table – 4.2.7 and Figure – 4.2.7). The expense for farm power is high in Yala season than in Maha season under every irrigation method in both districts. On the other hand the expenses for the farm power is comparatively high in major irrigation systems in Hambantota (Yala – Rs. 9,253 and Maha – Rs. 9,184 per hectare per season) and Matara (Yala – 9,523 and Maha – 9,218) districts. Major irrigation paddy farming in both districts uses only two or four wheel tractors other than the labor for the land preparation. Additionally they use tractors also for threshing and winnowing. The minor irrigation and rain-fed paddy farming use tractors as well as labor in all those activities. The second highest expense Rs. 7,804 per hectare per season for farm power is incurred in Hambantota rain-fed paddy farmers while the lowest Rs. 6,904 is recorded in Hambantota minor irrigation farmers during the Maha season. However, all the farmers have the opinion that the tractor power is the most effective power for paddy farming in both districts. According to them, the rapidly increasing price of diesel has increased the expenditure of farm power unbearably for the farmers.

Table – 4.2.7. Cost of farm power for paddy farming per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	9,253	7,042	7,804	8,033	9,523	7,578	8,551
Maha	9,114	6,904	7,736	7,918	9,218	7,506	8,362
Average	9,184	6,973	7,770	7,976	9,371	7,542	8,456

FIGURE - 4.2.7. EXPENDITURE FOR FARM POWER / HA



4.2.7. OTHER EXPENSES

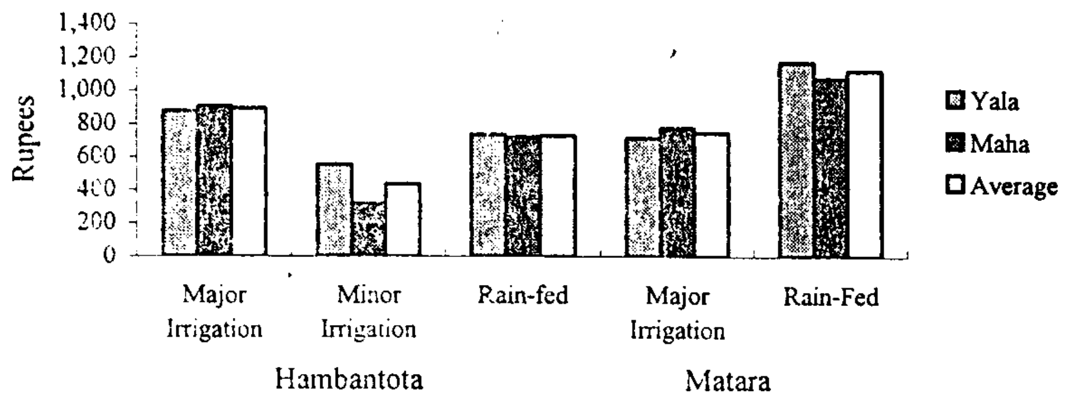
The farmers in both districts under different methods of irrigation also record other expenses as the production cost of paddy. Transport, travelling, additional expenses for labor and interest rate of credit are the other expenses of the paddy farmers in the study area. Other farming expenses for paddy farming is Rs. 932 per hectare per year in Matara district, which is higher than Rs. 684 in Hambantota district (Table – 4.2.8. and Figure – 4.2.8). However, the other farm expenses in minor irrigation paddy farmers in Hambantota district (Yala – Rs. 552 and Maha – Rs. 316) is the lowest and comparatively very low among the other paddy farmers. Minor irrigation farmers in Hambantota attempt to minimize expenses while cutting down activities which are not really essential.

Table – 4.2.8. Other expenses for paddy farming per hectare / season (Mean Average) (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	878	552	736	722	714	1,166	940
Maha	906	316	718	647	776	1,070	923
Average	892	434	727	684	745	1,118	932

* Percentages are in parenthesis

FIGURE - 4.2.8. OTHER EXPENDITURE / HA



4.2.8. TOTAL COST OF PRODUCTION

The mean average total cost of production per hectare in paddy cultivation in Hambantota (Yala - Rs. 33,365 and Maha - 32,924) is lower than in Matara (Yala- Rs. 35,702 and Maha - Rs. 35,015) district. (Table – 4.2.9). The highest cost of production is recorded in rain-fed paddy farming in Hambantota during the Yala season (Figure – 4.2.9A & B). The minor-irrigation farmers in Hambantota have the lowest total cost of paddy production during the Maha season. The cost of labor the highest component in the total cost of production in Hambantota (Yala – 35% and Maha 35%) and Matara (Yala – 34% and Maha 34%) districts (Figure – 4.9A & B). On the other hand cost of labor is higher in rain-fed paddy farming than under irrigated farming in Hambantota (Yala – 40% and Maha 40%) and Matara (Yala – 40% and Maha 39%) districts The labor expenditure is very high because high labor wages and the low labor productivity. Most of the family labor and much hired labor in these districts are categorized as unskilled labor. The second highest component of the total cost of paddy production is the farm power, which covers 24% in Yala and Maha seasons in both Hambantota and Matara districts. Expenditure for farm power is much higher in major-irrigation farming in Hambantota (Yala – 30% and Maha 30%) and Matara (Yala – 29% and Maha 28%) districts. It is noteworthy that about 60% of the total cost of paddy production in the both districts is spent on labor and farm power particularly the tractor. The third largest component of the total cost of paddy production is recorded as the agro-chemicals. Agro-chemical covers 15% in Yala and 14% in Maha seasons in Hambantota and 14% in Yala and Maha seasons in Matara districts. The major-irrigation farmers have more expenditure for agrochemicals in Hambantota (Yala – 16% and Maha 15%) and Matara (Yala – 17% and Maha 17%) districts compared to other paddy farmers. They are more concern about the cultural practices such as weeding and pest control in order to reap the highest income. Surprisingly, all the paddy farmers in both districts despite the irrigation methods and season spend less amount of money for fertilizer than for the agro-chemicals. They spend only 11% in Yala and 12% in Maha seasons in Hambantota and 11% in Yala and 12% in Maha seasons in Matara districts for the fertilizer. Among them major-irrigation paddy farmer spend highest percentage for fertilizer in Hambantota (Yala – 13% and Maha 14%) and Matara (Yala – 13% and Maha 13%) districts. The farmers spend few amounts but more money for equipment in Hambantota (Yala – 08% and Maha 08%) and Matara

(Yala – 09% and Maha 08%) districts than for paddy seeds. They spend only 05% in both seasons under all the irrigation methods in both districts.

Table – 4.2.9. Cost of production in paddy farming per hectare per season (Mean Average) (Rs.)

Item	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
			Yala				
Labor	8,472 (27)	10,478 (35)	15,848 (40)	11,599 (35)	9,312 (28)	15,166 (40)	12,239 (34)
Seeds	1,618 (05)	1,451 (05)	1,686 (04)	1,585 (05)	1,774 (05)	1,792 (05)	1,783 (05)
Fertilizer	3,974 (13)	3,260 (11)	4,168 (11)	3,801 (11)	4,412 (13)	3,774 (10)	4,093 (11)
Agro-chemicals	4,926 (16)	4,782 (16)	5,024 (13)	4,911 (15)	5,664 (17)	4,424 (12)	5,044 (14)
Equipment	1,844 (06)	2,298 (08)	4,002 (10)	2,715 (08)	1,768 (05)	4,336 (11)	3,052 (09)
Farm Power	9,253 (30)	7,042 (24)	7,804 (20)	8,033 (24)	9,523 (29)	7,578 (20)	8,551 (24)
Others	878 (03)	552 (02)	736 (02)	722 (02)	714 (02)	1,166 (03)	940 (03)
Total	30,965 (100)	29,863 (100)	39,268 (100)	33,365 (100)	33,167 (100)	38,236 (100)	35,702 (100)
			Maha				
Labor	8,341 (27)	10,424 (36)	15,706 (40)	11,490 (35)	9,210 (28)	14,676 (39)	11,943 (34)
Seeds	1,574 (05)	1,442 (05)	1,648 (04)	1,555 (05)	1,724 (05)	1,734 (05)	1,729 (05)
Fertilizer	4,178 (14)	3,308 (11)	4,248 (11)	3,911 (12)	4,308 (13)	3,842 (10)	4,075 (12)
Agro-chemicals	4,708 (15)	4,684 (16)	4,876 (13)	4,756 (14)	5,566 (17)	4,484 (12)	5,025 (14)
Equipment	1,704 (06)	2,266 (08)	3,972 (10)	2,647 (08)	1,676 (05)	4,240 (11)	2,958 (08)
Farm Power	9,114 (30)	6,904 (24)	7,736 (20)	7,918 (24)	9,218 (28)	7,506 (20)	8,362 (24)
Others	906 (03)	316 (01)	718 (02)	647 (02)	776 (02)	1,070 (03)	923 (03)
Total	30,525 (100)	29,344 (100)	38,904 (100)	32,924 (100)	32,478 (100)	37,552 (100)	35,015 (100)

* Percentages are in parenthesis

FIGURE - 4.2.9A. TOTAL EXPENDITURE / HA. - YALA

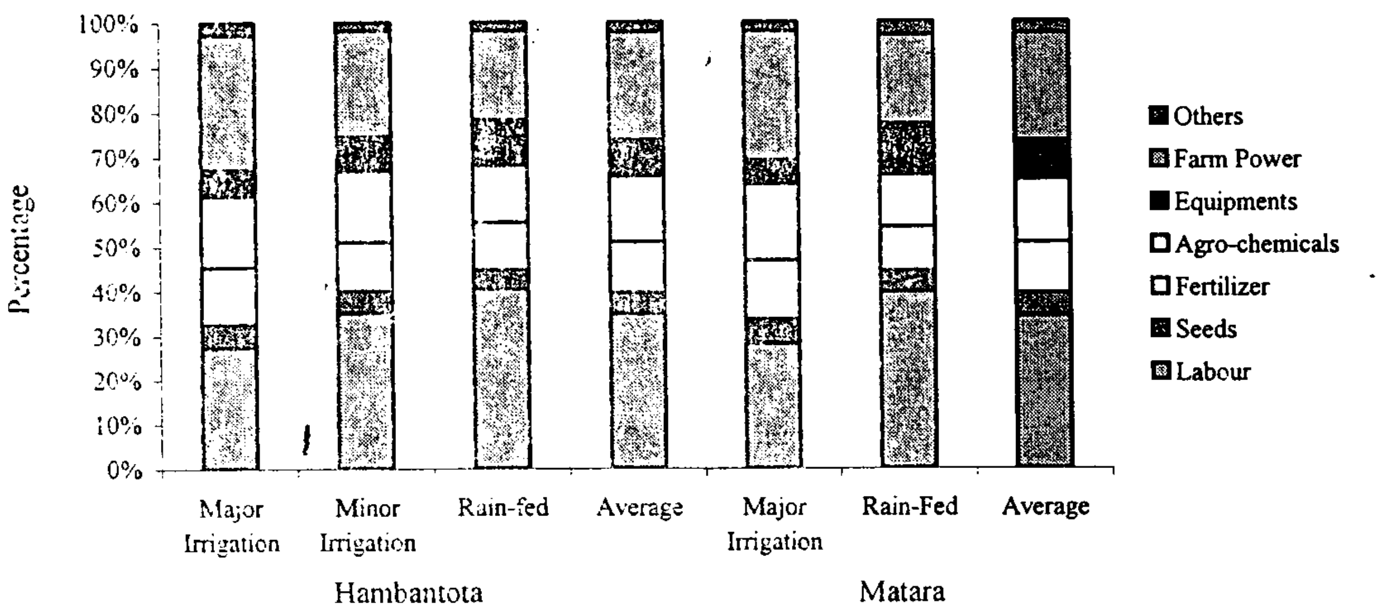
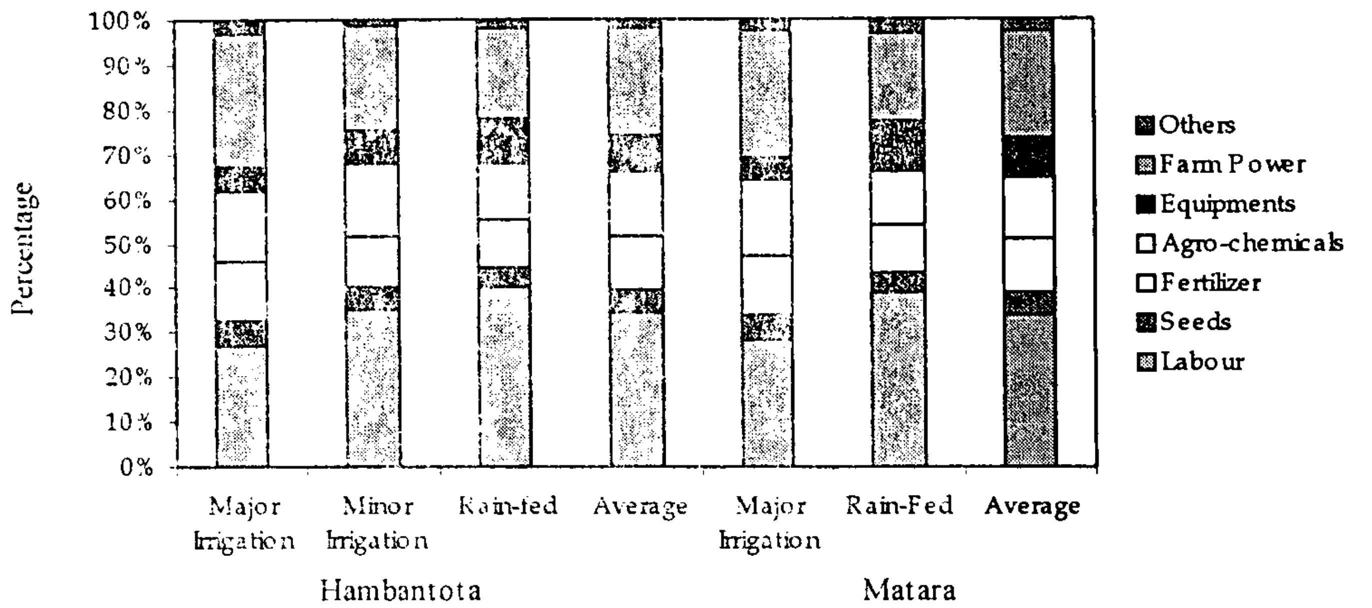


FIGURE - 4.2.9B. TOTAL EXPENDITURE / HA. - MAHA



4.3. YIELD, INCOME AND PROFIT

4.3.1. PADDY YIELD

According to the study the average paddy yield 3.6 Metric Tons / ha. (178.0 Bushels) per hectare per season in Hambantota district is higher than that of 3.3 Metric Tons / ha. (166.6 Bushels / ha.) per season in Matara district (Table – 4.3.1. and Figure – 4.3.1). The average yield in Maha season (3.7 MT / ha) is little higher than in Yala season (3.5 MT / ha.) in Hambantota district. The major-irrigation farmers in Hambantota district receive 4.2 MT / ha.) during Yala season while 4.6 MT / ha. during the Maha season. The similar pattern is follows by minor irrigation (3.4 and 3.5 MT / ha.) and rain-fed farmers (2.8 and 2.9 MT / ha.) in Hambantota district. During the Maha season farmers received sufficient water required for paddy farming in Hambantota. Due to the dry spell that often occurred with the limited rainfall, paddy yield is comparatively low during Yala season in Hambantota district. Contrary, paddy yield is little high during Yala season (3.4 MT / ha.) compared with Maha seasons (3.3 MT / ha.) in Matara district. The long daytime and clear sunshine makes the yield much higher during Yala (4.1 MT / ha.) than Maha (3.9 MT / ha.) season of the major irrigation paddy farming in Matara district. Even rain-fed farmers obtain higher yield (2.7 MT /ha.) during Yala season than Maha season (2.6 MT / ha.)

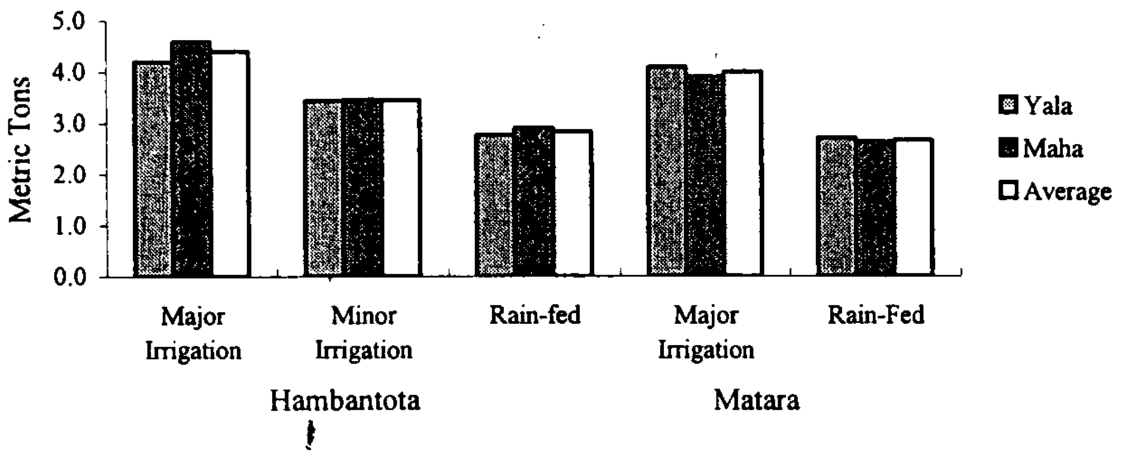
The highest paddy yields 4.6 Metric Ton per hectare per season is recorded in Hambantota under major-irrigation during the Maha season. Rain-fed paddy farmers in Matara district obtain the lowest yield 2.6 Metric Tons per hectare during Maha season. The average paddy yield under major irrigation is considerably much higher than the rain-fed paddy farming in both Hambantota (4.4.and 2.8 MT / ha.) and Matara (4.0 and 2.7 MT / ha.) districts. The average yields of 3.4 MT / ha. in minor-irrigation systems lies in between major-irrigation and rain-fed paddy farmers.

Table – 4.3.1. Mean average paddy yield per hectare / season in Bushels and Metric Tons

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	210.0	171.8	138.2	173.3	205.0	135.0	170.0
	(4.2)	(3.4)	(2.8)	(3.5)	(4.1)	(2.7)	(3.4)
Maha	230.0	172.6	145.2	182.6	195.0	131.4	163.2
	(4.6)	(3.5)	(2.9)	(3.7)	(3.9)	(2.6)	(3.3)
Average	220.0	172.2	141.7	178.0	200.0	133.2	166.6
	(4.4)	(3.4)	(2.8)	(3.6)	(4.0)	(2.7)	(3.3)

* Metric Tons are in parenthesis

FIGURE - 4.3.1. YIELD OF PADDY / HA.



