THE FACTORS AFFECTING THE COST OF PRODUCTION OF RICE IN KEGALLE & KURUNEGALA DISTRICTS OF SRI LANKA

Consultancy Report Submitted to the

National Science Foundation, Colombo

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TABLE OF CONTENT

Executive Summary

The study provides the detailed investigation of cost of production of paddy farming in Kegalle and Kurunegala districts of Sri Lanka. The main focus of the investigation was analyzing the factors affecting the variation in cost of production of paddy in Sri Lanka with the special reference to different Agro-climatic zones and different water regimes.

The study sites were selected from the two districts in order to represent the dry, intermediate and wet zones climates and major, minor and rainfed production areas. The primary objective of the study was to diagnose the main socio economic factors affecting the cost of production of paddy cultivation in Sri Lanka. The specific objective are to (i) measure the technical and economic efficiency of paddy farming in accordance with different agro ecological and source of water conditions, (ii) to identify and analyze the factors which influence production of paddy and their costs, (iii) to determine the average amounts and cost of inputs involved in the production of one kg of rice and (iv) to study institutional aspects and transfer of technology.

The research methodology was based on review of literature, questionnaire survey and participatory research techniques. Questionnaire survey was conducted using multistage stratified random sampling techniques. Sample size was 120 farm families from Kurunegala district, which represents 40 farm families each from major irrigation (Ridibendi ela), minor irrigation (Udagama and Bandara Koswatta minor irrigation) and rainfed areas (Pannala area). Ninety farm families were selected from Kegalle district (Dedigama and Rambukkana area), which represented only rainfed areas. The study covered the period of Maha 2000/01 and Yala 2001. The data was analyzed through the descriptive analysis and statistical analysis such as frontier production function and multiple regression.

Secondary information obtained suggests that paddy yield has stagnated and the question of viability of paddy farming has arisen. The cost of paddy farming has increased, while paddy price has decreased in recent times, hence farmers are faced with a very serious cost-price squeeze. The study findings reveal that, the average paddy yield per hectare in major irrigation, minor irrigation and rainfed farming in Kurunegala district during Maha 2000/01 was 4.6t, 3.2t and 3.7t respectively. The major irrigation yield was 30% and 110% higher than minor irrigation and rainfed cultivation yield respectively.

According to frontier production analysis, value of the mean technical efficiency is not closer to 1 in any study location indicating that paddy cultivation is technically not fully efficient in all locations. Nevertheless paddy cultivation is relatively efficient in major irrigation areas (76%) compared to the minor irrigation (61%) and rainfed areas (68%) of Kurunegala district. However, technical efficiency in the rainfed areas of Kegalle district is only 54%.

The multiple regression analysis indicates that the land size has significant impact on increasing production in all areas. Though there is no clear relationship between labour use and the level of production, it has a positive effect in rainfed areas of both districts.

The study findings indicates that the cost of production in major irrigations, minor irrigations and rainfed areas of Kurunegala district varied indicating relatively high cost in rainfed areas and least cost in minor irrigation. Cost in Kegalle district also shows a similar situation. The cost for producing one kg of paddy varies from Rs. 9.58, 12.32 and 12.36 in the areas of major irrigation, minor irrigation and rainfed areas respectively in Kurunegala district. The average cost for producing one kg for paddy in Kegalle district is around Rs. 11.00.

The average yield per acre in major irrigation areas during Maha 2000/01 was above 90 bushels and it was around 60 bushels and 55 bushels in minor irrigation and rainfed areas respectively. Thus yields in major irrigated areas is significantly higher than minor and rainfed areas due to water availability, better management practices and commercial cultivation practices, but yields in rainfed areas have gone down mainly due to lack of water mostly during maturing phase of the plant, small land holdings tenant cultivation and inefficient cultivation practices. The yield gap between research yield and actual yield is high in all areas, especially a significant variation in rainfed conditions. The factors affecting for the existing yield gap are associated with high risk of crop failures in rainfed and minor irrigated areas, poor extension services and constraints in social and institutional factors.

Considering existing yield level between efficient farmers and low efficient farmers, the yield level of low efficient farmers could be increased by 24%, 39% and 32% respectively in major, minor and rainfed areas without any additional cost. This can be achieved by use of production factors in an efficient manner, especially giving attention in the use of seed, fertilizer and agro-chemicals. In rainfed areas labour use efficiency is also very low. Results obtained from stochastic frontier production function analysis shows that, farmers' age, farming experience and level of education are the significant factors causing inefficiency among farmers in minor irrigation systems. Therefore, it is necessary to provide policy guideline, training, demonstration and field level research programme to enhance the farmers' knowledge, skills and entrepreneurship in order to improve the productivity.