4.3.2. INCOME AND PROFIT

4.3.2.1. Price

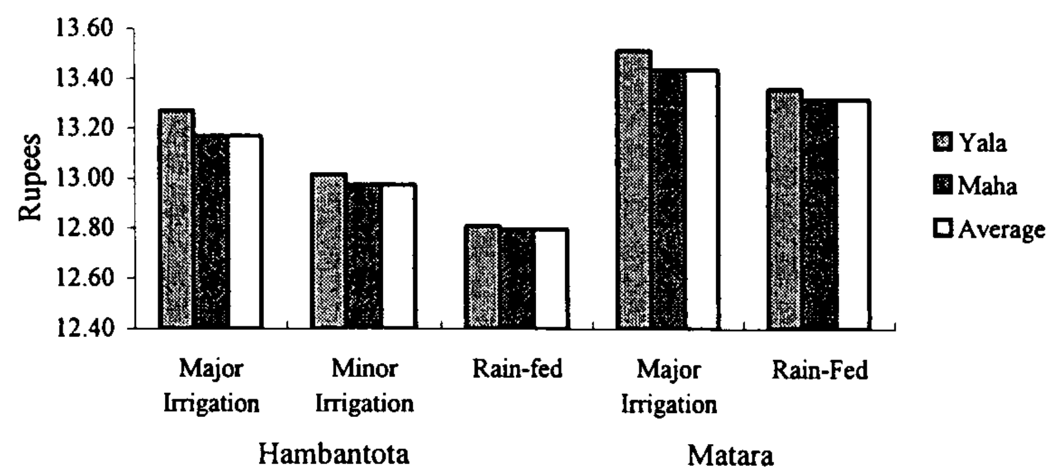
The mean value of average price of one Bushel or Kilogram is varying with the method of irrigation, the districts as well as the season of the paddy cultivation (Table – 4.3.2 and Figure – 4.3.2). The study shows that the mean average price of paddy has an inverse relationship with the yield similar to the theory. During the Yala season the average price of paddy is Rs. 13.03 per kg with the average yield of 3.5 MT / ha. while low in price Rs. 12.98 per kg during Maha season with higher yield of 3.7 MT / ha. in Hambantota district. On the other hand, in Matara district the mean average price of paddy is Rs. 13.44 with the higher yield of 3.4 MT / ha. during the Yala season. Price of paddy during Yala season is Rs. 13.38, which is little lesser than price in Yala with the comparatively low yield of 3.3 MT / ha. Anyway, the mean average prices of paddy in both districts are little higher than the guaranteed price fixed by the government at Rs. 13.00 per kilogram. The both districts have fairly satisfactory road network as well as an established marketing net work, which facilitate to raise them their paddy price. The major-irrigation farmers in Hambantota district (Yala – Rs.13.27 and Maha – Rs.13.17 per kg) and Matara district (Yala – Rs.13.44 and Maha – Rs.13.38 per kg) obtain the highest price for their paddy yield. However, the rain-fed farmers in Hambantota district obtain quite low value during Yala (Rs. 12.81) and Maha (Rs. 12.80) seasons, which the prices are even below the Guaranteed Price. It could be revealed that the quality of the paddy produced by rain-fed farmers in Hambantota district is not in good quality. In most cases the rice gains are not with even characters but as mixture of different varieties. Rain-fed farmers in Matara district receive comparatively closer price (Yala Rs. 13.51 and Maha Rs. 13.44 per kg) to the price selling by major-irrigation farmers. However, all the paddy farmers blame that the price they receive for paddy is too lower than their expectations.

Table – 4.3.2. Mean average price of paddy per Bushel and Kilogram (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	263.38	259.48	255.93	259.60	268.70	266.32	267.51
	(13.17)	(12.97)	(12.80)	(12.98)	(13.44)	(13.32)	(13.38)
Maha	265.41	260.31	256.20	260.64	270.24	267.18	268.71
	(13.27)	(13.02)	(12.81)	(13.03)	(13.51)	(13.36)	(13.44)
Average	264.40	259.90	256.07	260.12	269.47	266.75	268.11
	(13.22)	(12.99)	(12.80)	(13.01)	(13.47)	(13.34)	(13.41)

* Per kilogram, are in parenthesis

FIGURE - 4.3.2. PRICE OF PADDY



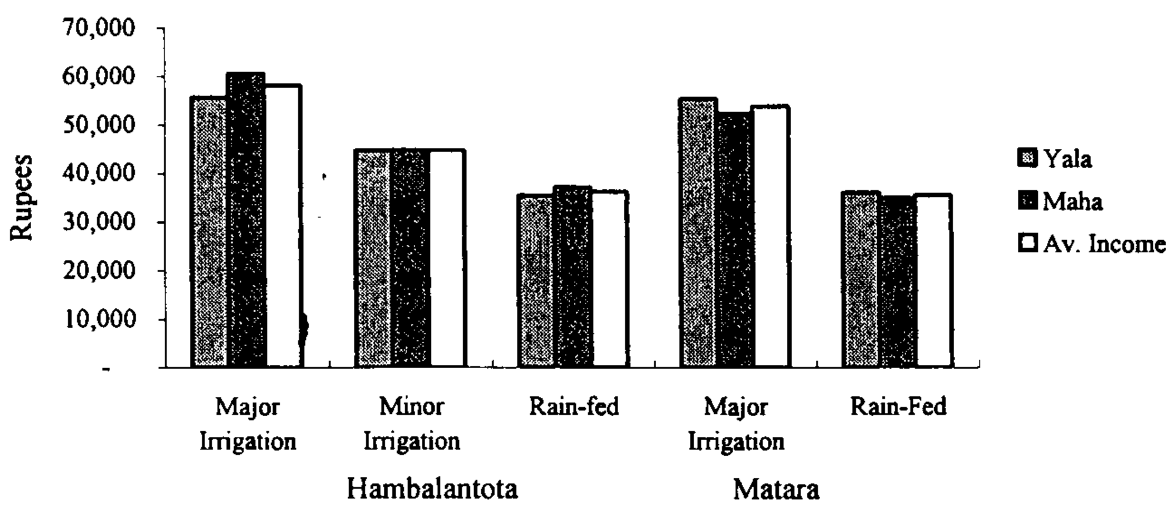
4.3.2.2. Income from paddy

The mean average income of paddy per hectare in Hambantota district (Rs. 46,292.39) is higher than in Matara district (Rs. 44,667.13) (Table – 4.3.3. and Figure – 4.3.3). As it was discuss under the paddy yield per hectare, the income also vary with the district, method of irrigation and also the season. The highest income is received by the paddy farmers cultivate under major irrigation in Hambantota district (Rs. 58,166.90). The rain-fed farmers in Matara district receive the lowest income during Maha season (Rs. 35,531.10). Compared to major-irrigation farmers, rain-fed farmers receive very low income in Hambantota district (Rs. 58,166.00 and Rs. 36,284.41) and Matara district (Rs. 53,894.00 and Rs. 35,531.10). The minor-irrigation farmers receive the income Rs. 44,735.92 that is in between the income of major-irrigation and rain-fed farmers.

Table – 4.3.3. Mean average income of paddy per hectare (Rs.)

Season	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
Yala	55,736.10	44,721.26	35,406.84	45,177.60	55,399.20	36,069.30	45,680.70
Maha	60,577.40	44,786.25	37,161.04	47,402.35	52,396.50	34,994.45	43,657.63
Average	58,166.90	44,753.92	36,284.41	46,292.39	53,894.00	35,531.10	44,667.13

FIGURE - 4.3.3. INCOME FROM PADDY / HA.



4.3.2.3. Profit of paddy farming

The profits that could obtain from paddy farming is also vary with district, method of irrigation and the season (Table – 4.3.4. and Figure – 4.3.4). The farmers in Hambantota district obtain the higher average profit (Yala – Rs. 11,812.20 and Maha – Rs. 14,478.02) than the farmers in Matara district (Yala – Rs. 9,979.20 and Maha – Rs. 8,642.63). The major-irrigation paddy farmers in Hambantota obtain the highest profit (Rs. 30,052.40) during the Maha season. Rain-fed farmers in Hambantota district obtain the highest loss from paddy farming during Yala season. Major-irrigation and rain-fed paddy farmers in Hambantota district obtain profit during both Yala (Rs. 24,771.10 and Rs. 14,858.26) and Maha (Rs. 22,232.20 and Rs. 19,918.50 per ha.) seasons. However, rain-fed farmers in Hambantota do paddy farming at a lost in both Yala (Rs. -3,861.16) and Maha (Rs. –1,742.96) seasons. Similarly, the major irrigation farmers in Matara district obtain profit during Yala (Rs. 22,232.20) and Maha (Rs. 19,918.50) seasons while rain-fed farmers have to bear lost of Rs. 2,166.70 per hectare during Yala and Rs. 2,557.55 per hectare during Maha.

Table – 4.3.4. Income and profit of production in paddy farming per hectare per season

Item	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
			Yala				
Average Yield (Bus / Ha./ Se)	210.0	171.8	138.2	173.3	205.0	135.0	170.0
Average Yield (MT / Ha / Se)	4.2	3.4	2.8	3.5	4.1	2.7	3.4
Average Price (Rs. / Bushels)	265.41	260.31	256.20	260.64	270.24	267.18	268.71
Average Price (Rs. / Kg)	13.27	13.02	12.81	13.03	13.51	13.36	13.44
Income (Rs. / Ha. / Se.)	55,736.10	44,721.26	35,406.84	45,177.60	55,399.20	36,069.30	45,680.70
Cost. (Rs. / Ha. / Se.)	30,965.00	29,863.00	39,268.00	33,365.33	33,167.00	38,236.00	35,701.50
Profit (Rs. / Ha. / Se.)	24,771.10	14,858.26	-3,861.16	11,812.27	22,232.20	-2,166.70	9,979.20
			Maha				
Average Yield (Bush / Ha.)	230.0	172.6	145.2	182.6	195.0	131.4	163.2
Average Yield (MT / Ha / Se)	4.6	3.5	2.9	3.7	3.9	2.6	3.3
Average Price (Rs. / Bushels)	263.38	259.48	255.93	259.60	268.70	266.32	267.51
Average Price (Rs. / Kg)	13.17	12.97	12.80	12.98	13.44	13.32	13.38
Income (Rs. / Ha. / Se.)	60,577.40	44,786.25	37,161.04	47,402.35	52,396.50	34,994.45	43,657.63
Cost. (Rs. / Ha. / Se.)	30,525.00	29,344.00	38,904.00	32,924.33	32,478.00	37,552.00	35,015.00
Profit (Rs. / Ha. / Se.)	30,052.40	15,442.25	-1,742.96	14,478.02	19,918.50	-2,557.55	8,642.63

* Percentages are in parenthesis

FIGURE - 4.3.4A. PROFIT FROM PADDY / HA. / SE. (RS.) - YALA

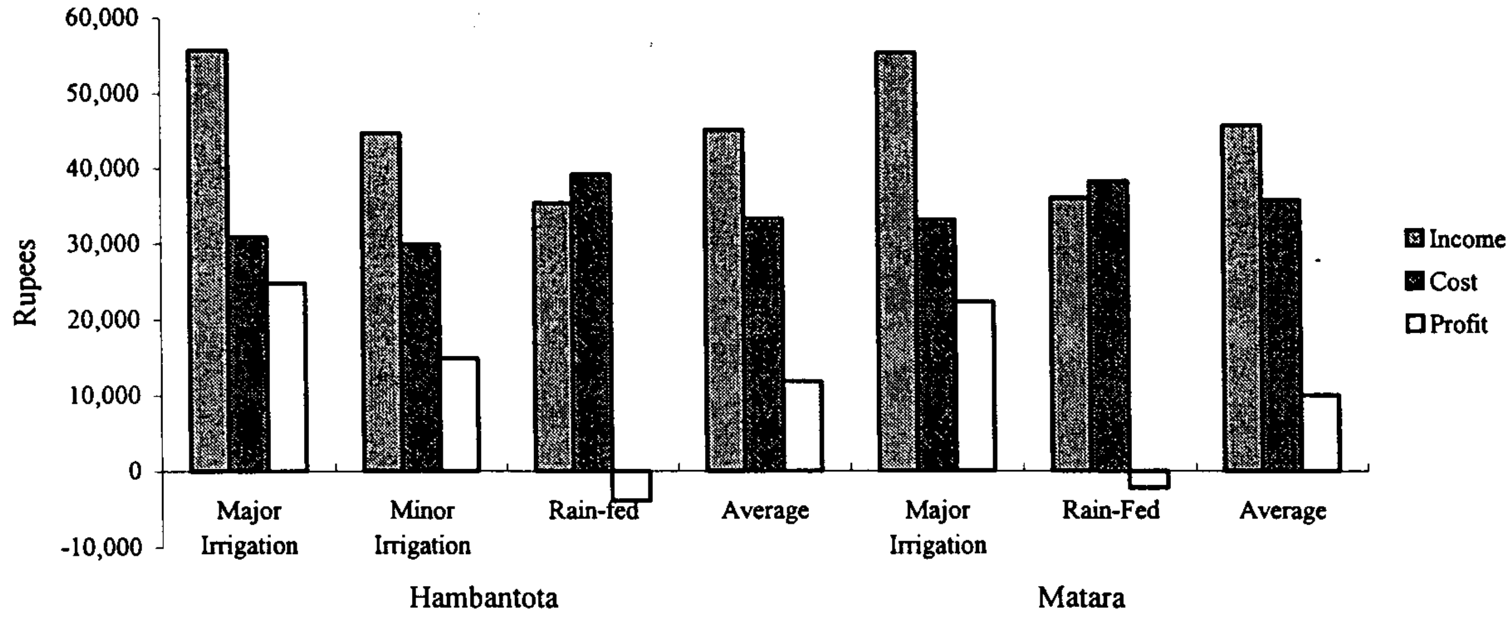
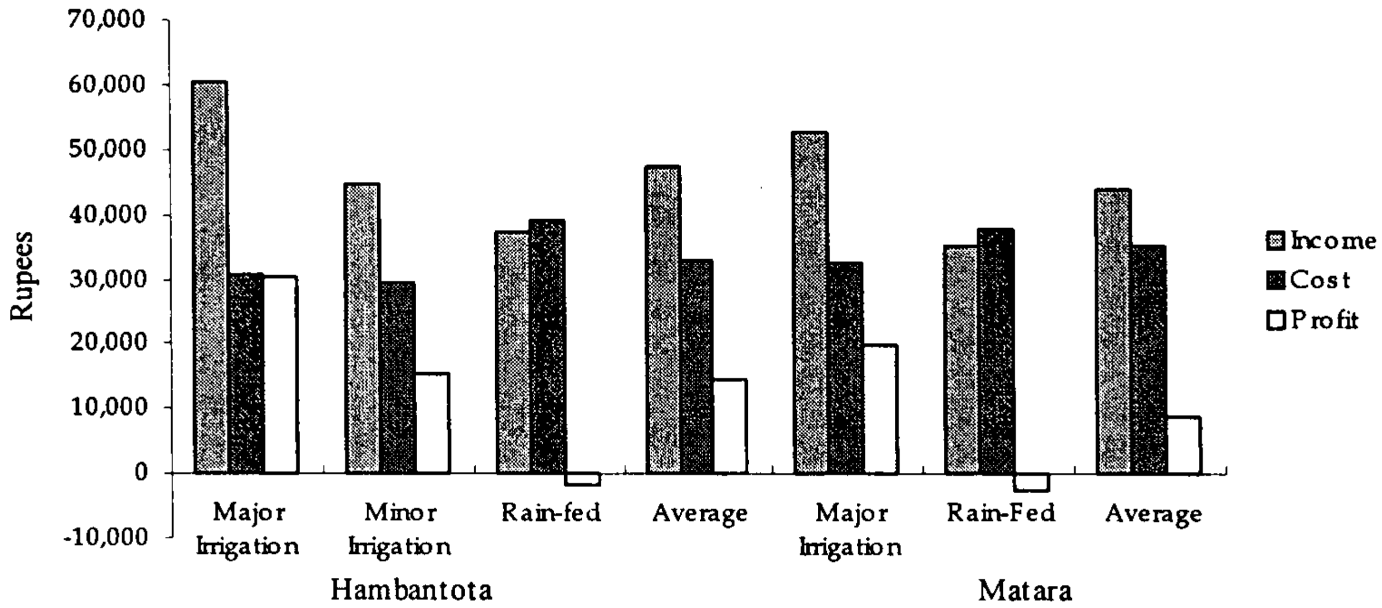


FIGURE - 4.3.4B. PROFIT FROM PADDY / HA. / SE. (RS.) - MAHA



4.4. INSTITUTIONAL SETTING

4.4.1. PADDY MARKETING

4.4.1.1. Consumption and Market Surplus

Generally the average paddy consumption is calculated as 100 kg per head per year. Therefore, average 5-member farm family in Hambantota district requires 500 kg per head per year while average 4-member family in Matara requires 400 kg. From the average paddy production Yala – 43% and Maha – 42% is consumed by the paddy farmers in Hambantota district and Yala 45% and Maha – 44% in Matara districts (Table - 4.4.1). The consumption is included with the 5 Bushels of paddy, which they separate for seed paddy requirement of the next season. The remaining portion of the production is the market surplus which is just above the half of the production in Hambantota (Yala – 56% and Maha – 57%) and Matara (Yala and Maha – 55%) districts. The highest surplus proportionate to the production is recorded in major irrigation of Hambantota district during Yala (79%) and Maha (76%) seasons. Even the major irrigation of Matara has the 71% in Yala and 72% in Maha of the production as market surplus. The market surplus of minor irrigation paddy farmers in Hambantota district is little bit higher than the consumption during Yala (59%) and Maha (60%) seasons. However, the market surplus in rain-fed paddy farmers is less than their consumption both in Hambantota (Yala 21% and Maha – 24%) and Matara (Yala 28% and Maha – 31%) districts. The rain-fed farmers have the limitations of water supply and they mainly utilize their unskilled family labor for paddy farming. Therefore, they have low production and the market surplus due to inefficient production systems.

Table - 4.4.1. Average paddy Production, Consumption and Surplus per hectare / season in Metric Tons

Item	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Average	Major Irrigation	Rain-Fed	Average
			Yala				
Surplus	3.3 (79)	2.0 (59)	0.6 (21)	2.0 (56)	2.9 (71)	0.7 (28)	1.8 (55)
Consumption	1.3 (21)	1.4 (41)	2.2 (79)	1.5 (43)	1.2 (29)	1.8 (72)	1.5 (45)
Production	4.2 (100)	3.4 (100)	2.8 (100)	3.5 (100)	4.1 (100)	2.5 (100)	3.3 (100)
			Maha				
Surplus	3.5 (76)	2.1 (60)	0.7 (24)	2.1 (57)	2.8 (72)	0.8 (31)	1.8 (55)
Consumption	1.1 (24)	1.4 (40)	2.2 (76)	1.6 (42)	1.1 (28)	1.8 (69)	1.5 (44)
Production	4.6 (100)	3.5 (100)	2.9 (100)	3.7 (100)	3.9 (100)	2.6 (100)	3.3 (100)

* Percentages are in parenthesis

4.4.1.2. Buying Agents

All the paddy farmers during both seasons (100% or 423) sell their surplus paddy production after drying, cleaning and winnowing. No any farmer sells their surplus paddy after milling in significant amounts. Majority of the paddy farmers in Hambantota (Yala – 43% and Maha – 42%) and Matara (Yala and Maha – 46%) districts sell their surplus paddy to the Country Assemblers (Table - 4.4.2). On the other hand most of the major irrigation paddy farmers in Hambantota (Yala – 74% and Maha – 71%) and Matara (Yala and Maha – 79%) districts sell their surplus paddy to the Country Assemblers. Country Assemblers are very popular among major irrigation paddy farmers because they come to their doorstep and purchase their paddy with ready cash without condemning the products. Village Collectors are the most popular marketing agents in minor irrigation (Yala – 57% and Maha – 51%) and rain-fed (Yala – 50% and Maha – 42%) paddy farming areas in Hambantota district. Even in Matara district Village Collectors are the most popular among rain-fed farmers (Yala – 58% and Maha – 55%). Village Boutiques are mainly functioning as buying agents of paddy only in rain-fed paddy farming areas in Hambantota (Yala – 25% and Maha – 28%) and Matara (Yala – 24% and Maha – 22%) districts. However, the Village Collectors together with Village Boutique collect the paddy produced by most of the rain-fed farmers in Hambantota (Yala – 75% and Maha – 70%) and Matara (Yala – 82% and Maha – 76%) districts. It is noteworthy that both Village Collectors and Village Boutique are functioning in the village, collecting the paddy at the same level of the marketing channel. Village collectors and Village Boutiques who are living in the same village in many instances lend money to the paddy farmers in emergency situations. Millers play a very reserve role in paddy marketing in both districts. Even the Farmer Organizations do not make any attempt in marketing of their paddy production.

Table - 4.4.2. Number of paddy farmers sell their paddy to buying agents

Buying agent	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Cou. Assemblers	39 (74)	11 (30)	03 (09)	53 (43)	33 (79)	04 (11)	37 (46)
Millers	05 (09)	03 (08)	04 (13)	12 (10)	07 (17)	02 (05)	09 (11)
Vill. Collectors	09 (17)	21 (57)	16 (50)	46 (38)	02 (05)	22 (58)	24 (30)
Village Boutique	00 (00)	02 (05)	08 (25)	10 (08)	00 (00)	09 (24)	09 (11)
Farmer Org.	00 (00)	00 (00)	01 (03)	01 (01)	00 (00)	01 (03)	01 (01)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Cou. Assemblers	39 (71)	14 (34)	05 (12)	58 (42)	33 (79)	05 (12)	38 (46)
Millers	05 (09)	04 (10)	07 (16)	16 (12)	07 (17)	03 (07)	10 (12)
Vill. Collectors	11 (20)	21 (51)	18 (42)	50 (36)	02 (05)	22 (54)	24 (29)
Village Boutique	00 (00)	02 (05)	12 (28)	14 (10)	00 (00)	09 (22)	09 (11)
Farmer Org.	00 (00)	00 (00)	01 (02)	01 (01)	00 (00)	02 (05)	02 (02)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

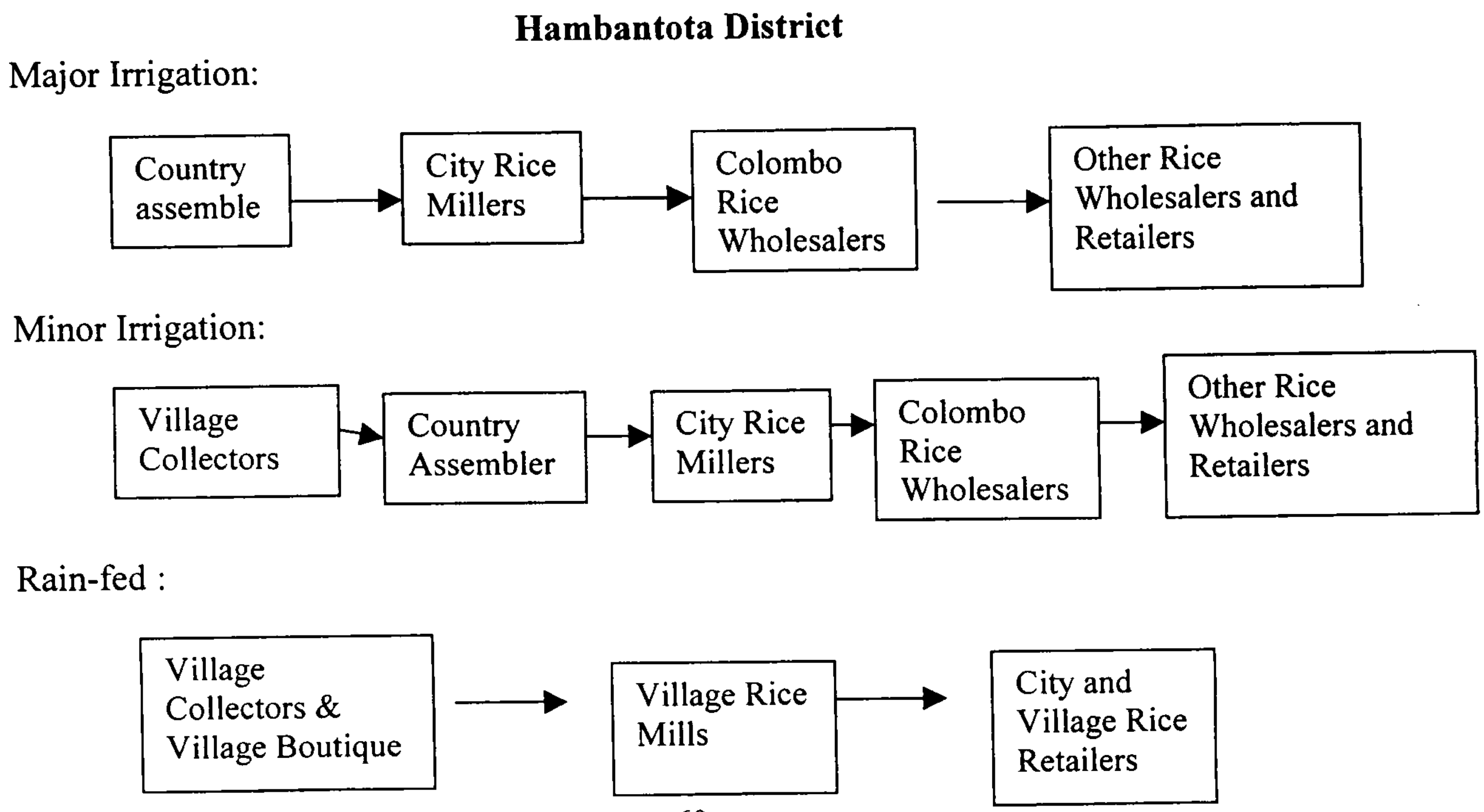
* Percentages are in parenthesis

In addition to the above buying agents, the Co-operative Societies in both districts collect the paddy production as a buying agent during the very high production season. Some seasons farmers have experience with bumper harvest with timely rainfall and other favorable climatic conditions. The Co-operative Societies act on the advice of District Secretary of the district considering an emergency situation. The District Secretary provides the necessary funds to purchase the paddy at the rate of guaranteed price decided by the government.

4.4.1.3. Marketing Channels

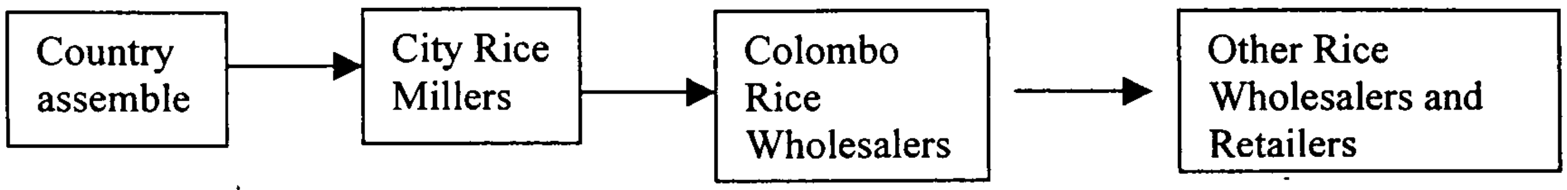
There are many marketing middlemen as well as channels are operating in paddy marketing of both districts. However, the most prominent marketing channels in both districts are similar according to the method of irrigation as follows (Figure – 4.4.1). Country assemblers, City Rice Millers, Colombo Rice Wholesalers and Other wholesalers and retailers in different cities is the very prominent marketing channel in major irrigation paddy production system in both Hambantota and Matara district. Additionally, another marketing middleman called Village Collectors is also involved with paddy marketing in minor irrigation system in Hambantota district. As the farmers are scattered and their production levels are low compared to major irrigation paddy farmers, Country Assemblers who are operating from the cities are bit reluctant to visit and collect paddy from minor irrigation farmers. The City Rice Millers convert the paddy they purchase into rice and transport them to Colombo Rice Wholesalers in most cases by their lorries. They are regular suppliers of rice to well connected wholesalers. Colombo rice wholesale market has become the center of distribution. Many other wholesalers and retailers purchase their paddy from the Colombo wholesale market. It is indeed surprise to hear that even the other wholesales and retailers who are coming from paddy producing areas such as Galle, Kluthara etc. purchase rice from Colombo wholesale market (Personnel communication with wholesalers). Although the market network is very complex, the most prominent marketing channel in rain-fed paddy production systems in both Hambantota and Matara district is similar and simple in terms of number of middlemen (3) involves. They channel involve with Village Collectors & Village Boutique, Village Rice Mills, City and Village Rice Retailers. All the middlemen are operating within the village and the adjoining city. They are mostly speculating in paddy marketing through the seasonal paddy production cycle. In most cases Village Rice Mills is the central point of marketing where City and Village retailers purchase rice.

Figure – 4.4.1. Marketing Channels



Matara District

Major Irrigation:



Rain-fed

There is a very special marketing channel functioning in marketing of paddy in both Hambantota and Matara district. Some lorry owners buy rice from the City or Village Rice Millers. They transport the purchased rice together with coconut and coconut oil to the districts of Badulla, Bandarawela and Nuwara Eliya as Transport Agents or Distributors. In the return trip they purchase vegetables from the above districts and transport them to Hambantota and Matara main cities. In most cases they are functioning as City Wholesalers of vegetables in both districts. Usually, they transport paddy twice a week as continuos marketing process.

4.4.1.4. Market Margin

The rice percentage of paddy is calculated on the advice of the Rice Breeders. The Rice Breeders generally recommend the variety after confirming at least 65% rice percentage. In some cases the rice percentage goes up 75% in the Samba varieties. According to the farmers in Hambantota and Matara districts the average weight of paddy equivalent to rice is 1.6. Hence, the prices at different stages in rice marketing channels are calculated in Rupees per Kilogram equivalent to a Kilogram of Rice for the convenience. In major irrigation system in Hambantota, the total market margin is Rs. 5.61 per kilogram while the farm gate price is Rs. 21.15 (Table - 4.4.3). The paddy farmers receive 79.0% of the retail price of their product. City Rice Millers retained the highest partial market margin (Rs. 2.64 or 47%) as they perform many important marketing functions mainly milling and transporting from village to mill and mill to Colombo market. Compared to City wholesalers and retailers (Rs. 1.26 or 23%), Colombo Wholesalers retain very low partial market margin (Rs. 0.74 or 13%). The total market margin related to minor irrigation system (Rs. 5.61) is higher than in the major irrigation production system. On the other hand the farm gate price (Rs. 20.78 per kg.) is lower than that of major irrigation system which is equal to 77.7% of the retail price. The Village Collectors and Country Assemblers share their partial market margin equally as Rs. 0.67 per kg, and 11% of the total market margin. Similarly the City Rice Millers obtain the highest market margin Rs.

2.64 or 44% of the total market margin. The partial market margins of rest of the middlemen are the same as in major irrigation conditions. The rain-fed farmers in the district receive the lowest price Rs. 20.48 per kg equivalent to rice for their paddy, which is 75% of the retailed price. Moreover, the rain-fed paddy marketing system has the highest total market margin of Rs. 6.84 per kg in compared to other major and minor irrigation paddy marketing systems. The City Rice Millers obtained the highest partial market margin Rs. 3.31 per kg or 48% of the total market margin similar to the other marketing systems. However, the City and Village retailers a different category of middleman obtain a considerable partial market margin of Rs. 2.56 per kg which is accounted to 37% of the total market margin. Surprisingly the price of rice at the village retailers and the main urban centers particularly Ambalantota, Beliatta and Walasmulla of Hambantota district is Rs. 27.32 per kg is higher than the price of the similar rice at Colombo Retail Market. According to the paddy marketers, Colombo market receives rice from all over the country including highest rice producing areas.

Table – 4.4.3. Market margins in Hambantota district

Middlemen	Price / kg*	% of Retail Price	Market Margin (Rs.)	Market Margin (Rs.)
	Major Irrigation			
Farm gate	21.15	79.0%		
Country Assemblers	22.12	82.7%	0.97	17%
City Rice Mills	24.76	92.5%	2.64	47%
Colombo Rice wholesalers	25.5	95.3%	0.74	13%
City wholesaler & retailers	26.76	100.0%	1.26	23%
Total			5.61	100%
	Minor Irrigation			
Farm gate	20.78	77.7%		
Village Collectors	21.45	80.2%	0.67	11%
Country Assemblers	22.12	82.7%	0.67	11%
City Rice Mills	24.76	92.5%	2.64	44%
Colombo Rice wholesalers	25.5	95.3%	0.74	12%
City wholesaler & retailers	26.76	100.0%	1.26	21%
Total			5.98	100%
	Rain-fed			
Farm gate	20.48	75.0%		
Village Collectors	21.45	78.5%	0.97	14%
Village Rice Mill	24.76	90.6%	3.31	48%
City and Village Retailers	27.32	100.0%	2.56	37%
Total			6.84	100%

*Rice equivalent

Compared to Hambantota district both major irrigation (Rs. 21.55) and rain-fed (Rs. 21.34) farmers in Matara district receive higher farm gate price per kg of paddy equivalent to rice (Table - 4.4.4.). It could be observed that the competition to purchase paddy is somewhat high in Matara district due to the better infrastructure facilities and closeness to Colombo City market. Further, the percentage of farm gate price to the retail price in major irrigation (80.5%) and rain-fed (76.4%) marketing systems also are higher than in Hambantota district. The partial market margin of City Rice Mills (Rs. 1.56) is

30% of the total market margin which is low compared to Hambantota major irrigation paddy marketing system mainly due to low transport cost. On the other hand, the partial market margin of Colombo Rice Wholesalers Rs. 1.76 covers 33% of total market margin is high due to the transport cost they have pay to the transport agents. The City and Village retailers retain the highest partial market margin of Rs. 3.17 or 48% of the total market margin in the rain-fed paddy marketing system. Because, they purchase and transport the rice from village mills as well as highly speculate in the marketing system. They are the most risk takers and earn profit from the seasonal price movement of the rice. On the other hand, the Village Collector earn high partial market margin of Rs. 1.92 per kg equivalent of rice covering 29% of the total market margin. Eventually, the retail price of rice is higher in Matara district Rs. 27.93 per kg than in Hambantota district.

Table – 4.4.4. Market margins in Matara district

Middlemen	Price / kg*	% of Retail Price	Market Margin (Rs.)	Market Margin (Rs.)
		Major Irrigation		
Farm gate	21.55	80.5%		
Country Assemblers	22.20	83.0%	0.65	12%
City Rice Mills	23.76	88.8%	1.56	30%
Colombo Rice wholesalers	25.50	95.3%	1.74	33%
City wholesaler & retailers	26.76	100.0%	1.26	24%
Total			5.21	100%
		Rain-fed		
Farm gate	21.34	76.4%		
Village Collectors	23.26	83.3%	1.92	29%
Village Rice Mill	24.76	88.7%	1.50	23%
City and Village Retailers	27.93	100.0%	3.17	48%
Total			6.59	100%

*Rice equivalent

4.4.1.5. Problems in Marketing

All the responded paddy farmers (100% or 423) are facing the most pressing problem of low price they receive for their paddy production. No standard characters to measure the quality of paddy also consider as a main problem by many paddy farmers in Hambantota (Yala – 39% and Maha – 40%) and Matara (Yala – 34% and Maha – 36%) districts (Table - 4.4.5). The Marketing agents measure the quality in terms of moisture content and the appearance. Therefore these farmers blame the village Collectors and Village Boutiques that they devalue their products mentioning some irrelevant measures. Due to the financial commitments after obtaining informal credit or agricultural inputs they are obligate to sell the products to the village Collectors and Village Boutiques. However, the paddy farmers in major irrigation in Hambantota (Yala – 19% and Maha – 22%) and Matara (Yala and Maha – 21%) districts face comparatively fewer burdens as they produce good quality paddy and also they sell their products to the Country Assemblers. Similarly, the poor weighing of the products by Village Buyers is a severe problem for rain-fed paddy farmers in Hambantota (Yala – 59% and Maha – 56%) and Matara (Yala – 34% and Maha – 51%) districts. The commercial Country Assembler coming from the urban center measures the product, which they purchase mainly major irrigation farmers accurately. Even the delay of payments by the

Table - 4.4.5. Problems of paddy farmers in selling their paddy to buying agents

Problems	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Low Price	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
No standard	10 (19)	16 (43)	21 (66)	47 (39)	09 (21)	18 (47)	27 (34)
Poor weighing	03 (06)	11 (30)	19 (59)	33 (27)	08 (19)	13 (34)	21 (26)
Delay payments	05 (09)	12 (32)	16 (50)	33 (27)	06 (14)	21 (55)	27 (34)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Low Price	55 (100)	41 (100)	43 (100)	139 (100)	42 (100)	41 (100)	83 (100)
No standard	12 (22)	17 (41)	27 (63)	56 (40)	09 (21)	21 (51)	30 (36)
Poor weighing	03 (05)	11 (27)	24 (56)	38 (27)	08 (19)	19 (46)	27 (33)
Delay payments	06 (11)	13 (32)	21 (49)	40 (29)	06 (14)	24 (59)	30 (36)
Total	55 (100)	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

4.4.2. EXTENSION SERVICES

4.4.2.1. Source of information

The farmers in both districts are supposed to receive technical information and current technology from the Agriculture Department. The study reveals that the main source of agricultural information for most of the paddy farmers is their fellow farmers in both Hambantota (Yala – 84% and Maha – 81%) and Matara (Yala – 78% and Maha – 77%) districts (Table – 4.4.6). It is noteworthy that the situation is common in paddy farming under each irrigation method and either season in both districts. The Extension Officers train selected farmers from different villages. They are supposed to train their fellow farmers in the village through Yaya Demonstration. However, the sharing of knowledge is comparatively more popular among the farmers in rain-fed and minor-irrigation areas than in major irrigation schemes. The rain-fed farmers have widely different levels of knowledge about paddy farming. Therefore, they always discuss the matters related to paddy farming when they meet each other informally more often than the major irrigation farmers. According to major irrigation farmers, all the fellow farmers have generally equal knowledge and therefore they are eager to receive the knowledge from other possible sources. Paddy farming is indeed a group work where they have to take in most cases common decision by sharing their knowledge on farm practices. Mass media is considered as the second most important source of information according to the paddy farmers in Hambantota (Yala and Maha – 64%) and Matara (Yala – 68% and Maha – 70%) districts. The new Television and Radio programs very often telecast or broadcast current information in more attractive manner. Extension offers could be categorized as third important source of information according to the number of paddy farmers receive information in Matara (Yala and Maha – 60%). Even in Hambantota the major irrigation paddy farmers (Yala – 70% and Maha – 67%) categorize Extension Officers as the third important source. Major irrigation farmers in both districts always seek the help of Extension Officers even visiting their office in order to solve farmers pressing problems or to find current information and technology. Rain-fed farmers usually do not make much effort to find the new knowledge and technology otherwise the offices come and given them the instruction. Farmer organizations are also an important source of information in Hambantota district (Yala – 63% and Maha – 65%) but comparatively less important in Matara district (Yala and Maha – 49%). The farmers in Hambantota district is much organized and meet very often to share their knowledge while the farmers in Matara district have less ability to meet each other due to comparatively high other commitments. Further, the recently appointed Agricultural Research & Development Assistants have become somewhat an important source of information in Hambantota district particularly among minor irrigation (Yala – 59% and Maha – 56%) and rain-fed (Yala – 69% and Maha – 65%) farmers. The farmers receive most of the information from the Extension Officers through the Research & Development Assistants. However, they mainly disseminate simple information and technology due to their insufficient training. On the other hand as a category of village level officers from the same area and their political commitments, they have become an effective officer not only disseminate knowledge but also to solve some other non-technical problems of the farmers.