CHAPTER ONE

INTRODUCTION

1.0 Background

Rice, as the staple food of Sri Lankans provide calories, protein and other nutrient requirements of people. The total extent under paddy cultivation in Sri Lanka is about 878,000 ha and it account for 14% of total cultivated land extent. At present about 700,000 farm families directly involve in paddy farming. The annual paddy production had been 2.9 million metric tons with an average of 3,672 kg per hectare harvested from total 0.90 million hectares of lands in two cropping seasons in 1999. Paddy accounted for 2.3 percent of the GDP and 15 percent of agricultural GDP in year 2001. It constitutes 15.7 percent of all island consumer index, which indicates the high level influence it makes on cost of living index.

The total extent of paddy cultivation in Sri Lanka was classified under three categories namely major irrigation, minor irrigation and rainfed areas[1]. About 55% of cultivable lands are under major irrigation and 24% and 21% of lands are cultivated under minor and rainfed conditions respectively.

Rice, as the main staple food crop in Sri Lanka was given the highest priority by the various governments in agricultural policy formulations. All the successive governments since independence in 1948, made massive investments to promote the paddy sector through many development projects such as creation of new irrigation settlements schemes, investment on research and extension and other support services. Nevertheless, the country still imports around 13% of the national rice requirement in order to cater the per capita consumption of 93.5 kg of rice per year.

Area under cultivation increased from 759,000 ha in 1970 to 878,000 ha in 2000. According to the statistics published by the Department of Census and Statistics, the extent of paddy cultivation has increased by 85% from 1951/52 to 1999/2000. Paddy production has increased from 1.7 million metric tons in 1970 to 2.8 million metric tons in 2000 representing a 71 percent increase within three decades. Both increase in area under cultivation and average yield contributed to this increase. The notable current issues in rice production could summarize fewer than three headings:

(i) Stagnation in Yields Levels

According to past records the average paddy yield has reached a plateau level by 1995. Though average yield has increased by 67% during (1960-80) period, it has increased only by 8% during (1980-2000) period. The average yield was stagnated around 3.5 t/ha during the last decade.

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[1] According to classification of Irrigation Department, paddy lands that are cultivated under irrigated reservoirs and tanks of which capacity is 80 ha or above were considered as major irrigation and those with less than 80 ha considered as minor irrigation. Paddy lands fully depended on rainfall are considered as rainfed farming.

It is accepted that an average research yield of paddy deviates based on major, minor and rainfed conditions. According to the research stations results the average research yield was reported as 7.3 ton/ha, 4.3 t/h and 3.5 t/ha in major, minor and rainfed areas respectively. According to Department of Agriculture, however, farmers yield levels in all areas are lower than these figures at present indicating more than 40 percent gap between research and actual yields

(ii) Viability of Rice Production

On the other hand 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 remains at Rs. 11.00 per kg. According to present production practices and average yield, paddy cultivation is economically viable in major irrigation while paddy cultivation in minor and rainfed areas are below the break even yields (Department of Agriculture, 2000). Though gross income for paddy cultivation has increased in all areas in the past ten years, net income and returns to capital has increased only in selected major irrigation areas.

(iii) Food Security

Like in many other countries, Sri Lanka also adopted various polices to maintain food security of the country. But still its' 40% of the total grain requirement is fulfill by imports. Though extent of rice cultivation and the total production has increased over the period, per capita rice consumption has decreased from 174.5 kg/year (1980/81) to 101.9 kg/year (1995/96), while per capita wheat consumption has increased from 30.4 kg (1980/81) to 40.5 kg (1995/96) during same period. It indicates the level of dependency on food imports in order to maintain the country's food security.

Therefore, the 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 is designed with a view to capture the major trends emerging as well as to highlight the current and potential problems that would hinder the improvements in paddy farming sector in Sri Lanka. The study would provide a descriptive account of the key issues affecting the paddy production. Thus main areas of investigation were based on three factors namely, increase the yield level of inefficient farmers, factors affecting yield gaps between research yield and actual yield and possible ways and means to reduce cost of production.

The study was conducted based on a comprehensive research study carried out in 02 districts covering dry and wet zones of Sri Lanka. The National Science Foundation (NSF) provided the financial assistance to carry out the study.

1.2 Objectives:

The prime objective of the study is to identify current technical and socio-economic factors affecting the paddy farming in Sri Lanka. Specific objectives are;

1. To measure the technical and economic efficiency of paddy farming in respect to different agro- climatic and water regimes conditions.

2. To identify and analyze the factors which influence production of rice and their costs including marketing
3. To determine the average amounts and cost of inputs involved in the production of one Kg of rice under irrigated (major and minor irrigation) and rainfed conditions in the dry and wet zones of Sri Lanka.
4. To study issues pertinent to institutional aspects and transfer of technology in paddy cultivation.

1.3 Research Methodology

The methodology was designed to measure the relationship of various production factors of paddy cultivation in accordance with different water regimes and climatic conditions. The methodology was designed to capture necessary information in line with the study objectives mentioned in Section 1.2.

Objective 1: To measure technical and economic efficiency of paddy farming in respect to different agro-climatic and water regimes conditions.

This objective relates to technical efficiency of rice production under various physical and climatic conditions. Additional land availability for extensive cultivation is very limited and once the frontier for extensive cultivation is reached, further increase in production has to come from improvement in productivity of the crop. In this context, technical efficiencies and its determinants in rice production assume paramount importance to over come the problem of production.