Table - 4.4.6. Sources of information received by paddy farmers

Sources	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
			Yala				
Extension Officer	37 (70)	19 (51)	15 (47)	71 (58)	29 (69)	19 (50)	48 (60)
Res & Dev Ast	18 (34)	22 (59)	22 (69)	62 (51)	12 (29)	12 (32)	24 (30)
Neighbors	40 (75)	31 (84)	27 (84)	98 (80)	31 (74)	31 (82)	62 (78)
Marketing Agents	09 (17)	04 (11)	02 (06)	15 (12)	06 (14)	01 (03)	07 (09)
Mass Media	34 (640	23 (62)	21 (66)	78 (64)	27 (64)	27 (71)	54 (68)
Farmer Org.	30 (57)	26 (70)	20 (63)	76 (62)	19 (45)	20 (53)	39 (49)
Total	53 (100)	37 (100)	32 (100)	122 (100)	42 (100)	38 (100)	80 (100)
			Maha				
Extension Officer	37 (67)	23 (56)	19 (44)	79 (57)	29 (69)	21 (51)	50 (60)
Res & Dev Ast.	18 (33)	23 (56)	28 (65)	69 (50)	12 (29)	14 (34)	26 (31)
Neighbors	40 (73)	37 (90)	35 (81)	112 (81)	31 (74)	33 (80)	64 (77)
Marketing Agents	09 (16)	05 (12)	03 (07)	17 (12)	06 (14)	02 (05)	08 (10)
Mass Media	34 (62)	26 (63)	29 (67)	89 (64)	27 (64)	31 (76)	58 (70)
Farmer Org.	30 (55)	29 (71)	28 (65)	87 (63)	19 (45)	22 (54)	41 (49)
Total	55 (100	41 (100)	43 (100)	138 (100)	42 (100)	41 (100)	83 (100)

* Percentages are in parenthesis

Marketing Agents are very less effective except in disseminating information when introducing a new agro chemical. However, they have some effort in major irrigation schemes in both Hambantota (Yala – 17% and Maha – 16%) and Matara (Yala and Maha – 12%) districts. The Marketing Agents consider these areas as a potential market to increase their market coverage as well as the market share.

4.4.2.2. Problems of Extension Service

The problems related to extension service have no any difference between the two seasons Yala and Maha. However, there is a great variation regarding the problems of extension service among the farmers cultivating paddy under different method of irrigation (Table – 4.4.7). Information gap is the main extension problem, which has been identified by the highest number of farmers in both Hambantota (71%), and Matara (67) districts. According to 78% (189) of the respondent farmers, the most important communication gap is the lack of accurate market information on both paddy (rice) and inputs while only 38% (92) of them consider gap of technological information. The farmers feel that they always receive the price for their paddy much less than the market price. The market information they receive through the mass media are considered as the distorted information. The paddy farmers are not satisfied with price of inputs particularly the fertilizer and agro-chemicals mainly because the lack of information and knowledge about the quality standard. They often blame on the adulterated fertilizer and chemicals available in the village. Farmers have the suspicion about the ever-increasing price of fertilizer and agro-chemicals. Less innovation in the message disseminate by the extension service is also considered as a very important inhibiting factor of the effectiveness of extension service for 53% respondents in Hambantota and 57% in Matara district. They usually receive the same technical innovation for many seasons they cultivated paddy. Although the poor coordination activities of extension service is a main problem for majority 55% of the farmers in Hambantota, only 33% of the paddy farmers in Matara district consider the poor coordination as a problem. Coordination among the activities performed by different service organizations such as Agricultural Department, Irrigation Department, Agrarian services Department, and other input-supplying agents is very week in the districts. Strong cooperation and coordination among service organization may strengthen not only the group dynamics of the farmers but also their economic return. Hambantota paddy farmers often face the delay of fertilizer supplies by Agrarian Services Department and also the irregular water supply by the Irrigation Department due to poor coordination. Insufficient visits and poor access for extension officers are main problems among rain-fed farmers in Hambantota (72% and 56%) and Matara (59% and 34%) districts respectively. However, the major irrigation paddy farmers in Hambantota (22% and 24%) and Matara (24% and 21%) are not much interest in visits by or access for the extension service. Many rain-fed farmers in Hambantota (72%) and Matara (59%) districts are not satisfied with the number of visits make by extension officers in order to disseminate the information and technology for paddy farming.

Table – 4.4.7. Problems of extension service for paddy farmers

Problem	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Insufficient visits	12 (22)	15 (34)	37 (72)	64 (43)	10 (24)	29 (59)	39 (43)
Poor access	13 (24)	14 (32)	29 (56)	56 (37)	09 (21)	17 (34)	26 (28)
Less innovations	23 (42)	22 (51)	35 (67)	80 (53)	23 (55)	29 (59)	52 (57)
Information gap	36 (65)	29 (68)	41 (79)	106 (71)	24 (57)	38 (76)	62 (67)
Poor coordination	19 (35)	27 (63)	37 (72)	84 (56)	13 (31)	17 (34)	30 (33)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

4.4.3. CREDIT MARKET

4.4.3.1. Needs of Credit

Most of the paddy farmers in both Hambantota and Matara district (81%) had additional financial needs when they lost the paddy yield due to unexpected drought, flood or pest outbreak (Table – 4.4.8.). Comparatively, almost all the rain-fed farmers in both Hambantota (98%) and Matara (90%) felt the financial needs very severely when they face unexpected loss of the paddy yield. The majority of the paddy farmers in Hambantota (55%) and Matara (63%) obtain credit seasonally to purchase inputs required for paddy cultivation. Among them 79% and 88% rain-fed paddy farmers in Hambantota and Matara district respectively obtain season credit to obtain the inputs. However, the number of major irrigation farmers who obtain credit to purchase inputs is low (35% and 33%) in both districts. Due to their poor income from farming and lack of any other source of income rain-fed farmers have to obtain credit to continue farming seasonally. They spend all the income they could receive from selling excess paddy yield before the commencement of the next season. However, the majority of the major-irrigation and minor-irrigation farmers in both districts are middle-income farmers. They in most cases manage the expenses of inputs with their savings form the paddy income. Although very few major irrigation farmers in both districts (15% and 14%) obtain credit for non-farm activities, many rain-fed farmers (53% and 46%) obtain credit for non-agricultural purposes. They use these credits mostly for small businesses and some time for family matters such as illness or a family function. Generally, only few paddy farmers obtain credits in Hambantota (10%) and Matara (09%) districts for the purpose of consumption. The number of rain-fed farmers who obtain credit for consumption is relatively high in both districts. It could be revealed that most of the rain-fed farmers are regular borrowers while major irrigation paddy farmers have to borrow money mainly for special occasions when they have unexpected expenditure.

Table – 4.4.8. Needs of credit for paddy farmers

Needs	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Purchase inputs	19 (35)	22 (51)	,41 (79)	82 (55)	14 (33)	44 (88)	58 (63)
Loss of products	39 (71)	31 (73)	51 (98)	121 (81)	29 (69)	45 (90)	74 (81)
Non-agriculture	08 (15)	14 (32)	28 (53)	49 (33)	06 (14)	23 (46)	29 (32)
Consumption	03 (05)	05 (12)	07 (14)	15 (10)	02 (05)	06 (12)	08 (09)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

4.4.3.2. Sources of Agricultural Credit

The major source of agricultural credit is the Banks both in Hambantota (59%) and Matara (64%) districts (Table – 4.4.9). Most of the major irrigation farmers in Hambantota (69%) and Matara (86%) districts obtain formal credits from banks and have become regular customers. They indeed enjoying the subsidized agricultural credit with low interest rates in average 12%. However, the numbers of rain-fed farmers who obtain formal credits from banks are comparatively low in Hambantota (42%) and Matara (46%) districts. Many of the rain-fed farmers have become disqualified to obtain credits due to unsettled agricultural loans. The majority of rain-fed farmers in Hambantota (51%) and Matara (68%) districts obtain informal credit from the village moneylenders particularly the village boutique owners who sell fertilizer and agro-chemicals. They in most cases get the inputs with the agreement that they would sell their paddy to the moneylenders. On the other hand, this informal credit market is readily available and no formalities are involved in obtaining credit. However, the interest rates are very high ranging from 5% to 10% per month. Only very few farmers particularly rain-fed farmers in Hambantota (12%) and Matara (10%) districts pawn their assets such jewelry or household items in the case of emergency needs of inputs. Due to unexpected pest outbreak and droughts they have to find quick money to purchase inputs again during the same season. Some paddy farmers particularly major irrigation farmers in Hambantota district (20%) obtain credit from their fellow farmers when they have urgent need of credit. They are better off farmers, and have good relations and trust among each other. The credit markets for minor irrigation farmers in Hambantota district are mainly the formal credit from banks (66%) and moneylenders (27%) while few of them obtain credit from fellow farmers (15%) and pawning assets (10%). Anyway the credit market of minor irrigation farmers are somewhat formal than rain-fed farmers.

Table – 4.4.9. Sources of agricultural credit received by paddy farmers

Source	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Banks	38 (69)	28 (66)	22 (42)	88 (59)	36 (86)	23 (46)	59 (64)
Money lenders	06 (11)	12 (27)	27 (51)	44 (29)	03 (07)	34 (68)	37 (40)
Pawn assets	02 (04)	04 (10)	06 (12)	12 (08)	02 (05)	05 (10)	07 (07)
Fellow farmers	11 (20)	06 (15)	05 (09)	22 (15)	02 (05)	02 (05)	04 (05)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

4.4.3.3. Problems in Formal Credit Market

Problems of agricultural credits faced by the farmers are varying according to distract as well as the method of irrigation of their paddy farming. The percentage of farmers who face each problem related to agricultural credit in Hambantota is higher than in Matara district (Table – 4.4.10). High interest rate, too much formalities to obtain and insufficiency of the amount are the main problems of agricultural credit according to 51%, 51% and 45% farmers in Hambantota and 48%, 46% and 42% farmers in Matara district respectively. It is noteworthy that relatively few major irrigation farmiers in both Hambantota (38%) and Matara (33%) consider the interest rate as a problem of agricultural credit. Compared to income from the paddy farming under major irrigation system farmers obtained a considerable amount of harvest to receive a higher profit margin. However, 60% and 61% of the rain-fed farmers in Hambantota and Matara districts respectively feel that the interest rate of formal agricultural credit is high compared to their poor returns from paddy farming. The most important problem of the major irrigation farmers regarding agricultural credit is the insufficiency of the amount they could obtain as credit in Hambantota (58%) and Matara (67%) districts. Most of the major irrigation farmers are innovators. They do farming using more capital-intensive technology particularly machinery as well as agro-chemical. Therefore, they need more occasional operational capital to purchase or utilize their required inputs. Only few rain-fed farmers (Hambantota – 33% and Matara - 22%) have the problem of insufficiency of the amount they could obtain as agricultural credit. They are mainly using labor intensive farming techniques, which they mostly manage with the family labor. Lack of surety is the least important problem for major and minor irrigation farmers because only very few farmers in both Hambantota (major - 04%, minor – 12%) and Matara (05%) consider it as a problem to obtain agricultural credit from banks. The major irrigation farmers are regular as well as trustworthy customers of the banks for a long period. Although the surety is an important problem for 63% rain-fed farmers in Hambantota, only 10% of the rain-fed farmers in Matara district consider it as a problem. Many of the rain-fed farmers in Hambantota district do not have either proper claim for the lands they cultivate or any other asset to be considered as surety for formal credit. Too much formality involved with formal credit market is a problem for few major irrigation farmers in both Hambantota (31%) and Matara (19%) districts. Too much formality in formal credit market is one of the main problems for majority of rain-fed (67%) and minor irrigation (59%) farmers in Hambantota district and rain-fed farmers (68%) in Matara district. Not only the major irrigation farmers are regular and trustworthy customers but also have better educational background compare to the rain-fed and minor-irrigation farmers. Only few farmers face a problem of obtaining formal credit because they do no have an insurance policy. However, a considerable number of rain-fed farmers in Hambantota (33%) and Matara (27%) districts face a problem of obtaining credit without an insurance policy. In most cases they have not continued the payments of installments regularly. Therefore, they are unable to receive compensation for their crop damages particularly causing by drought and pests due to discontinued insurance policy.

Table – 4.4.10. Problems of agricultural credit obtained by paddy farmers

Problem	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Interest rate	21 (38)	24 (56)	31 (60)	77 (51)	14 (33)	30 (61)	44 (48)
Formalities	17 (31)	25 (59)	35 (67)	77 (51)	08 (19)	34 (68)	42 (46)
Insufficient	32 (58)	19 (44)	17 (33)	68 (45)	28 (67)	11 (22)	39 (42)
No surety	02 (04)	05 (12)	33 (63)	40 (27)	02 (05)	05 (10)	07 (07)
No insurance	04 (07)	06 (15)	17 (33)	27 (18)	03 (07)	13 (27)	16 (18)
Unsettled credit	06 (11)	08 (20)	16 (30)	30 (20)	02 (05)	20 (39)	22 (23)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

4.4.4. CROP INSURANCE

4.4.4.1. Policy Holders

The majority and almost a similar percentage of paddy farmers have insured their paddy fields in both Hambantota (56%) and Matara (58%) districts (Table - 4.4.11). Most of the major irrigation paddy farmers in Hambantota (75%) and Matara (81%) districts have the insurance policy. Even the majority of minor irrigation paddy farmers (61%) in Hambantota district has insurance policy. However, only few rain-fed paddy farmers have insurance policy in Hambantota (33%) and Matara (39%) districts. Even the majority of minor irrigation paddy farmers (61%) have the crop insurance policy.

Table – 4.4.11. Crop Insurance Policy obtained by paddy farmers

Situation	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Yes	41 (75)	26 (61)	17 (33)	84 (56)	34 (81)	20 (39)	54(58)
No	14 (25)	17 (39)	35 (67)	66 (44)	08 (19)	30 (61)	38 (42)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

4.4.4.2. Reasons to insure paddy farm

Most of the paddy farmers in Hambantota and Matara districts have obtained the insurance policy due to understanding the importance of insurance for paddy farming (81% and 85% respectively) and also to obtain formal credit from the banks (81% and 81% respectively) (Table – 4.4.12). All the rain-fed farmers (100%) in both districts have recognized the importance of holding an insurance policy. They feel that the understanding of merits particularly to face unexpected drought, flood or pest outbreak, of the insurance policy encouraged them to obtain the policy. Further, they are intended to adopt innovations in order to improve farming conditions as well as to obtain higher income without any fear as they have the insurance policy. Having a crop insurance policy is a condition to be qualified to obtain subsidized agricultural credit from the formal credit markets. With the increasing rate of defaulters, the banks consider the insurance other than the ownership of the paddy land to lend agricultural credit in order to make sure the repayment of loans. Few major irrigation paddy farmers in Hambantota (34%) and Matara (32%) district have obtained the crop insurance also considering the risk involving in their paddy farming. However, the high risk involving in paddy farming is one of the main reasons for most of the minor irrigation (64%) and rain-fed (86%) paddy farmers in Hambantota district and 88% of the rain-fed farmers in Matara district. The rain-fed farmers very often face drought conditions and pest outbreaks in both districts due to the limited rainfall and uncertainty of setting the rain in time. Although Extension Officers and Crop Insurance Board persuade many major irrigation farmers in Hambantota (51%) and Matara (47%) only few rain-fed and minor irrigation paddy farmers in Hambantota (21% and 32% respectively) and Matara (31%) districts have been persuaded to obtain the insurance policy. According to the study the very low disposable income of the minor irrigation and rain-fed farmers influence them to make decision on financial management other than the others persuasion. However the rain-fed and minor irrigation farmers are influenced by their own past experience to adopt the insurance policy.

Table – 4.4.12. Reasons for insuring paddy crop by farmers

Reasons	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
High risk	14 (34)	17 (64)	15 (86)	45 (54)	11 (32)	18 (88)	29 (53)
Obtain credit	34 (83)	20 (76)	15 (86)	68 (81)	29 (85)	15 (75)	44 (81)
Persuasion	21 (51)	08 (32)	04 (21)	33 (39)	16 (47)	06 (31)	22 (41)
Important	28 (68)	23 (88)	17 (100)	68 (81)	26 (76)	20 (100)	46 (85)
Total	41 (100)	26 (100)	17 (100)	84 (100)	34 (100)	20 (100)	54 (100)

* Percentages are in parenthesis

4.4.4.3. Reasons not to insure paddy farm

Almost all the paddy farmers who do not have an insurance policy in Hambantota (86%) and Matara (91%) stated that the high premium is most important factors preventing them adopting insurance (Table 4.4.13). This condition is common to the entire paddy farmer in both districts who are cultivating paddy under different irrigation methods. The Crop Insurance Board decides the premium rate considering many factors through different criteria specific to the locations. On the other hand, low compensation for their crop damages has influenced most of paddy farmers in Hambantota (80%) and Matara (85%) district respectively irrespective of the district and the method of irrigation not to hold an insurance policy. The farmers blame the inappropriate criteria the insurance officials use for the damage measurements and determination of the compensation. However, they deny their any adverse selection and moral hazards. Further, the difficult formality involving in the damage estimation and payment procedures of compensation has also act as a discouraging factor for majority of paddy farmers in Hambantota (65%) and Matara (57%) districts irrespective of their method of irrigation. No risk involving in paddy farming under major irrigation systems is considered as an important factor for many farmers in Hambantota (57%) and Matara (63%) not to adopt an insurance policy.

Although many rain-fed farmers do not have insurance policy, only one respondent (3%) from each district has not adopted the policy due to no risk in paddy farming. The rain-fed farmers are very often prone to natural disasters such as flood, drought and pest outbreaks. Defaulters of paddy insurance among the non-insured paddy farmers in Hambantota (41%) are lower than in Matara (57%) district. The farmers in Hambantota district attempt to minimize the risk through insurance because paddy farming is only source of income for most of the farmers. Many paddy farmers in Matara district have some other sources of income which they can compensate some of the loses in paddy farming. Only very few paddy farmers in Hambantota (16%) and Matara (19%) have not interested about insurance policy considering their poor knowledge as an important factor. Generally the paddy farmers in both district have sufficient educational level to understand the existing insurance policy.

Table – 4.4.13. Reasons for not insuring paddy crop by farmers

Reasons	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Poor knowledge	01 (07)	02 (13)	07 (21)	10 (16)	00 (00)	07 (24)	07 (19)
High Premium	10 (71)	15 (88)	33 (93)	57 (86)	07 (88)	28 (92)	35 (91)
Default	03 (21)	06 (38)	18 (52)	27 (41)	06 (75)	16 (52)	22 (57)
Low Compensation	12 (86)	14 (81)	28 (79)	53 (80)	07 (88)	25 (84)	32 (85)
No risk	08 (57)	03 (19)	01 (03)	12 (18)	05 (63)	01 (04)	06 (16)
Difficult formality	09 (64)	12 (69)	22 (62)	42 (63)	05 (63)	17 (56)	22 (57)
Total	14 (100)	17 (100)	35 (100)	66 (100)	08 (100)	30 (100)	38 (100)

* Percentages are in parenthesis

4.4.5. IRRIGATION SERVICES

4.4.5.1. Problems

All the farmers in Hambantota district where they have dry zone paddy cultivation have recognized the long-term reduction of rainfall in the district. However many problems related to water supply in major and minor irrigation systems have been identified in both districts. Almost all the problems of water services have affected mostly the minor irrigation farmers in Hambantota district other than the farmers who cultivate paddy under major irrigation in both districts (Table - 4.4.14). Minor irrigation farmers receive water from the natural water springs (natural surface aquifers) which are very limited in supply and highly sensitive to drought conditions. Lack of maintenance of the water distribution channels in major irrigation systems has become a severe problem for the majority of the farmers in Hambantota (51%) and Matara (55%) districts. In minor irrigation system the problem of maintenance is very severe for most of the farmers (72%) in Hambantota district. There are three types of channels namely Main channels, Distribution channels and Farmer field channels are demarcated in the irrigation water supply systems. Due to the lack of funds government do not make enough attention to repair the anicuts and broken parts, and clean the main and distribution channels. However, the farmers are responsible for the maintenance of the farmer field channels. It could be observed that even the farmers do not clean farmer field channels, which distribute water to their own paddy fields. Therefore, a considerable amount of scare water resources are wasted at the distribution. Poor water collection system is considered by 40% of the minor-irrigated farmers and 25% and 21% of major irrigation farmers in Hambantota and Matara districts. Although the major irrigation systems have tanks for the collection of water, most of the natural water springs have no any collection methods. Hence, water flows trough the channels rapidly without making any use. Majority of minor-irrigation farmers (53%) has the impression that their water distribution channels have not been constructed properly to distribute the water efficiently and effectively. About 65% of the minor irrigation farmers, and 29% and 33% major irrigation farmers in Hambantota and Matara districts respectively are unhappy with the inefficiency of the water supply authorities. According to them the officers do not supply the water according to their requirements in terms of time and amount. Some farmers in major-irrigation systems (Hambantota 25% and Matara 38%) and minor irrigation systems (21%) have their own problems in supplying water for paddy farming. They are complaining about the damaging of distribution channels, converting water flows to their paddy field by force and wasting of water by over use.

Table – 4.4.14. Problems of water supply for irrigated paddy farmers

Reasons	Hambantota District			Matara District
	Major Irrigation	Minor Irrigation	Total	Major Irrigation
Poor collection	14 (25)	17 (40)	31 (32)	09 (21)
Bad channels	12 (22)	23 (53)	35 (36)	11 (26)
Lack of maintenance	28 (51)	31 (72)	59 (60)	23 (55)
Inefficient management	16 (29)	28 (65)	44 (45)	14 (33)
Farmers' problems	14 (25)	09 (21)	23 (23)	16 (38)
Total	55 (100)	43 (100)	98 (100)	42 (100)

* Percentages are in parenthesis

4.4.6 FARMER ORGANIZATION

4.4.6.1. Members

The main reason to establish the farmer organizations particularly in major and minor irrigation systems was to solve the farmers' problems related to water management. Presently irrigation department maintain their farmer organizations only in major irrigation systems. The Agricultural Research and Development Assistants under the guidance of Agrarian Services Department have established the farmer organization in each village. They are functioning at the village level under the supervision of Development Offices in each Agrarian Service Center (ASC). However, they are given agricultural related information and trained on current technologies by the Agricultural Instructors functioning at the ASC. Further, the Department of Agriculture has established Yaya Organizations in selected areas in both districts. Hence, each farmer has to become a member of the farmer organization in his village to reap the benefits such as efficient and effective water management, use of current information and technology as well as purchasing the inputs (mainly fertilizer) at subsidized rates. Therefore, all the respondent farmers have the membership in at least one farmer organization in the village.

4.4.6.2. Main Functions

The farmer organizations are supposed to make contribution to each and every activity involves with paddy production as well as marketing. Generally, the contribution of farmers in the activities of farmer organizations is very poor in both districts (Table - 4.4.15). However, majority of farmers in both districts (Hambantota 52% and Matara 58%) joins the organization when they need lobbing particular for the problems related to supply of water, fertilizer and seed paddy. Further many of them (Hambantota 48% and Matara 51%) share the information and knowledge, which they received from different sources, through the farmer organization. The Department of Agriculture trains the selected farmers to disseminate knowledge and skills on current technology. Thereafter, they are responsible in disseminate his knowledge and skills among their fellow farmers through Yaya Organizations. However, comparatively less number of rain-fed farmers (Hambantota 48% and Matara 42%) shares the information and knowledge through the organizations. As the income and interest of rain-fed farmers are low compared to irrigated farmers, they have no much intention to work with fellow farmers in sharing of information and knowledge through formal farmer organizations. However, the major and minor irrigation farmers are actively sharing technical information through the farmer organizations. They actively participate in Yaya Organizations and demonstrate the current technology such as Integrated Pest Management (IPM). The farmers believe that they have already increased their paddy yield by cultivating one variety at the same time and conducting cultural practices in similar manner through Yaya Organizations. Farmers' contribution in the organization in decision making on farming activities as a group is less than 31% in Hambantota and 45% in Matara district. The farmers in Hambantota district make their individual decision due to limited water availability in dry zone particularly during the Yala season. The rain-fed farmers blame each other for seeding paddy at different dates, which create many problems in pest control. Very few farmers in both districts (Hambantota 15% and Matara 12%) purchase their inputs through the farmer organization. Even the farmers, who purchase the inputs through the farmer organization, they purchase only the fertilizer selling by the Agrarian Service Centers. The ASC encourage the farmers to purchase fertilizer as groups for the convenience. All the farmers (100% or 242) purchase their agro-chemicals individually from the private traders. Presently the sharing of labor among the fellow farmers has been reduced to 28% in Hambantota and 24% in Matara district. However, according to the farmers they share the labor not because of the farmer organization but their traditions, customary management systems and family relations. Product marketing is the least contributing function by the farmers in their organizations in Hambantota (10%) and Matara (08%) districts. Among them the group dynamic in marketing of the paddy production is negligible in Hambantota (06%) and Matara (04%) districts.

Table – 4.4.15. Contribution of paddy farmers in main functions of farmer organizations

Functions	Hambantota District				Matara District		
	Major Irrigation	Minor Irrigation	Rain-fed	Total	Major Irrigation	Rain-Fed	Total
Purchase inputs	08 (15)	07 (16)	08 (15)	23 (15)	07 (17)	04 (08)	11 (12)
Decision making	18 (33)	16 (37)	12 (23)	46 (31)	22 (52)	19 (38)	41 (45)
Labor sharing	12 (22)	12 (28)	18 (35)	42 (28)	09 (21)	13 (26)	22 (24)
Information sharing	28 (51)	23 (53)	21 (40)	72 (48)	26 (62)	21 (42)	47 (51)
Product Marketing	07 (13)	05 (12)	03 (06)	15 (10)	05 (12)	02 (04)	07 (08)
Lobbing	28 (51)	28 (65)	22 (42)	78 (52)	27 (64)	26 (52)	53 (58)
Total	55 (100)	43 (100)	52 (100)	150 (100)	42 (100)	50 (100)	92 (100)

* Percentages are in parenthesis

4.5. ECONOMICS OF RICE PRODUCTION

4.5.1. PRODUCTIVITY AND TECHNICAL EFFICIENCY

4.5.1.1. Hambantota District (Dry Zone)

4.5.1.1.1. Yala Season

The stochastic frontier was fitted to paddy output, which was considered as a function of costs of labor, seed, fertilizer, agrochemical, farm equipment, farm power and all other costs as the inputs in value terms (monetary values). Two dummy variables, one for insurance and the other for membership of farm organization was used to assess the impact of these variables on the output of paddy in both areas under study. The method of maximum likelihood estimation was used to estimate the underline coefficients. The results presented in Table 4.5.1.

The negative relationship of labor cost with output indicates possible decrease of output with an increase in labor input/cost. For example, the coefficient of –0.22 under major irrigation indicates the unit rise in labor cost will decrease the output by 0.22 units. The similar interpretation can be made for minor-irrigation (-0.52) and rain-fed (-0.82) showing the severity of labor cost in rain-fed cultivation. The use labor in major irrigation is comparatively low as they use tractor for land preparation and post harvesting operations, therefore less dependent on labor. The labor use in rain-fed farming particularly the family labor is very high which increases the calculated labor cost. Although the productivity of labor is comparatively low, the cost of labor is high and reduces eventually the impact on the efficiency of paddy production. Further, the results revealed that production efficiency in rain-fed farming could be increased significantly (0.39) by increased use of farmers own seed paddy. Stated differently, they believed that use of high quality certified seed will increase their yield and so efficiency of input use. Therefore, the rain-fed farmers should be encouraged to produce their own high quality seed paddy or making available them in right time and required quantities in order to increase their production efficiency. The estimated co-efficient of fertilizer is significantly positive under all the three irrigation methods. An increase of fertilizer use could increase the output and therefore the technical efficiency under minor-irrigation and rain-fed farming more than under major-irrigation. In other words, paddy farmers in the major irrigation systems apply fertilizer much efficiently than the others. With respect to agrochemicals, negative coefficients in major (-0.23) and minor (-0.24) irrigation systems indicate the impossibility to increase productivity by increasing agrochemicals. They may already use agrochemical more than it is required, which reduces the efficiency of resource use. Cost of farm equipment makes significant impact on efficiency of paddy farming under all irrigation methods in Hambantota district. Introducing farm equipment can increase the technical efficiency in paddy farming. Cost of farm power under all the irrigation methods particularly in minor irrigation (-0.32) makes negative impact on the production and therefore the technical efficiency. The cost of farm power is comparatively high in both districts. Though there were positive relationship between output and other cost, the coefficients are not statistically significant implying that other costs do not significantly influence the productivity and therefore the technical efficiency.

The dummy variable that represents impact of insurance was significant at 5% level suggesting the severity of the risk factor involved in paddy farming. It is well known that both yield and price uncertainty is high in paddy farming giving hard time for farmers to make their future decision. This came out to be very important policy implications in that current insurance policies, if any, should be review and provide (less expensive) alternative insurance packages from which to choose depending on the risk prevailing in a particular area rather than one unique package across island. Estimated coefficients indicates that holding an insurance policy gives positively significant technical efficiency all three major-irrigation (0.12), minor-irrigation (0.22) and rain-fed (0.14) irrigation methods. With insurance policy farmers are become risk seekers to adopt innovations even under some uncertainty conditions. Further the technical efficiency of being a member of the farmer organization also positively significant under major-irrigation (0.31), minor-irrigation (0.34) and rain-fed (0.12) irrigation methods. The paddy farmers can increase the technical efficiency of paddy production by becoming a member of the farmer organization. The implication of these results is that having being a member of farmer organizations, everyone has equal right in access to new information so that they can take collective actions.

Table – 4.5.1. Maximum likelihood estimates: Hambantota District, Yala 2001[1].

Variable	Unit of measurement	Estimated Coefficients		
		Major Irrigation	Minor Irrigation	Rain-fed
Labor Cost	Rs.	-0.2234*	-0.5211*	-0.8238*
		(0.0954)	(0.2327)	(0.0542)
Seed Cost	Rs.	0.3213	0.2142	0.3916*
		(0.4016)	(0.2678)	(0.0614)
Fertilizer Cost	Rs.	0.2182*	0.3240*	0.2324*
		(0.0949)	(0.1350)	(0.0272)
Agro-chemical Cost	Rs.	-0.2328*	-0.2431*	0.1262
		(0.0327)	(0.0724)	(0.1542)
Farm Equipment Cost	Rs.	0.4213*	0.3534*	0.1127*
		(0.0731)	(0.0382)	(0.0275)
Farm Power Cost	Rs.	-0.2111*	-0.3151*	-0.1232*
		(0.0681)	(0.0900)	(0.0342)
Other Cost	Rs.	0.4292	0.2823	0.3242
		(0.4769)	(0.3521)	(0.1907)
Insured Farmers	Dummy	0.1227*	0.2176*	0.1423*
		(0.0212)	(0.0231)	(0.0321)
Member Farmer Organization	Dummy	0.3121*	0.3423*	0.1232*
		(0.0827)	(0.0742)	(0.0217)
Number of cases		53	37	32

* Significant at 05% level
Standard errors are in parenthesis

4.5.1.1.2. Maha Season

[1] The exogenous variables are inputs in value term (monetary values). Exogenous variables could be measured in quantity as well as in value terms (Gujarati, 1988). Proxies have not been used for fertilizer and agrochemical variables since they are measurable.

During the Maha season the paddy farmers use the available labor much efficiently under major and minor irrigation systems. However rain-fed farmers use more labor (-0.21) even in Maha season, which reduces the technical efficiency (Table - 4.5.2.). The minor irrigation (0.12) and rain-fed farmers (0.23) could increase the use of quality seed paddy in order to increase the technical efficiency. All the paddy farmers have positively significant coefficients with cost of fertilizer. As in Yala season, there exists a potential to increase Maha paddy production in Hambantota district by additional use of fertilizer. Estimated Maximum likelihood coefficients are significantly different from zero suggesting higher yield response for the additional use of fertilizer, especially in minor irrigation regimes. They are in a position to increase the production efficiency by increasing the fertilizer application. With respect to farm equipment, positive and significant coefficients for Maha season suggests that use of more farm equipment particularly for weeding can increase the technical efficiency of paddy farming, as the weeding is a severe problem during the Maha season. The negative and significant coefficients for minor irrigation (-0.13) and rain-fed (-0.24) imply the significant reduction in actual yield thus reducing the technical efficiency. As with Yala season, the paddy farmers in Hambantota district, irrespective of the irrigation methods, can increase their production and therefore the technical efficiency significantly in paddy farming by adopting crop insurance policy (major-irrigation 0.23, minor irrigation 0.24, and rain-fed 0.31). As discussed above, similar conclusions can be made with respect to crop insurance and farmer organization.

Table – 4.5.2. Maximum likelihood estimates: Hambantota District, 2001/2002

Variable	Unit of measurement	Estimated Coefficients		
		Major Irrigation	Minor Irrigation	Rain-fed
Labor Cost	Rs.	0.1234 (0.0718)	0.3221 (0.2167)	-0.2131* (0.0927)
Seed Cost	Rs.	0.4127 (0.2428)	0.1261* (0.0631)	0.2310* (0.1100)
Fertilizer Cost	Rs.	0.3161* (0.0725)	0.4312* (0.1624)	0.3648* (0.0732)
Agro-chemical Cost	Rs.	-0.3172* (0.0749)	0.1022 (0.0567)	-0.2171* (0.0835)
Farm Equipment Cost	Rs.	0.5213* (0.1713)	0.2182* (0.0913)	0.4138* (0.0931)
Farm Power Cost	Rs.	0.5643 (0.1763)	-0.1286* (0.0348)	-0.2431* (0.0639)
Other Cost	Rs.	0.2194 (0.1856)	0.3184 (0.1990)	0.2874 (0.1691)
Insured Farmers	Dummy	0.2314* (0.0232)	0.2412* (0.0536)	0.3121* (0.1423)
Member Farmer Organization	Dummy	0.2543* (0.0727)	0.3217* (0.1064)	0.4135* (0.1253)
Number of cases		55	41	43

* Significant at 05% level
** Standard errors are in parenthesis

4.5.1.2. Matara District (Wet Zone)

4.5.1.2.1. Yala Season

Maximum likelihood estimates for stochastic frontier production function were obtained for the data collected from Matara district and separate regressions were run for Yala and Maha seasons (Table - 4.5.3). Among the estimates, variables of labor (for rain-fed), fertilizer, agrochemical, farm power, insurance (for rain-fed), and farmer organization were statistically significant at 0.05 level. Cost of labor has negative coefficient of -0.12 in paddy farming under rain-fed condition, which imply that additional unit of labor will results on negative contribution to the total production of paddy.

Table – 4.5.3. Maximum likelihood estimates in Matara District during Yala 2001.

Variable	Unit of measurement	Estimated Coefficients	
		Major Irrigation	Rain-fed
Labor Cost	Rs.	0.2341	-0.1162*
		(0.1423)	(0.0484)
Seed Cost	Rs.	0.3162	0.2672
		(0.2834)	(0.1572)
Fertilizer Cost	Rs.	0.1872*	0.2673*
		(0.0604)	(0.0955)
Agro-chemical	Rs.	-0.1231*	0.2132
Cost		(0.0352)	(0.1122)
Farm Equipment	Rs.	0.1623*	0.1832*
Cost		(0.0613)	(0.0447)
Farm Power Cost	Rs.	-0.1341*	-0.2133*
		(0.0373)	(0.0237)
Other Cost	Rs.	0.5231	0.4133
		(0.3269)	(0.2296)
Insured Farmers	Dummy	0.1211	0.1028*
		(0.1524)	(0.0210)
Member Farmer	Dummy	0.2254*	0.3871*
Organization		(0.0934)	(0.0653)
Number of cases		42	38

* Significant at 05% level
** Standard errors are in parenthesis

The cost of seed paddy, in rain-fed farming during Maha season did not yield significant coefficient but remain positive contribution to the yield. However, coefficient of cost of fertilizer significant at 0.05 level in both major irrigation and rein-fed conditions. However, rain-fed farmers (0.27) can increase the productivity and therefore the technical efficiency by increasing fertilizer input than by major irrigation farmers (0.19). This fact is supported from the descriptive analysis section discussed in other chapter (3 and 4) showing higher percentage of farmers in the major irrigation regimes apply recommended fertilizer. With respect to agrochemical, the major irrigation regimes had significant negative relationship (-0.1231) suggesting that additional agro-chemical does not contribute to higher output. The study reveals that farmers under major irrigation use high amount of agro chemical although they have exposure to the information on Integrated Pest Management (IPM) demonstrations. The rain-fed farmers have adopted

IPM and have reduced their cost on agrochemicals, and they may operate at optimal level of production with respect to agro-chemicals. Even in Matara district paddy farmers' use very limited farm equipment in paddy cultivation. The estimated coefficients for both major and rain-fed conditions were positively significant at 0.05 level. They can increase the production and thereby technical efficiency by introducing farm equipment particularly weeders. However, farm power variable was significantly (0.05 level) and negatively related to output. Thus the agro-chemicals have negative influence over paddy output and therefore on the technical efficiency. The implication is that farmers need to reduce the use of farm power in order to increase the production. Similar to Hambantota district, other costs involved in paddy farming in Matara also have no significant impact on the total output and therefore on the technical efficiency. The insurance variable had significant positive impact on the output suggesting its positive impact to raised technical efficiency. As expected, these results suggest that risk in paddy production is higher under rain-fed conditions than major irrigation. Being a member of farmers' organization is positively significant with the output under both major-irrigation (0.23) and rain-fed (0.39) systems.

4.5.1.2.2. Maha Season

Separate stochastic production frontiers of the Cobb-Douglas are specified for two irrigation methods in Maha 2001 / 2002 and estimated as before. The results are shown in Table 4.5.4. The estimated coefficients for the labor input as well as seed paddy do not make any significant influence on the output and therefore on the technical efficiency. Maha season in Matara district is very successful season as the farmers receive sufficient rainfall as well as favorable climatic conditions. With the high demand they use both labor and seeds more efficiently. However the fertilizer in both major (0.23) and rain-fed (0.31) irrigation conditions have significant positive impact on the production and technical efficiency. They would be able to increase the production efficiency by adding more fertilizer. It is noteworthy that the cost of agro-chemicals has no significant effects on the output. Both major irrigation (0.23) and rain-fed (0.25) farmers in Matara district have efficiently tended to adopted the IPM technology, which use minimum agro-chemicals to control pests in paddy farming. Though the farm power variable does not have significant impact on the paddy output on the major irrigation areas, it has significant negative impacts (-0.16) on the rain-fed areas. Hence, reduction of cost of farm power can increase the technical efficiency of paddy production under rain-fed farming. The cost of other inputs does not have significant impacts. The dummy variable representing insurance variable has significant impact (0.22) only on rain-fed conditions. This suggests that appropriate insurance policy can increase the technical efficiency of rain-fed paddy farmers in Matara district. Farmer organizations dummy variable has shown significant at 0.05 level in both situations: farming under major irrigation (0.13) and rain-fed (0.21).