Technical efficiency is most frequently associated with the role of management in the production process. It is assumed that difference in the efficiency is attributable to difference in the entrepreneurial skills of the farmers. Probing into the reasons for variation in efficiencies will give further impetus to the production of rice by appropriate policy prescriptions.

Frontier production function analysis was followed to measure technical and economic efficiency of different farmers under various agro-climatic conditions.

Objective 2: To identify and analyze the factors influencing the production of rice and their costs including marketing.

This objective involves identifying factors influence in paddy production, thus it is expected to carry out detail comprehensive examination of the use of inputs in paddy production such as land, labour (family and hired labour), household assets as well purchased inputs, support services and cultural practices. More specifically, the research team investigated the share of each input in the paddy production process. In addition, land size, land tenure, type of labour used, cultural practices, levels of education, farming experience, use of agrochemicals and their availability and marketing of output were also investigated. Thus, a detailed examination of farm inputs was done with considering the socio-economic characteristics of the farm households, production methods and output. The investigation of farm supporting

services such as credit, extension and insurance services were examined and analyzed in order to see their contribution to production process.

Objective 3: To determine the average amounts and cost of inputs and returns involved in the production of one kg of paddy under irrigated (major and minor irrigation) and rainfed conditions in the dry/intermediate and wet zones of Sri Lanka.

This objective is centered on costs and returns data. The investigation on the household expenditure on agricultural production would indicate the cash requirement for farming and the demand for credit facilities at the farm level. This particular investigation will also help to identify the relationship between farm incomes and expenditure and to relate those to the socio-economic variables of the households.

Objective 4: To study the issues pertinent to institutional aspects and transfer of technology in paddy cultivation.

The institutional aspects such as farm support services, source of credit, farmer organizations and research and extension services have been made enormous impact on paddy production. Therefore, it is expects to assess availability of farm support services and institutional support on increasing farm outputs. It also reflects how institutional aspects would relate with production efficiency under various conditions.

1.4 Data Collection

Since the study aims to measure the production efficiency both in terms of economic and technical factors, the study should be based on a very comprehensive database. The necessary data were collected through secondary sources, questionnaire survey, key informant discussions and other participatory data collection tools.

(a) Primary Data

An in-depth questionnaire survey was conducted to collect primary data in relation to factors of production of rice cultivation and other information pertaining to general socio-economic status of farmers.

(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 includes collection of data and information from past research reports, journal articles, newspaper articles and other forms of publications.

(c) Participatory Data Collection Methods

Focus group interviews and key informants interviews were used as participatory data collection techniques. The research team visited the sites and conducted focus group interviews, which includes general farmers, FO representatives, state officials, traders, middlemen and other private sector individuals. The discussions focused on explore the field situation of paddy production, particularly problems related to paddy cultivation, support services provided, input supply, marketing and various other aspects of the enterprise.

1.5 Study Sites

As proposed in Terms of Reference (TOR) given by NSF, a sample survey was conducted in two districts namely Kurunegala and Kegalle to collect necessary primary information. The sample was based on two main criterions:

i) Differences in Agro Climatic Zones

The two selected districts (Kegalle and Kurunegal) represent wet zone (WL_1) and intermediate zone (IL_3) areas respectively for the study.

ii) Differences in Water Regimes

Study locations from each district were selected considering the three water regimes of Major Irrigation, Minor Irrigation and Rainfed areas.

Considering financial and time constraints the total sample size was limited 210 farm families from two districts. The selection of sample size between the two districts was determined on distribution of total paddy extent and production of paddy in major and minor irrigation and rain fed areas. Thus the HARTI selected 120 farm families from Kurunegala district, which represents 40 farm families each from major, minor, and rainfed areas. Ninety farm families were selected from Kegalle District, which represented only rainfed areas. The specific study sites in each district and their respective sample sizes are given in table 1.1.

Table 1.1 Distribution of Sample

District	Study Site	Water Regime	Sample Size
Kurunegala	Ridibendi Ela (Nikaweratiya)	Major Irrigation	40
	Hettipola (Udagama & BandaraKoswatta minor irrigation)	Minor Irrigation	40
	Pannala	Rainfed	40
Kegalle	Dedigama	Rainfed	50
	Rambukkana	Rainfed	40

1.6 Data Analysis

A descriptive analysis was applied to examine the socio-economic characteristics of sample sites and statistical analysis was followed to analyse the cost of production, yield and income level. A multiple regression model was run to examine the effect of various production factors on the level of paddy yield, while a Frontier Production Function Analysis was conducted to measure technical efficiency of rice production.

The frontier production function measures efficiency against the best production farmer. This estimate the maximum output obtainable with given inputs, enables the measurement of the farm specific technical efficiency as the vertical deviation of the farm specific output from the frontier output.

The efficient production frontiers for the farmers in different locations was estimated separately both Yala 2001 and Maha 2000/01. Factors influencing the technical

inefficiencies were measured both in terms of main production factors and other factors such as farmers' age, education, experience etc.