Table – 4.5.4. Maximum likelihood estimates: Matara District Maha 2001 / 2002.

Variable	Unit of measurement	Estimated Coefficients	
		Major Irrigation	Rain-fed
Labor Cost	Rs.	0.2858	0.2146
		(0.1504)	(0.3211)
Seed Cost	Rs.	0.2321	0.3127
		(0.2579)	(0.1832)
Fertilizer Cost	Rs.	0.2341*	0.3134*
		(0.0689)	(0.0612)
Agro-chemical	Rs.	0.2316	0.2531
Cost		(0.2114)	(0.1489)
Farm Equipment	Rs.	0.2131*	0.2829*
Cost		(0.0496)	(0.0743)
Farm Power Cost	Rs.	0.2231	-0.1624*
		(0.1174)	(0.0649)
Other Cost	Rs.	0.6129	0.2389
		(0.6810)	(0.1625)
Insured Farmers	Dummy	0.3214	0.2241*
		(0.1692)	(0.0732)
Member Farmer	Dummy	0.1264*	0.2118*
Organization		(0.0333)	(0.0812)
Number of cases		42	41

* Significant at 05% level

** Standard errors are in parenthesis

4.5.2. RANGE IN TECHNICAL EFFICIENCY

4.5.2.1. Mean Technical Efficiency

Mean technical efficiency, total variance and gamma values of frontier production functions by different irrigation systems in both Hambantota and Matara district are shown in Tables - 4.5.5, 4.5.6 and Appendixes 4 & 5. The Gamma value (γ) in every irrigation system of both districts during both seasons is large and statistically significant implying significant variation in range in technical efficiency in each irrigation system in both districts during Yala and Maha seasons. The highest mean technical efficiency (88.3) is recorded in major irrigation system in Matara district during the Maha season 2001 / 2002. The lowest mean technical efficiency (53.8) is recorded in rain-fed paddy production system in Hambantota district during Maha 2001/2002 season. Generally mean technical efficiencies are high in major irrigation systems while low in rain-fed irrigation systems. Further, the mean technical efficiency is higher in Maha season than in Yala season. This suggests that paddy production practices in rain-fed areas are not as efficient as that of major irrigation systems. One reason may be the lack of water in rain-fed cultivation for the successful growth in plants.

Table – 4.5.5. Gamma values, mean technical efficiencies and total variance

District and Season	Variable	Major Irrigation	Minor Irrigation	Rain-fed
		Hambantota District		
Yala - 2001	γ	0.9231*	0.4157*	0.7213*
	Mean TE	83.2	79.7	54.6
	σ^2	0.0785	0.3421	0.2436
Maha- 2001 / 2002	γ	0.8126*	0.5341*	0.6213*
	Mean TE	84.3	81.6	53.8
	σ^2	0.0342	0.2438	0.0584
		Matara District		
Yala - 2001	γ	0.8254*	-	0.6283*
	Mean TE	86.2		63.6
	σ^2	0.2731		0.0671
Maha- 2001 / 2002	γ	0.4534*	-	0.4135*
	Mean TE	88.3		65.8
	σ^2	0.3152		0.0376

* Significant at 05% level

Table - 4.5.6. Technical Efficiency of farmers in Hambantota district

	Major-irrigation		Minor-irrigation		Rain-fed	
	Yala	Maha	Yala	Maha	Yala	Maha
			Hambantota District			
Number	55	53	41	37	43	32
Mean efficiency	0.8324	0.8433	0.7966	0.8157	0.5463	0.5378
SD	0.0542	0.0506	0.0274	0.0146	0.0608	0.0597
Maximum	0.9387	0.9387	0.8392	0.8451	0.6125	0.6125
Minimum	0.6872	0.7111	0.7145	0.7832	0.4439	0.4439
			Matara District			
Number	42	42	-	-	41	38
Mean efficiency	0.8618	0.8832	-	-	0.6359	0.6579
SD	0.0230	0.0152	-	-	0.0478	0.0349
Maximum	0.8986	0.9087	-	-	0.7098	0.7098
Minimum	0.8236	0.8467	-	-	0.5096	0.5562

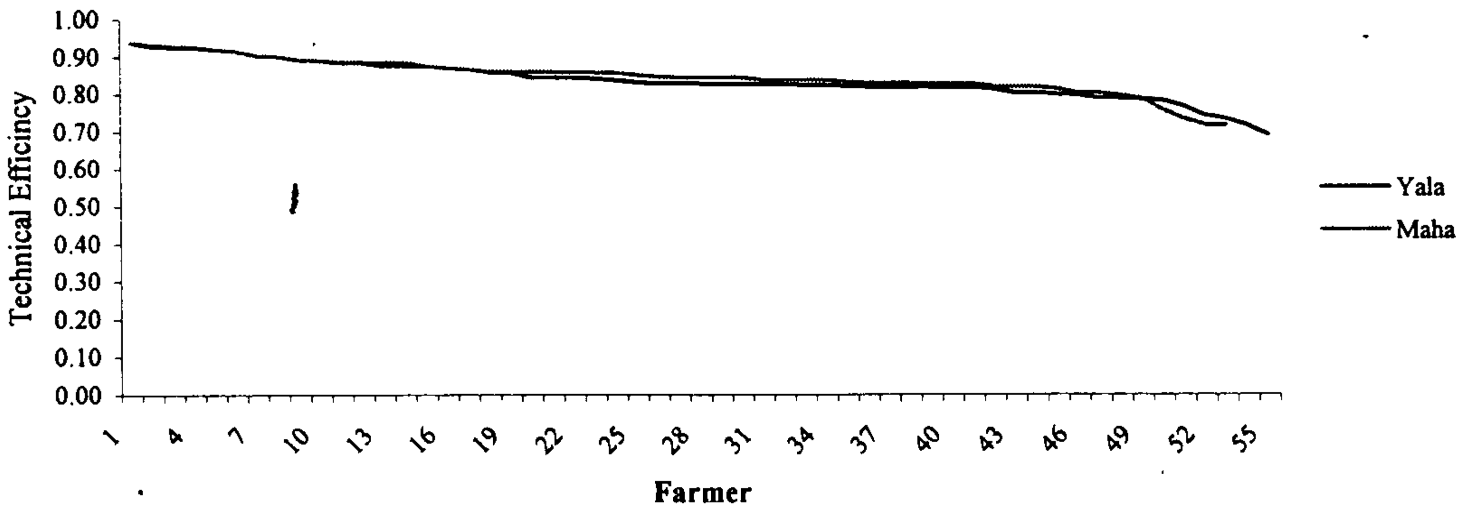
4.5.2.2. Technical Efficiency of individual farmers

4.5.2.2.1. Hambantota District

Major-irrigation

Figure 4.5.1A shows the efficiency of paddy production of the farmers in both Yala and Maha seasons in Hambantota district. The efficiency tended to vary from about 95% to about 70% but the average is around 85%. Therefore, on average, farmers tended to use available technology at highest rate and therefore, unless new production practices are introduced, there are very little rooms to further increase the production from the existing technology.

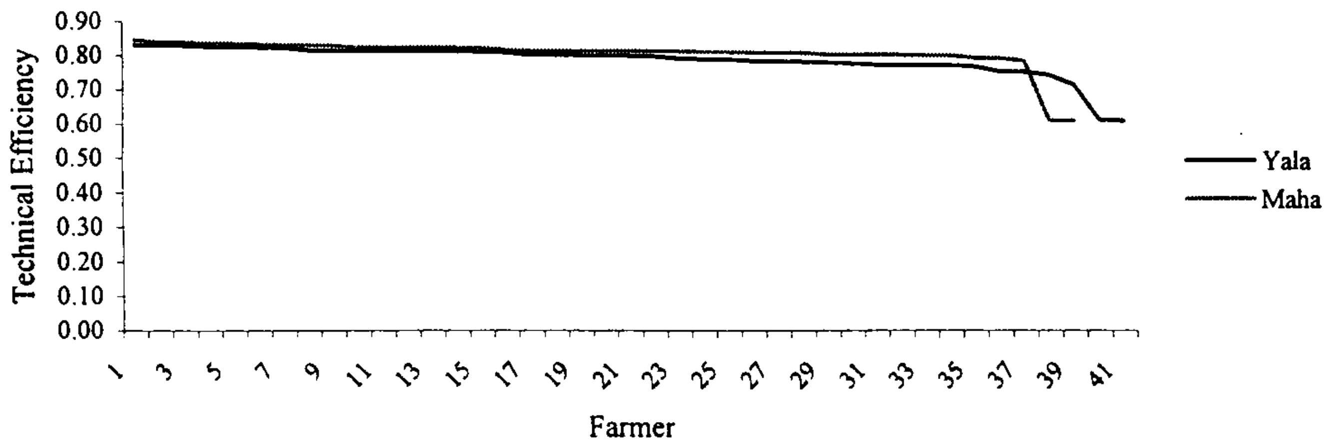
FIGURE - 4.5.1A. TECHNICAL EFFICIENCY - MAJOR-IRRIGATION - HAMBANTOTA



Minor- irrigation

Paddy farmers under minor irrigation system in the Hambantota district also show the similar pattern of efficiency of production that observed under major irrigation system above. As can be seen from Figure – 4.5.1B, the variation of the technical efficiencies of production among farmers are very low. The highest efficiency achieved is about 85%. Therefore, compared to farmers under major irrigation, the farmers in the minor irrigation systems are relatively inefficient. .

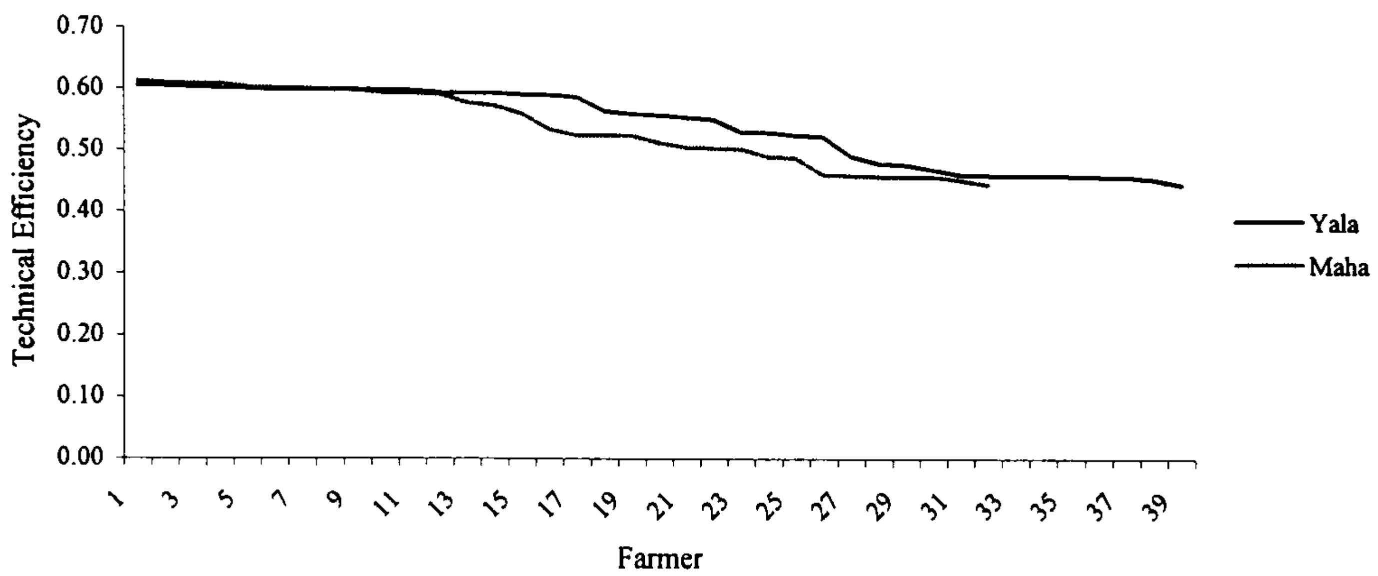
FIGURE - 4.5.1B. TECHNICAL EFFICIENCY - MINOR-IRRIGATION - HAMBANTOTA



Rain-fed

Under rain-fed conditions, efficiency of paddy production is relatively poor. The maximum efficiency they reached is 61% while the lowest is about 45% (Figure – 4.5.1C). This explained the poor yield obtained by those farmers and therefore the income of the rain-fed paddy farmers. Farmers may not get enough of rain during growing period leading to poor performance of yield. Overall, rain-fed paddy farmers are comparatively technically inefficient and there tended to be some rooms to improve the productivity. However, availability of rain at right time and right amount will be important in any attempt to improve the productivity of those farmers.

FIGURE - 4.5.1C. TECHNICAL EFFICIENCY - RAIN-FED - HAMBANTOTA

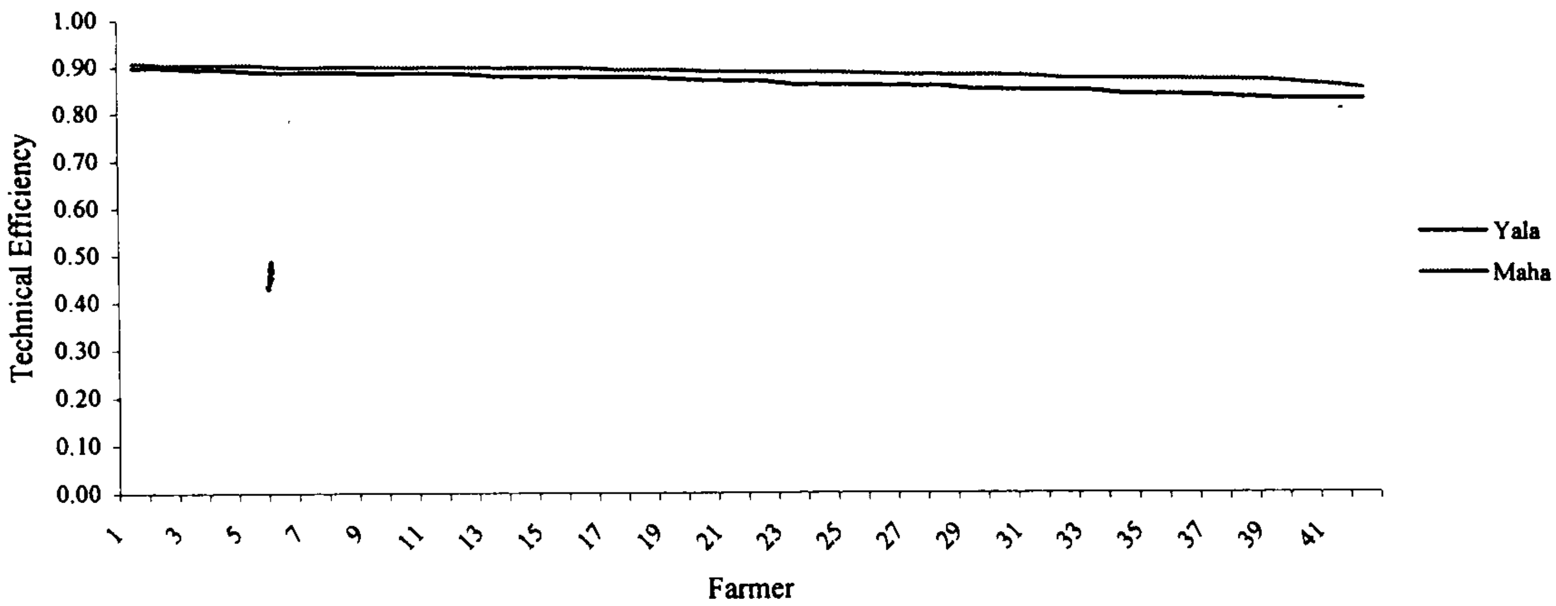


4.5.2.2.2. Matara District

Major-irrigation

It is noteworthy that paddy farmers under major irrigation systems in the Matara district are also producing at similar efficiency that exhibited in the Hambantota district under major irrigation regimes. Best practice farmers are producing at 91% efficiency while the lowest efficiency is being about 83% (Figure 4.5.2A). The achievement distributions of efficiency of production among farmers show that there is little rooms left to improve the production levels through reorganizing existing practices.

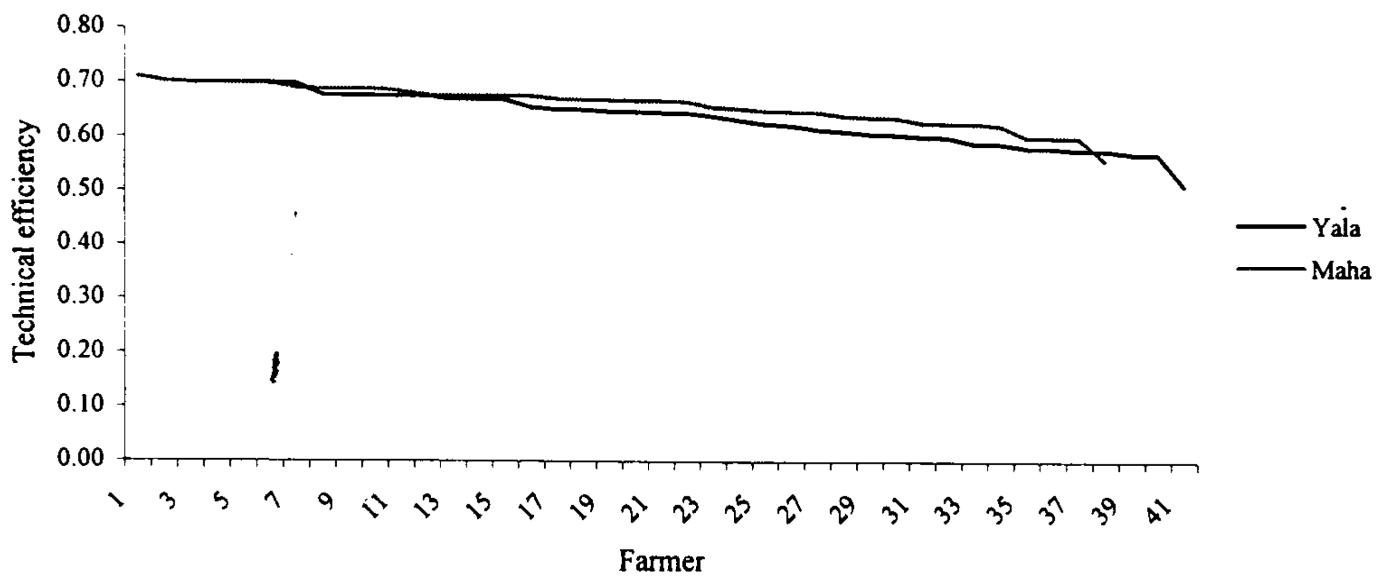
FIGURE - 4.5.2A. TECHNICAL EFFICIENCY - MAJOR-IRRIGATION - MATARA



Rain-fed

Similar to Hambantota district, rain-fed paddy farmers in Matara district are also experiencing somewhat low efficiency in paddy production. The best farmers are producing at 70% efficiency while the lowest efficiency is being about 50%. This shows that, over all, there are rooms to increase the paddy productivity of rain-fed areas. Again, along with other factors of production, availability of rain at right time and right amount is important to increase the efficiency of the factor production.

FIGURE - 4.5.2B. TECHNICAL EFFICIENCY - RAIN-FED - MATARA



4.5.3. ORDINARY LEAST SQUARES REGRESSION ANALYSIS

4.5.3.1. Hambantota District (Dry Zone)

4.5.3.1.1. Yala Season

The estimated t values for the factors determining technical efficiency of paddy farming under major irrigation minor irrigation and rain-fed in Hambantota district during Yala season are shown in Table – 4.5.7. It should be noted that the low R-square value of this regression tell us that the independent variables explained on 40% variation of the dependent variable (paddy output). However, though we cannot make strong arguments based on this regression analysis, we may be able to reach somewhat tentative conclusion but combining with other analysis of this study. Age of the paddy farmers have significant negative relation (-2.391) on the output under the rain-fed condition. More elderly farmers in rain-fed areas in Hambantota district are working in paddy farming with low efficiency (Table – 4.5.3). The education level of the farmers in rain-fed paddy producing areas is positively significant (2.873) suggesting educated farmers are more efficient than others, which is consistent with our expectations. As evident from our survey that the education levels of these farmers are comparatively low, therefore it is reasonable to obtain low output or low technical efficiencies. Cultivation of highland crops is not significantly correlated with the paddy production in Hambantota district during the Yala season. The variable of land extents or acreage had a significant positive contribution to total output (coefficient for major irrigation 3.862 and for minor irrigation 3.248), which may explained the existence of economies of scale. Though it is expected, ownership of the land is not statistically significant. The sources of seed paddy have significant impact on the total output in major (3.273) and minor (2.214) irrigation areas but not in rain-fed areas. As observed from the survey, most farmers in rain-fed areas used their own seed paddy while in other two areas (major and minor irrigations) farmers depend most of their seed paddy from reliable private agent or government agents. The implication of these results is that improvement of paddy industry (efficiency) depends on the supply of high quality seed paddy. Similar conclusion can be made with source of fertilizer. Thai is source of fertilizer is positively significant for the farmers cultivate paddy under major (2.736) and minor (2.237) irrigation conditions while significantly negative (-2.921) under rain-fed conditions. As shown from the survey those farmers in major and minor irrigation areas obtain fertilizer from private sector while rain-fed farmers purchase their fertilizer through the ASC. The rain-fed farmers even do not apply the fertilizer in recommended dosage. The farmers under major irrigation control weed in paddy through agro-chemicals considering the severity and make significant contribution (2.897) to the output. Adoption of IPM by paddy farmers has significant impact on pest control and technical efficiency in paddy production. Source of labor mainly family labor in minor irrigation is positively significant (2.918) but negatively significant with the rain-fed farmers (-2.871). The source of credit is not significant with technical efficiency of the farmers in Hambantota district.

Table – 4.5.7. Estimated t values of variables in OLS regression on technical efficiency in Hambantota Yala - 2001

Hambantota	Variable	t value Major Irrigation	 Minor Irrigation	 Rain-fed
Yala – 2001	Farmer's age	0.932 (0.016)	1.231 (0.014)	-2.391* (-0.008)
$R^2 = 0.40$	Education level	0.874 (0.081)	1.346 (0.084)	2.873* (0.061)
	Highland cultivation	1.246 2.583)	1.327 (2.342)	0.965 (1.021)
	Land Extent (paddy)	3.862* (0.321)	3.248* (0.794)	0.842 (0.822)
	Ownership	0.763 (1.492)	1.236 (1.124)	1.154 ().723)
	Source of seed paddy	3.273* (1.126)	2.214* (1.682)	1.328 (1.202)
	Source of fertilizer	2.736* (1.013)	2.237* (1.217)	-2.921* (-1.224)
	Method of weed control	2.897* (1.076)	0.928 (4.028)	1.653 (1.024)
	Method of pest control	3.412* (1.324)	2.935* (1.425)	3.185* (1.911)
	Source of labor	0.838 (1.412)	2.918* (1.015)	-2.871* (-0.613)
	Source of information	0.869 (1.134)	0.328 (1.272)	0.829 (1.123)
	Source of Credit	0.892 (1.113)	0.142 (1.102)	0.875 (1.214)

* Significant at 5% level
Co-efficients are in parentheses

4.5.3.1.2. Maha Season

The results of the regression analysis for Maha season (Table - 4.5.8) are almost similar to the results discussed for Yala season above. The very low R-square (30%) in this regression suggests that very poor fit of the regression. This may be true because some variables included in the regression are not directly related to production like amount of fertilizer, land or capital. However, the extent of highland cultivation have is significantly negative (-2.329) relationship with production of paddy implying that increase highland production acreage has negative impact on the paddy production. As evident from the survey, many rain-fed farmers are interested in cultivating field crops during the Maha season thus it is not surprised to have negative coefficient with the highland acreage. Although the source of seed paddy is significant in major irrigation paddy farming during the Yala season, the source of seed paddy is not significant during Maha season (1.827). Farmers in many cases purchase seed paddy in addition to their own seed paddy.

Table – 4.5.8. Estimated t values for variables in OLS regression on technical efficiency in Hambantota Maha - 2001 / 2002

Hambantota	Variable	t value		
		Major Irrigation	Minor Irrigation	Rain-fed
Maha- 2001	Farmer's age	0.864	1.312	-2.218*
/ 2002		(0.013)	(0.009)	(-0.006)
	Education level	0.984	0.898	2.125*
$R^2 = 0.30$		(0.063)	(0.072)	(0.035)
	Highland cultivation	0.378(2.614)	-3.722*	-2.329*
		2.798*	(-2.361)	(-1.008)
	Land Extent (paddy)	(0.312)	3.429*	1.267
		0.891	(0.725)	(0.761)
	Ownership	(1.382)	1.851	1.192
		1.827	(1.112)	(0.713)
	Source of seed paddy	(1.021)	2.221*	0.928
		2.749*	(2.011)	(1.126)
	Source of fertilizer	(1.014)	2.341*	-2.771*
		2.212*	(1.124)	(-2.153)
	Method of weed control	(1.132)	0.386	0.798
		2.981*	(3.284)	(1.483)
	Method of pest control	(1.385)	2.742*	3.982*
		0.981	(1.512)	(1.563)
	Source of labor	(1.423)	2.671*	-2.519*
		0.659	(1.102)	(-0.579)
	Source of information	(1.187)	0.387(1.236)	0.589
		0.716	0.289	(1.114)
	Source of Credit	(1.104)	(1.131)	0.592
				(1.232)

* Significant at 05% level
Co-efficients are in parentheses

4.5.3.2. Matara District (Wet Zone)

4.5.3.2.1. Yala Season

This regression fits the data very poorly (R-square = 0.24). As explained in above, since we are dealing with many indirect variables, which are not directly relevant to the production this poor fit is not surprising. As shown in Table - 4.5.9, Age has significant negative impact (-3.542) on the dependent variable. The level of education of the paddy farmers in Matara district is not significant at 0.05 level. Though the highland cultivation variable is no statistically significant, it suggest negative impact on the paddy production. Highland farming by the paddy farmers is not a common practice in Matara but given the opportunity for highland cultivation, they may change their mind in the future. Extent of paddy land cultivated by both major irrigation (3.426) and rain-fed (2.341) farmers is positively significant at 0.05 level suggesting that increase in land area significantly increase the paddy output. In other words there exist economies of scale for the paddy sector in Matara. Ownership of the land makes no any relation with the technical efficiency. Source of seed paddy become significant contribution for paddy under both major (2.832) and rain-fed (2.143) irrigation regime. Most of the farmers in Matara district use the seed paddy prepared by them but if they have access to high quality certified seed paddy, the yield of paddy can be increased. Similar to Hambantota district, Source of fertilizer, methods of weed and pest control significantly affect the paddy yield, though increase in the use of fertilizer tend to decrease paddy yield in rain-fed areas. The rain-fed paddy farmers might already use maximum amount of fertilizer, so without increasing the availability of other variables. Source of labor, source of information and the source of credit have no significant impacts, suggesting that as far as they could get enough of those inputs, the source is immaterial to them.

Table – 4.5.9. Estimated t values for variables in OLS regression on technical efficiency in Matara Yala- 2001

Matara	Variable	t value: Major Irrigation	t value: Rain-fed
Yala – 2001	Age of farmer	0.984 (0.012)	-3.542* (-0.001)
$R^2 = 0.24$	Education level	0.746 (0.063)	1.125 (0.051)
	Highland cultivation	-0.624 (-3.021)	-1.432 (-1.124)
	Land Extent (paddy)	3.426* (0.413)	2.341* (1.112)
	Ownership	0.586 (1.526)	1.521 (1.142)
	Source of seed paddy	2.832* (1.021)	2.143* (1.426)
	Source of fertilizer	3.743* (1.115)	-2.453* (-1.782)
	Method of weed control	3.213* (1.231)	1.167 (1.287)
	Method of pest control	3.265* (1.221)	4.363* (2.232)
	Source of labor	0.659 (1.482)	-0.873 (-0.872)
	Source of information	0.983 (1.122)	0.841 (1.210)
	Source of Credit	0.286 (1.001)	0.521 (1.162)

* Significant at 05% level
Co-efficients are in parentheses

4.5.3.2.2. Maha Season

The regression analysis with Maha season data shows the almost similar results as described just above for Yala season. Though the regression is poorly fit the data, it provides valuable information about the impacts of some important variables. As shown in Table - 4.5.10, extent of paddy land, methods of weed and pest control are contributes significantly in any attempt to increase paddy yield and therefore the technical efficiency. The impacts of other variables in this regression is also similar to those describe under 4.5.3.2.1. Therefore, no discussion will be maintained here with respect to those variables.

Table – 4.5.10. Estimated t values for variables in OLS regression on technical efficiency in Matara, Maha - 2001 / 2002

Matara	Variable	t value		
		Major Irrigation	Minor Irrigation	Rain-fed
Maha- 2001 / 2002	Age of farmer	1.121		3.201*
		(0.013)		(0.008)
	Education level	0.928		1.327
		(0.064)		(0.052)
$R^2 = 0.38$	Highland cultivation	0.987		0.682
		(3.113)		(1.321)
	Land Extent (paddy)	4.821*		3.226*
		(0.425)		(1.115)
	Ownership	0.993		1.829
		(1.721)		(1.131)
	Source of seed paddy	1.261		3.762*
		(1.213)		(1.613)
	Source of fertilizer	3.128*		1.828
		(1.217)		(1.206)
	Method of weed control	4.893*		2.654*
		(1.421)		(1.626)
	Method of pest control	5.542*		3.824*
		(1.322)		(2.003)
	Source of labor	2.832*		-0.987
		(1.562)		(-0.853)
	Source of information	1.451		1.737
		(1.135)		(1.163)
	Source of Credit	0.231		0.892
		(1.002)		(1.228)

* Significant at 05% level
Co-efficients are in parentheses

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSIONS

5.1.1. General

The farmers in major and minor-irrigation areas in Hambantota district and the farmers in major-irrigation areas in Matara obtain profit from paddy farming during both seasons. All the paddy farmers in both districts have achieved significant technical efficiency under both seasons. The mean technical efficiency is high in major-irrigation and minor-irrigation farmers while very low in rain-fed farmers in both districts. However, the rain-fed farmers in both districts do paddy cultivation at a lost during the both seasons.

The minor-irrigation and rain-fed paddy farmers have got used to cultivate highland crops giving priority considering the profitability of highland crops than paddy farming. Moreover, a considerable number of rain-fed farmers in Hambantota district cultivate seasonal field crops in their paddy fields during the seasons with low rainfall.

The paddy farmers in Hambantota district receive higher yield than in Matara district under each irrigation method during each season. In both districts rain-fed farmers obtain very low yield compared to the major irrigation farmers while the yield of minor-irrigation farmers is remaining at the average in Hambantota district.

5.1.2. Inputs

Comparatively the farmers use highest around 40% of their total expenditure for labor while next 20% for farm power. They even spend more money for agro-chemicals than for the fertilizer for paddy cultivation. Expenditure for farm equipment is comparatively low but little higher than for the paddy seeds.

The major-irrigation farmers are doing capital-intensive paddy farming while rain-fed farmers are doing mainly labor intensive farming. However, all the farmers have a problem of high labor wages in paddy farming. The wages for labor in paddy farming is higher in Matara than in Hambantota district with the rapid urbanization. Labor expenses particularly in rain-fed farming have a negative influence in increasing paddy production and therefore the technical efficiency. Although the wage rate in agriculture is much below that of industrial labor wages and poor return in agriculture makes the labor cost unbearable. As wage rate increases, farmers tended to hire less of labors resulting in appropriate labor input and therefore the lowering output. On the other hand, the ever-increasing cost of living makes no any room for reduction of the labor wages.

Most farmers that use major irrigation produce their required seed paddy by themselves. The farmers who used own seed paddy have confidence and also obtain comparatively high yield with high technical efficiency. Rain-fed farmers are less intended to produce seeds due to risk in farming and small extent of land. The seed paddy production by farmers is comparatively cheep. Although the paddy farmers in both districts used improved paddy varieties they still require a better high yielding and pest resistant variety with a greater confidence.

Private sector dominates the fertilizer marketing for major-irrigation and minor-irrigation paddy farming in Hambantota district and major irrigation in Matara district. However, the farmers face many problems mainly high price and poor fertilizer response to the paddy yield. One reason for this poor response may be the inappropriate combination of inputs. The prevailing very high expenditure on fertilizer prevents use of fertilizer adequate amount affecting negatively on an attempt to increase technical efficiency. The rain-fed farmers particularly use less amount of fertilizer than the recommendations leaving more room to increase technical efficiency using even existing technology.

The major-irrigation and rain-fed farmers in both districts mainly use weedicides (chemicals) to control weeds. Major irrigation farmers spend more on weedicide than rain-fed farmers do as they make much attention in crop management. As evident from the regression analyses, the expenditure for chemical is significant negatively with the paddy output. This is not to say that farmers do not use chemical but rising cost of agrochemical adversely affect the paddy output. Use of manual methods is also restricted because of the higher wage rate. In some cases manual weeding exceeded the cost of chemical application.

Integrated Pest Management has become very popular in both districts particularly among the major-irrigation and minor-irrigation farmers. Rain-fed farmers still prefer chemical method, as it is convenient and can save cost. Stagger paddy cultivation particularly by the rain-fed farmers creates higher pest breeding and causes severe crop damages.

The expenditure on equipment is comparatively very low at present. The expenditure for equipment is positively significant for paddy output in Hambantota and Matara districts under all the irrigation methods during the both seasons. Use of farm equipment would increase the technical efficiency of paddy production.

Major-irrigation farmers have higher expenditure for farm power particularly for tractors compared to minor-irrigation and rain-fed farmers. They use tractors instead of labor for the preparation of paddy lands. The expenditures for farm power are negatively significant with the total output under all regimes except the major-irrigation farmers in Hambantota during Maha season.

5.1.3. Institutions

The market surplus of the major irrigation farmers is more than 70% while rain-fed-farmers have around average 25% of their paddy production. Country assemblers are the main buying agents of paddy at village level in major irrigation areas. However, the collectors at village level mainly collect paddy from rain-fed paddy farming areas. The paddy collected from major-irrigation areas is transported to Colombo market. The collected paddy in rain-fed areas is sold within the district. Further, new rice marketing channels are emerging in the district throughout the season without considering the harvesting period. The market margin in major-irrigation paddy farmers is less than the rain-fed farmers because the middlemen in rain-fed paddy marketing obtain abnormal partial margins even more than one fourth through unethical practices.

The farmers receive technical information from fellow farmers as the most prominent source after introduction of Yaya track demonstration. The Mass Media has become the second place pushing the governmental Extension Service into the third place.

Compare to farmers in major-irrigation schemes, rain-fed farmers are intended to obtain more credits for the seasonal farming activities as regular borrowers. They borrow money mainly from informal credit markets where they charge very high interest rates.

Most of the major-irrigation paddy farmers have bought crop insurance while only a few rain-fed farmers are continuing on the crop insurance. Having available an affordable and appropriate insurance policies have the potential to increase the paddy production and therefore the technical efficiency of paddy farming in Hambantota districts. Even Matara district, the rain-fed farmers can increase the technical efficiency by holding an insurance policy. They hold the policy with the understanding of the importance as well as to obtain formal credit. However, the farmers are discouraged to become a policyholder by the high premium rate and low compensation in the event of loss.

A considerable amount of water is wasted in irrigated agriculture due to lack of maintenance in main and distribution channels and negligence of the farmers to maintain their farmer field channels. Minor-irrigation water is wasted due to lack of mechanism for collecting excess water and due to not proper operational distribution schemes in place.

Some farmers are active members of a farmer organization but very ineffective in mobilizing their services. Being a member of the farmer organization has a positive significant contribution to paddy farming in both districts. Yaya-demonstration is popular among the farmer as their group activity.

5.2. RECOMMENDATIONS

5.2.1. General

The younger generation in the rain-fed paddy farming area should be encouraged to perform efficient paddy production systems. The educational programs including professional programs in Hambantota district should be increased or improved particularly the rain-fed paddy producing areas in order to make innovative farmers in future. Further, the intelligence, knowledge and skill of the present farmers should be improved through non-formal and in-formal educational strategies.

Improvement of profitable highland crop cultivation on unprofitable paddy lands could be an important strategy in Hambantota district.The rain-fed farmers are not conducting a viable farming and have to go for other viable option if they are not going to improve the way of farming.**5.2.2. Inputs**

Farmers cannot survive in the long run with the existing low price of paddy and ever-increasing labor wage. To make the labor more technically efficient, the paddy farmers have to replace a part of labor with machinery. The paddy sector alone cannot control the labor wages unless the industrial sector or agro-based industries absorb a part of the excess labor in the paddy sector.

It is worthwhile to transfer the responsibility of seed paddy production to the farmers under the supervision of extension officers in order to minimize the demerits of supplying seed paddy by the government as well as to maximize the own confidence of the farmers. Rain-fed farmers may also produce seed paddy as a group. In addition to the continuos paddy breeding program improvement of yield and pest resistance through genetic engineering / biotechnology would be more appropriate to find quick solution.

The similar fertilizer mixture may not suitable for different soil conditions in paddy fields located in different areas. Therefore, local soil tests before recommending fertilizer would be a remedy for the poor fertilizer response to paddy yield. Further, correct application minimizes the wastage as well as the cost of fertilizer. Changing of fertilizer mix and price would be a policy decision of the government. However, there is no other option in the vicinity to reduce the price of fertilizer particularly for the rain-fed farmers to grow paddy. They may go for crops, which has high technical efficiency in response to the fertilizer.

Introducing mechanical weeder could reduce the expenditure on weedicide to make the weed control a positive significant for the paddy production. Further the weeder may improve the efficiency of labor through controlling weed more effectively. However, the possibility should be investigated for transplanting, row seeding or any other option through a careful research program in order to go for mechanical weeding.

The expenditure for pesticides is about one fifth of the total expenditure for agro-chemicals. Therefore, use of pesticide should be minimized by popularization of IPM with low chemicals. Moreover, the farmers should be strictly advised to establish their crop at the same time in order avoid stagger cultivation which is favorable for pests. Improvement of pest resistant variety through bio-technology and genetic engineering also a research options.

Farmers should be provided with appropriate farm equipment at a reasonable price in order to increase their technical efficiency of paddy production. Sprayers, seeders, weeder and low cost harvester have become very important farm equipments for both districts.

Rapidly increasing world market price of fuel could not be controlled locally. Subsidies in fuel would be a policy decision, as practice in many developed and developing countries, which has to be taken after many consultations. For example, in Canada, farmers get farm fuel rebate, where they could buy fuel for farming with less price. The dilemma in this option is that how we prevent the use of those fuel in other activities. However, the over expenditure on farm power has to be overcome by inventing low cost machinery other than using currently existing tractors as the only farm power machinery, or need to find the ways to save the cost on fuel (i.e. blending of fossil fuel with bio-fuel –ethanol).