1.7 Scope of the Study

The investigation was focused on studying five major issues. Firstly, it measures technical efficiency of paddy farming under different agro-climatic and water regime conditions. Secondly it highlights level of influence made by various factors of production in rice cultivation. Thirdly, it deals with the farm incomes, costs and net returns reflecting food security and self-sufficiency of paddy production. Fourthly, it highlights institutional and technical aspects pertinent to paddy farming and finally suggests appropriate recommendation to increase paddy production.

The study component concerning with factors influenced in paddy production will reflect a detail examination of the use of farmer's owned inputs such as land, labour, household assets as well as purchased inputs and services for farming purposes. Some of the key issues that need to be investigated in this regard are; (a) relationship between land tenure status of operational land holding; (b) ownership patterns and distribution of land and other assets; (c) nature of the family labour 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 was 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 support services was analyzed considering both formal and informal services available to farmers. Among the major services that was 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 costs and returns of paddy cultivation. This section is expected to provide detailed insights of the operational status of the farm economy with a view to establish 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 will help to identify the relationship between farm income and expenditure and to relate these to the socio-economic variables of the households.

1.8 Rationale

In view of the changes that have taken place in the agrarian sector during the past few years, a detailed investigation of the production efficiency and the economic viability of paddy cultivation are timely and relevant. Such a study based on farm level data, would provide insights into the economics of paddy cultivation with special reference to production inputs, farm management practices, farm supporting services, cost and returns, disposal of outputs and food security. Though some descriptive analyzes have been carried out in the past, statistical analysis on these aspects have hardly been undertaken. Therefore, the proposed

study provides a detailed account on constrains, trends and potential of paddy farming in Sri Lanka.

1.9 Limitations of the Study

Like many other socio-economic and cost of production surveys the study had to faced some limitations.

i. Paddy cultivation in Sri Lanka heavily relied on family owned resources such as family labour, draught power, and seed paddy. Thus, difficulties emerged in making a realistic assessment of these production inputs.

ii. The existing paddy lands register was used as the sample frame. However, the paddy lands register has not been updated regularly. Therefore, the sample frame used for the study did not include recent inclusions of cultivators.

iii. Farmers in the village level in the various parts of the country use various traditional measurement units. For instance in one locality in the study district uses *kuruni* as the paddy measurement the unit, while in another it is *laha* or *bera*. These measurements also were not identical in the two districts.

iv. As in the case of many other social science research studies, some answers on past activities given by farmers from recalling memory may not be very reliable.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Economics of Paddy Cultivation in Sri Lanka

A comprehensive body of literature is available on economics of paddy cultivation in Sri Lanka and it could be broadly classified under three broad categories.

(a) Cost of Production surveys conducted annually by the Department of Agriculture and paddy statistics collected by the Dept. of Census and Statistics:
These surveys are conducted island wide using representative samples from each district. Cost of production information is available both in terms of production inputs and operational activities. Thus a detail set of information are published annually both at district and national level.

(b) Descriptive analysis of paddy cultivation and cost of production conducted in the past (Central Bank of Ceylon, 1969; Abeyratne, 1991; Henegedara 2000; Rupasena, 1999).

(c) Analytical studies focused on variation in cost of production of paddy in terms of factors of production, Nominal Protection Co-efficient (NPC) and Effective Protection Coefficient (EPC). (Gunawardena, 1987; Sirisena, 1986; Edirisinghe 1991; Wickramarachchi, 1993; Samarathunga and Rafeek 2000).

There has been an apparent dilemma in the rice production sector in Sri Lanka during last couple of decades. The view is largely based on the poor performance of paddy in recent years in terms of stagnant yields, low market price, contraction of extent cultivated, part-time occupation with more lucrative off-farm employment and comparison of domestic rice price with international market.

According to the cost of production data published by Department of Agriculture from 1978 to 2001, paddy production become unprofitable enterprise over the years except in major irrigated areas and some minor irrigation schemes. The situation in rainfed area has been deteriorating drastically. The descriptive and analytical studies show that rice production and yield has increased over the past 50 years and it reached to a plateau level since 1995 (Sandaratne, 2001). The increase of production and yield was attributed mainly due to the introduction of high yielding varieties in 1960s and expansion of the area cultivated in 1970 to 1980s. Having analyzed the overall impact of intensive programme implemented in the past 50 years, several research studies conducted in the past by analyzing comparative advantage of rice production showed the technical and economic efficiency levels of rice in Sri Lanka. Abeyratne et al (1991), Edirisinghe (1991), Wickramarachchi (1993), Samarathunga and Rafeek (2000) have estimated DRC for respective years showed some contrasting results. These studies gave mixed and contrasting findings. The reason was the estimates were one-time point estimates of yield, which fluctuate, significantly year-to-year. Kikuchi et-al (2002) overcomes these defects by dealing with a long-term trend in rice production (1980-1997). They showed that rice production in Sri Lanka had comparative advantage around 1980 and advantage has been eroded in the last two decades. But they

emphasized that rice production in the major irrigation regime that shares about 70% of total rice production of the country is still profitable, as long as the investment costs of constructing these major irrigation schemes are treated as sunk cost. They also highlighted that the major factor that has been pushing down the comparative advantage of rice production is the increase in the agricultural wage rate. According to economic analysis on paddy production by Ranaweera, et-al (1990), rice production in Sri Lanka is not responsive to prices, in both short run and long run. They also concluded that non-price factors have a greater influence than price factors in determining the level of production.