5.2.3. Institutions

Arranging paddy marketing including storing and milling through the farmer organization or farmer companies may give higher farm-gate price as well as assurance of market for their paddy products. Considering the present trend mass media could be organized in a way to disseminate farming and marketing information more efficiently as well as effectively.

An effective farmer credit scheme within the farming community or under farmer companies has to be established to protect the poor farmers from local moneylenders.

The crop insurance scheme has to be restructured giving responsibility to the farmer organizations or the companies in order to attract more farmers to enable them to promote paddy farming by adopting innovations.

A mechanism required for regular maintenance of all the channels has to be established with the participation of farmers and officers for efficient and effective water resource management in responsible manner. Further, collection of flowing water in minor irrigation system has become an important strategy which farmers can use the excess water during the dry periods.

The farmer organizations have to be revitalized to mobilize their services mainly on water management, simultaneous crop cultivation, information distribution and, inputs and product marketing.

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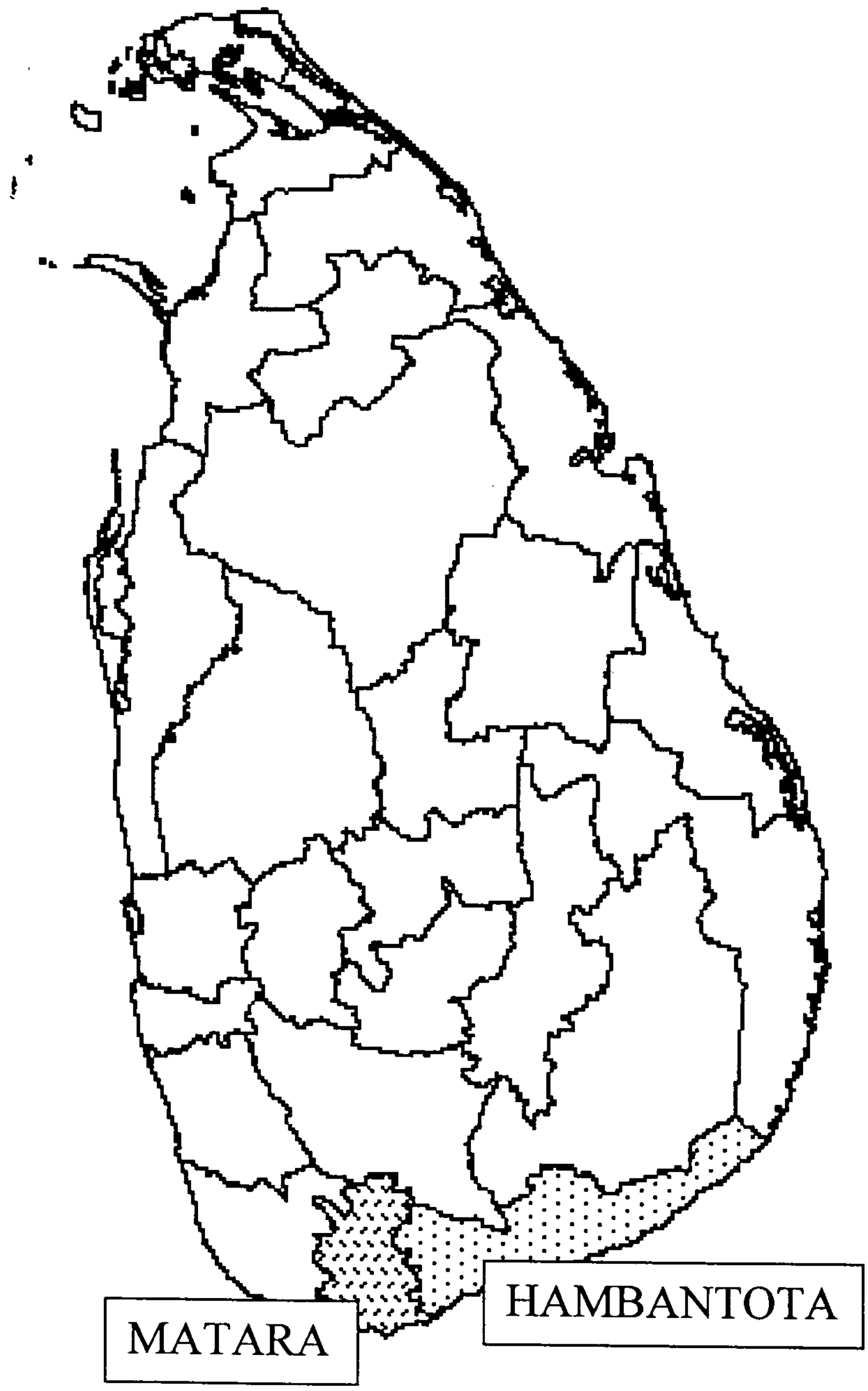
APPENDIX - 1

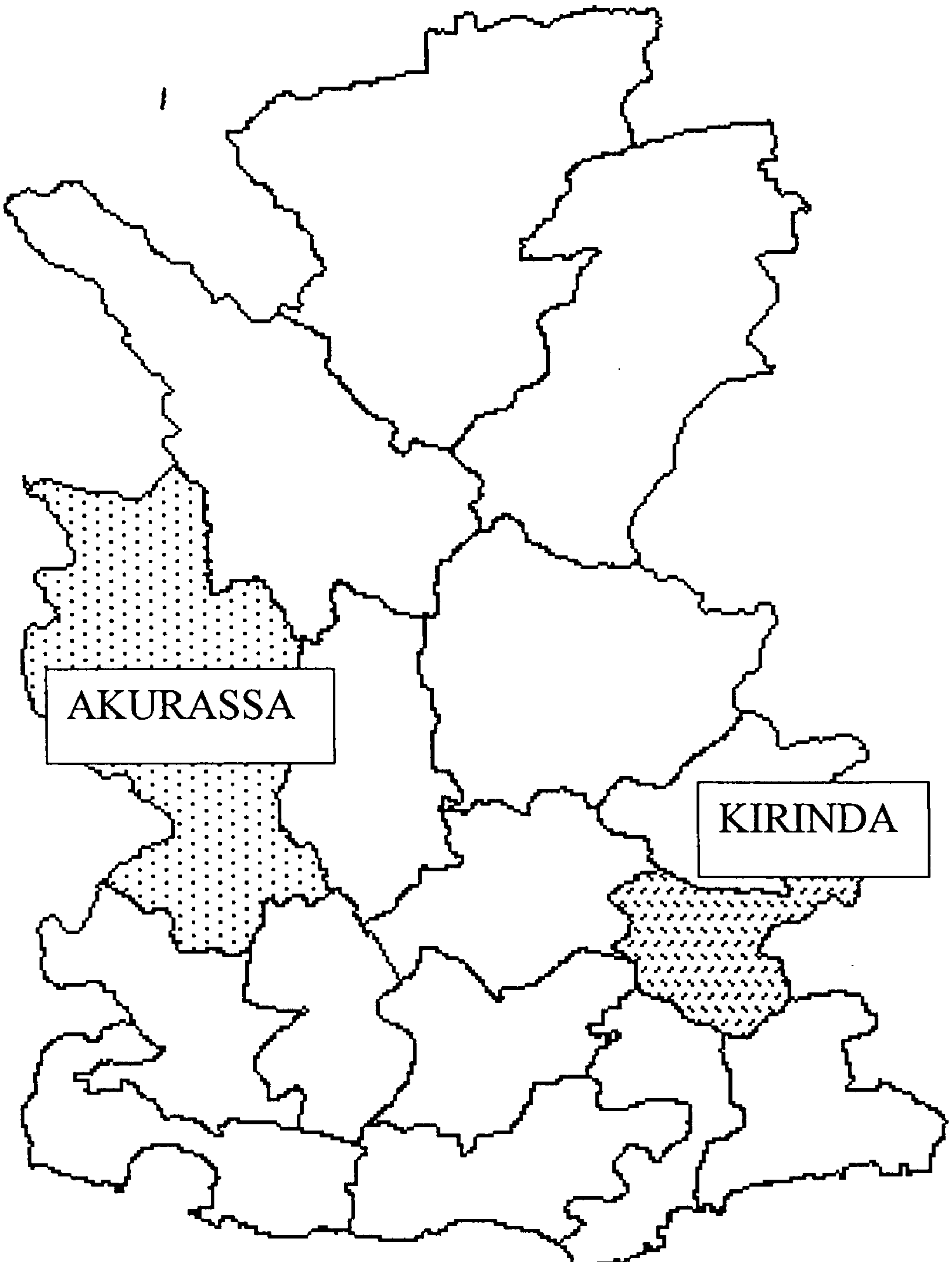
MAP - 1. DISTRICTS SELECTED FOR THE STUDY



MAP OF SRI LANKA

APPENDIX - 2

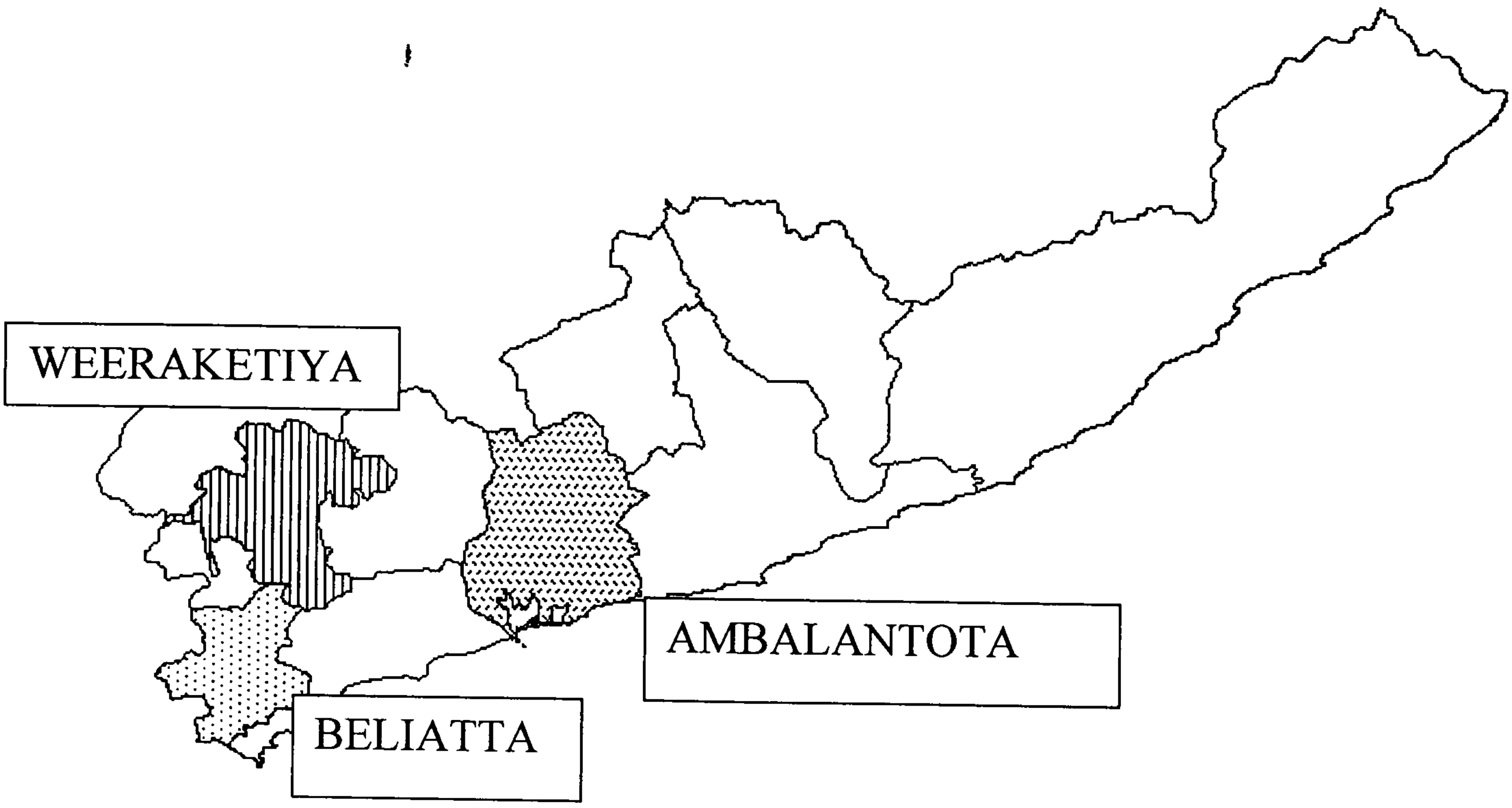
MAP -2. STUDY LOCATIONS IN MATARA DISTRICT



MAP OF MATARA DISTRICT

APPENDIX - 3

MAP - 3. STUDY LOCATIONS IN HAMBANTOTA DISTRICT



MAP OF HAMBANTOTA DISTRICT

APPENDIX – 4

Technical Efficiency Indices of Individual Farmers in Hambantota District (Total Sample)

Farmer	Major-irrigation		Minor-irrigation		Rain-fed	
	Yala	Maha	Yala	Maha	Yala	Maha
1	0.9238	0.9312	0.7728	0.8126	0.5981	0.5723
2	0.9261	0.9261	0.7982	0.8024	0.4587	0.4587
3	0.8217	0.8317	0.7145	0.8132	0.6032	0.6032
4	0.6872	0.7123	0.7671	-	0.5986	-
5	0.8273	0.8273	0.8302	0.8302	0.5213	0.5028
6	0.8712	0.8712	0.8129	0.8129	0.5529	0.5234
7	0.7938	0.7981	0.7823	0.8122	0.5903	0.5903
8	0.9283	0.9283	0.8392	0.8392	0.5901	-
9	0.9387	0.9387	0.7998	0.8021	0.4562	0.4562
10	0.8239	0.8416	0.8122	0.8122	0.5983	0.5234
11	0.8972	0.8972	0.8123	0.8237	0.6056	-
12	0.9002	0.9002	0.7912	0.7912	0.5293	0.4893
13	0.8723	0.8823	0.7789	0.8345	0.4592	-
14	0.8127	0.8127	0.8231	0.8231	0.6093	0.6093
15	0.8192	0.8239	0.7889	0.8018	0.4578	-
16	0.9128	0.9128	0.8341	0.8341	0.5568	0.5234
17	0.7839	0.8329	0.8239	0.8391	0.4902	0.4571
18	0.8392	0.8392	0.7516	0.8228	0.6049	0.5587
19	0.8372	0.8562	0.7526	0.7992	0.5291	0.5014
20	0.7982	0.7982	0.8023	0.8023	0.4578	-
21	0.7921	0.8543	0.7764	0.8163	0.5492	0.4873
22	0.8392	0.8392	0.7431	0.7932	0.5928	0.5928
23	0.8216	0.8459	0.7721	0.8102	0.4761	0.4562
24	0.8532	0.8532	0.7835	-	0.4521	-
25	0.8129	0.8391	0.8229	0.8229	0.6082	0.6082
26	0.9182	0.9182	0.8315	0.8315	0.5862	0.5763
27	0.8392	0.8392	0.8291	0.8291	0.6017	0.6017
28	0.8549	0.8549	0.7832	0.7832	0.4782	-
29	0.8236	0.8532	0.7716	0.8451	0.6012	0.6012
30	0.7812	0.8091	0.8129	0.8072	0.4439	0.4439
31	0.8861	0.8861	0.7719	-	0.5634	0.5043
32	0.8091	0.8218	0.8012	0.8012	0.4572	-
33	0.8812	0.8812	0.8102	0.8102	0.5983	-
34	0.8122	0.8239	0.7891	0.8236	0.6125	0.6125
35	0.8723	0.8321	0.8152	0.8071	0.4598	0.4598
36	0.8167	0.8236	0.7992	-	0.5931	0.5931
37	0.7982	-	0.8091	0.8091	0.5235	0.5123
38	0.8128	0.8128	0.8128	0.8346	0.5983	0.5983
39	0.8235	0.8561	0.8138	0.8138	0.5937	-
40	0.8612	0.8612	0.8217	0.8217	0.6082	0.6082
41	0.8812	0.8812	0.8016	0.8126	0.5589	0.5341
42	0.8194	0.8212			0.5972	0.5972
43	0.8321	0.8321			0.4678	0.4512
44	0.8212	0.8524				
45	0.7832	0.7832				

46	0.7621	0.7913				
47	0.8123	0.8821				
48	0.7782	-				
49	0.8891	0.8891				
50	0.7291	0.7291				
51	0.8142	0.8142				
52	0.8214	0.8214				
53	0.8653	0.8653				
54	0.7111	0.7111				
55	0.7392	0.7542				
Number	55	53	41	37	43	32
Mean efficiency	0.8324	0.8433	0.7966	0.8157	0.5463	0.5378
SD	0.0542	0.0506	0.0274	0.0146	0.0608	0.0597
Maximum	0.9387	0.9387	0.8392	0.8451	0.6125	0.6125
Minimum	0.6872	0.7111	0.7145	0.7832	0.4439	0.4439

APPENDIX – 5

Technical Efficiency Indices of Individual Farmers in Matara District (Total Sample)

Farmer	Major-irrigation		Rain-fed	
	Yala	Maha	Yala	Maha
1	0.8834	0.8834	0.6735	0.6879
2	0.8236	0.8637	0.6978	0.6978
3	0.8834	0.8834	0.7098	0.7098
4	0.8534	0.8534	0.5682	-
5	0.8734	0.8936	0.6435	0.6668
6	0.8857	0.8857	0.6984	0.6984
7	0.8562	0.8763	0.5992	0.6248
8	0.8346	0.8654	0.6749	0.6749
9	0.8423	0.8682	0.6982	-
10	0.8326	0.8978	0.5782	0.6192
11	0.8435	0.8735	0.6487	0.6738
12	0.8863	0.8975	0.6984	0.6984
13	0.8452	0.8838	0.5742	0.5984
14	0.8349	0.8673	0.6029	0.6512
15	0.8857	0.8938	0.6239	0.6453
16	0.8465	0.8676	0.7016	0.7016
17	0.8764	0.8946	0.6457	0.6872
18	0.8567	0.8892	0.5982	0.6237
19	0.8893	0.8893	0.5096	0.5562
20	0.8258	0.8579	0.6083	0.6341
21	0.8697	0.8769	0.6202	0.6538
22	0.8239	0.8467	0.6439	0.6639
23	0.8986	0.9087	0.6682	0.6682
24	0.8934	0.8934	0.6759	0.6826
25	0.865	0.8896	0.5739	0.6736
26	0.8748	0.8967	0.5862	0.6458
27	0.854	0.8978	0.5672	0.5973
28	0.883	0.9032	0.6984	0.6984
29	0.8946	0.9037	0.6304	0.6891
30	0.8238	0.8678	0.6684	0.6735
31	0.8649	0.8649	0.6673	0.6873
32	0.8576	0.8756	0.5873	0.5983
33	0.8359	0.8693	0.6048	0.6353
34	0.8812	0.8812	0.6735	-
35	0.8439	0.8794	0.6128	0.6476
36	0.8672	0.8953	0.6534	0.6753
37	0.8549	0.8953	0.6373	0.6373
38	0.8284	0.8974	0.5793	0.6234
39	0.8756	0.8756	0.6745	0.6689
40	0.8979	0.9028	0.6487	0.6673
41	0.8739	0.9038	0.6459	0.6653
42	0.8745	0.8838		
Number	42	42	41	38
Mean efficiency	0.8618	0.8832	0.6359	0.6579
SD	0.0230	0.0152	0.0478	0.0349
Maximum	0.8986	0.9087	0.7098	0.7098
Minimum	0.8236	0.8467	0.5096	0.5562

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