Several methods were followed to determine the most efficient production frontier by different researchers (Farrell, 1957; Aigner and Chu, 1968; Timmer 1970 and Aigner, 1977). Battese (1992) proved that the econometric modeling of frontier production functions provides useful insights into best practice technology and measures by which the productivity efficiency of different firms may be compared. Despite its well-known limitations, the Cobb-Douglas functional form has been widely used in farm efficiency analysis for both developing and developed countries. Ekanayake and Jayasooriya (1987) and Karunaratne and Herath (1989) estimated the technical efficiencies for rice and other field crops in the Mahaweli System H using stochastic frontier model.

Having considered costs of production, disposals, tenure and net value, in rainfed and irrigated conditions, Henegedara (2000) shows that paddy cultivation is economically viable only in major irrigation areas. Intensive cultivation and commercial farming practices were major causative factors for the viable productive situations in major irrigations. It was also found that more than 45% of total productions were accounted for labour and it vary 45%-54% in some rainfed areas. Efficiency of paddy cultivation was measured both in terms of technical and economical efficiencies. These analysis were based on frontier production analysis.

Wijeratne and Hemakeerthi (1992) reported that the production costs have increased over the years in the districts that have better water conditions. This indicates that to a larger extent that uncertainty of water supplies has decreased the level of investment on rice production. Tudor Silva et-al. (2000) found a trend towards diversification or rotation of paddy with commercially oriented crops mainly in the areas outside the predominant paddy growing areas.

Sanderatne (2001) identified three main issues in paddy farming i.e. stagnant yields, viability of paddy farming and evolution of paddy farming as a part-time occupation. He emphasized the vital importance of increasing average national yield up to 5 metric tons per hectare within the coming decades in order to maintain the paddy farming economically and socially viable enterprise. He also recommended that Research and Development (R&D) policies and institutional issues needed to be addressed immediately to achieve the expected targets. Panabokke and Punyawardena (2000) recommend regionalize the paddy cultivation to more potential areas of the country rather than spreading across the whole country. In this regard Gamage (2000) investigated the water use efficiency (WUE) in agriculture and suggested to identify best rice producing areas and to restrict the paddy cultivation to imperfectly drained and poorly drained soils in major irrigation projects.

The above review mainly analyzed the economics of paddy cultivation in Sri Lankan context. Analysis was based on quantitative and qualitative methods in terms of measuring technical and economic efficiencies, financial and non-financial values. It indicates efficiency level of paddy farming with various levels of resources allocations. The findings clearly indicate that main production factors such as land, labour, seeds, water, fertilizer and chemical greatly influenced the level of production. The size of land holdings and water availability also greatly influenced production level.

2.2 Agricultural Policy Reforms

Domestic agricultural policies had undergone various changes, in line with macro economic policy reforms made after1948. Since these policies had direct impact on cost of production of rice and levels of farmers' income, it is worthwhile to brief these policies and reforms here. The policies followed by various political regimes after independence (1948-1970) focused mainly on increasing rice production through expanding the area cultivated and improving productivity. The six year development plan (1951-1957), the six year program of investment (1954-1959) and the ten year development plan (1959-1968) emphasized the need of enhancing the efficiency of the non plantation crop sector in Sri Lanka (Athukorala and Jayasooriya, 1994). Programs during the 1948-1970 period centered around five activities (Chandrapala, 1986) namely,

I increase the extent of paddy land cultivated by the development of irrigation infrastructure and land settlement programs;
II to increase production and productivity through research and improved production technology;
III to develop institutions for farmers such as the establishment of cultivation committees and rural banks etc;
IV to change land and land tenure policies and
V to provide subsidies for production inputs and credit facilities

The policies implemented during the period of 1970-1977 provided greater emphasis on farm support services such as credit, marketing and crop insurance. Rural Banks, Paddy Marketing Board and Crop Insurance Board were established during this period. Programs for the development of irrigation, research and extension services, land settlements and rural institutions were also implemented.

Agricultural policy reforms implement after 1977 period were intended to achieve four major objectives (Ministry of Finance and Planning, 1984). The policies adopted during this period were in line with the government structural adjustment programs and the liberal market economic policies.

I Achievement of self-sufficiency in rice.
II Expansion of exports to increase the contribution of agriculture to the balance of payments situation
III The creation of new employment opportunities and the consequent enhancement of incomes in the rural sector.
IV The improvement of the nutritional status of the people.

Agricultural policy reforms implemented in the past fifty years in Sri Lanka irrespective of policy regimes could be categorized under seven headings as follows (Sirisena, 1986; Abeyratne, 1991).

(a) Development of irrigation and agricultural infrastructure
(b) Guaranteed price schemes
(c) Production subsidies
(d) Research and development
(e) Trade policy reforms
(f) Institutional development programs
(g) Agricultural credit programs

Every successive government provided production subsidies to protect and encourage small producers. The various production incentives took the form of low prices, low interest rates, loans and trade incentives (Abeyratne, 1991). There were two main inputs subsidies given to farmers i.e. the fertilizer subsidy and the irrigation subsidy. The fertilizer subsidy had a positive effect on productivity and total production of paddy (Annual reports, Department of Agriculture). The impact was very significant in the case of high yielding varieties, which required use of inorganic fertilizers for a better yield. However, the impact of reducing total production cost was marginal due to the fact that fertilizer accounted for only12 percent of total cost though it helped to increase fertilizer application among small producers who were not able to bear the high production costs (Henegedara, 2000).

Out of total fertilizer subsidy allocation, more than 60 percent of the subsidy was utilized for paddy compared to tea, rubber and coconut. The average fertilizer usage for paddy has increased from 155Kg/ha in 1978 to 308 Kg/ha in 1997 despite the decrease of the total extent cultivated from 876,000 ha (1978) to 729,815 ha (1997).

Along with the effects of green revolution in 1960s, research and Development (R&D) on improved high yielding varieties were stressed. The paddy variety usage statistics indicates that, the adoption of high yielding varieties increased from 71% in (1972) to almost 100% in late 1980s. New seed varieties have shown a greater yield response to fertilizer use, method of cultivation i.e. transplanting and broadcasting and the use of herbicide, pesticide and fungicide.

In order to achieve a number of objectives of in the liberal policy reforms introduced since 1977, quantitative restrictions (QRs) on imports were replaced in 1978 by introducing a six-band tariff system ranging from 0 percent tariff for essential consumer items to 500 per cent tariff for luxury items respectively. Presidential Tariff Commission on Trade and Tariff altered this system in 1992 and a three-band tariff structure was introduced with the rates of 10, 20 and 45 percent in order to relax the rigidity and correct the distortions in domestic agricultural sector. The introduction of the three-band tariff structure in 1992 helped to reduce market distortions in the non- plantation agricultural sector (Gunawardena & Somaratna, 1996).

The new trade agreements on agriculture with the GATT/Uruguay Round agreement on Agriculture (GURAA) and the South Asian Preferential Trade Agreement (SAPTA) have opened new horizons and avenues for non-plantation agricultural commodities. In compliance with GURAA, Sri Lanka is bound to have all tariffs on imports of agricultural products at a uniform rate of 50 per cent (Gunawardena and Somaratna, 2000). Thus approximately 700 agricultural products will benefit under the GURAA and SAPTA agreements.

The import duty rates imposed by the government on paddy were changed from time to time considering local production and internal political pressures. According to Table 2.3, the tariff on the import of rice was 25% in 1980 and it remained so until 1989. The rate was reduced to 8 percent in 1990 for two years. It was however increased from 12 to 16 percent in 1992 and again to 35% or Rs. 7/Kg. in 1994. Even though it was reduced to zero in 1995/96 Maha and 1997 Yala seasons due to severe drought and the resultant low production, the tariff was increased again to 35% in 1998 with another 4.5% charge as the national security levy. It however dropped to 10 percent in 1999 and increased to 35 percent in January 2000 (Table 2.1).

Table 2.1: Variation of Duty Rates for Rice Imports

Period	Rate of Duty
1986 – 1989	25%
1990	08%
1992 July 30	12%
1992 Dec. 01	16%
1993 July 26	20%
1993 Aug. 17	35%
1994 Dec. 13	20%
1995 Feb. 01	31%
1996 April 15	0%
1997 Jan. 31	35%
1997 Nov. 20	0%
1998 Feb. 01	35%
1999 Nov. 22	10%
2000 Jan. 01	35%

Source: Sri Lanka Custom Notifications (Various Issues)

Though there has been a degree of flexibility in regard to tariff rates, no rational policy has been adopted in this regard (Rupasena, 2000). However, the impacts of these changes were very effective in determining domestic market prices. Until 1990 the CWE had a monopoly on rice imports. After August 1990, private traders were allowed to import and to maintain buffer stocks subject to the payment of import duties when stocks were released to the local market.

The impact of tariff rates on local producers and the consumers is negligible when compared to Nominal Protection Coefficient [1](NPC) and the Effective Protection Coefficient (EPC)[2] According to HARTI statistics based on 1991/92 survey data in four major rice producing areas, the NPC or the NPR was -8.2 at the rate of official exchange rate and -16.8 at the rate of shadow exchange rate (Wickramarachchi, 1993). It implies that rice was negatively protected or local producers were taxed. According to the same estimates, EPC or the Effective Protection Rate. (EPR) was -9.8 and -21.6 respectively in newly irrigated and rehabilitated irrigated areas at the rate of official exchange rate. The rate was -23.2 and -32.0 respectively in newly and rehabilitated areas in terms of the shadow exchange rate (Wickramarachchi, 1993). This implies again that protection had a negative effect on local producers.

Following the agricultural policy reforms, the agricultural delivery system also improved through strengthening the institutional mechanism of the state services and the participation of beneficiary groups. Thus Agrarian Service Centres (ASCs) were established in 1971 to provide farm support services such as extension, credit and marketing through the Department of Agrarian Services, Department of Agriculture, Paddy Marketing Board and Agricultural Development Authority. Under the Agricultural Productivity Act of 1971, farm support services were strengthened through promoting the participation of beneficiary groups. Thus Agricultural Productivity Committees were formed in every ASCs representing farmer representatives and line agency officers. However after 1988 the role of the Agrarian Service Centers was limited to training and extension, and the private sector was encouraged to provide fertilizer, chemicals and seeds.

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1 NPC is the ratio of domestic market price of a given commodity to its border price.
Thus: $\mathbf{NPC = P^d / P^b}$ where $\mathbf{P^d}$ – domestic price of given commodity
$\mathbf{P^b}$ – border price of the commodity

2 The EPC is defined as the ratio between the value added in domestic market prices to the value added in world prices for a particular production process.
$\mathbf{EPC = V^d / V^b}$ where $\mathbf{V^b}$ – value added in border prices
$\mathbf{V^d}$ – value added in domestic prices

CHAPTER THREE

ECONOMIC ASPECTS OF PADDY FARMING

3.1 Cost of Production

Theoretically, costs are divided into two parts: 1) fixed cost 2) variable cost. Fixed cost includes expenditure incurred before production commences. This implies that fixed cost does not vary with the quantity of production; an example is the cost of purchasing or renting of paddy lands, while variable cost varies with production, an example being the cost of labour. In this study, only the variable costs are taken into account and divided into three components, namely labour, power and material cost. Power cost includes expenditure incurred for hiring machinery and equipment. The major cost component this category is the tractor charges. Material cost includes expenditure on fertilizer and agro chemicals. In the survey information on cost were collected on operational basis. In addition to the hired inputs, information on family inputs such as labour was gathered. Data were analyzed on an operational vise, a component vise and a cash/non-cash basis. Imputed values for family owned inputs based on the market rates were placed in the non-cash category. Percentages were calculated to show the importance of major cost items. Results are presented in a tabular form.

3.1.1. Total Cost

Table 3.1 presents the total cost of production per acre in the study locations. As shown in the table, cost of production during the 2001 Yala season exceeded Rs.19, 000 per acre except in Hettipola where the cost was Rs.17, 171 per acre. Lowest cost was reported in Hettipola even for the Maha season. The reason for low cost in Hettipola was due to low wage rates prevailing in the area and lesser use of fertilizer. The above reason is evident in Table 3.2 where the cash cost was separated in order to get an idea of cash requirement for paddy cultivation. Farmers at Ridibendiela and Pannala required about Rs.12, 000 in cash to cultivate one acre of paddy land. The cash cost represents about 65 percent of the total cost at Ridibendiela where paddy is grown under major irrigation. However, cash cost at Hettipola was about 50 percent of the total cost because of the low-level fertilizer application. As regard to Kegalle district where paddy is grown in rain-fed condition cash cost per acre was about Rs.8800, which was about 45 percent of the total cost of production where once again there is a low fertilizer application.

Table No 3.1: Cost of Cultivation per acre of Paddy during Yala 2001 and Maha 2000/01

District/Location	Mode of water supply	Yala 2001			Maha 2000/01		
		Total Cost (Rs./acre)	Cash Cost (Rs./acre)	% of Cash Cost to Total Cost	TOTAL COST (Rs./acre)	Cash Cost (Rs./acre)	% of Cash Cost to Total Cost
KURUNEGALA							
Ridibendiela	Major Irri.	19057	12295	65	18311	11823	65
Hettipola	Minor Irri.	17171	8141	47	17233	8844	51
Pannala	Rainfed	19676	12166	62	20576	12704	62
KEGALLE							
Dedigama & Rambukkana	Rainfed	19077	8840	46	18988	8813	46

The breakdown of the cash cost is given in Table 3.2 for both seasons. The situation varies by location. At Ridibendiela, labour cost represents about 45 percent of the total cash cost followed by about 40 percent for material cost. The rest 15 percent was spent on farm power. In Kegalle district power and material costs consisted of about 30 percent each. The power cost was considerably higher than that of Ridibendiela. The total farm power cost in Kegalle district was 35 percent higher than the power cost of Ridibendiela during the 2001 Yala season. One of the reasons for the higher level of farm power cost in the Kegalle district is use of manual labour and animal draught power for land preparation and threshing.

Table No. 3.2: Composition of Cash Cost for Paddy Cultivation during Yala 2001 and Maha 2000/01

District/ Location	Mode of Water Supply		Yala 2001				Maha 2000/01			
			Labour Cost (Rs)	Power Cost (Rs)	Material Cost (Rs)	Total Cost (Rs)	Labour Cost (Rs)	Power Cost (Rs)	Material Cost (Rs)	Total Cost (Rs)
KURUNEGALA										
Ridi bendi ela	Major Irrigation	(Rs./ac)	5585	1930	4779	12295	5516	1665	4642	11823
		%	45.4	15.7	38.9	100.0	46.7	14.1	39.3	100.0
Hettipola	Minor Irrigation	(Rs./ac)	3161	1811	3169	8141	3517	1672	3655	8844
		%	38.8	22.2	38.9	100.0	39.8	18.9	41.3	100.0
Pannala	Rainfed	(Rs./ac)	3654	4593	3919	12166	5385	3181	4138	12704
		%	30.0	37.8	32.2	100.0	42.4	25.0	32.6	100.0
KEGALLE										
Dedegama & Rambukkana	Rainfed	(Rs./ac)	3779	2580	2481	8840	3855	2439	2519	8813
		%	42.8	29.2	28.1	100.0	43.7	27.7	28.6	100.0

In the study, importance of each cost item was examined by calculating percentage contribution to the total cost. Results are presented in Table 3.3. Cost of labour is the highest component representing over 50 percent of the total cost in all localities for both seasons. In Kegalle district, labour cost exceeded over 65 percent and the amount was around Rs. 13,000 per acre compared to Rs.10, 500 at Ridibendiela in Kurunegala district. In major irrigation areas the second most important cost item is the material cost because of high level of fertilizer and agro chemical use. The study found that material cost at Ridibendiela represented 26 percent followed by 18 percent of power cost.

Table No. 3.3: Composition of Total Cost of Cultivation of Paddy during Yala 2001 and Maha 2000/01

District/ Location	Mode of Water Supply		Yala 2001				Maha 2000/01			
			Labour Cost (Rs.)	Power Cost (Rs.)	Material Cost (Rs.)	Total Cost (Rs.)	Labour Cost (Rs.)	Power Cost (Rs.)	Material Cost (Rs.)	Total Cost (Rs.)
KURUNEGALA										
Ridi bendi ela	Major Irri.	(Rs./acre)	10590	3480	4986	19057	10413	3060	4838	18311
		%	55.6	18.3	26.2	100.0	56.9	16.7	26.4	100.0
Hettipola	Minor Irri.	(Rs./acre)	9302	4211	3658	17171	9608	3723	3903	17233
		%	54.2	24.5	21.3	100.0	55.8	21.6	22.6	100.0
Pannala	Rainfed	(Rs./acre)	10002	5585	4089	19676	12028	4247	4302	20576
		%	50.8	28.4	20.8	100.0	58.5	20.6	20.9	100.0
KEGALLE										
Dedigama & Rambukkana	Rainfed	(Rs./acre)	12712	3498	2866	19076	13075	3076	2837	18988
		%	66.6	18.3	15.0	100.0	68.9	16.2	14.9	100.0

Labour Use

As explained in the above, since the labour cost is the highest in the total cost, labour requirement for paddy farming was examined in the survey. As shown in the Table 3.4, the number of man-days per acre varies from 38 days at Hettipola to 60 days at Dedigama/Rambukkana. In Kegalle district exchange labour (Attam) is widely used while in Kururnegala hired labour is widely used under major irrigation. Farmers in the major irrigation have to carry out the land preparation simultaneously considering the water issue from the irrigation schemes. Consequently, harvesting of all fields takes place at the same time. Also land preparation and harvesting require a greater number of labour days. These two reasons attributed to high demand for hired labour for cultivation of paddy under major irrigation. Average wage rate per day was around Rs.200 per man and Rs.125 per woman without meals. Due to scarcity of female labour at Pannala the cost was around Rs.150 per day.

Table No. 3.4: Labour Requirement for Paddy Cultivation during Yala 2001 and Maha 2000/01

Season	District/ Location	Mode of Water Supply		Family Labour	Hired Labour	Exchange Labour	Total	*Wage rate (Rs/day)	
								Male	Female
YALA 2001	KURUNEGALA								
	Ridibendiela	Major Irrigation	(Md./acre)	23.77	23.25	1.58	48.61	210	121
	Hettipola	Minor Irrigation	(Md./acre)	26.87	9.75	1.85	38.47	220	128
	Pannala	Rainfed	(Md./acre)	24.65	14.33	8.97	47.94	183	148
	KEGALLE								
	Dedigama & Rambukkana	Rainfed	(Md./acre)	31.45	12.89	12.31	56.65	214	137
MAHA 2000/01	KURUNEGALA								
	Ridi bendi ela	Major Irrigation	(Md./acre)	24.34	23.66	1.24	49.23	202	122
	Hettipola	Minor Irrigation	(Md./acre)	28.83	12.30	1.74	42.88	211	126
	Pannala	Rainfed	(Md./acre)	27.39	19.61	6.58	53.57	203	151
	KEGALLE								
	Dedigama & Rambukkana	Rainfed	(Md./acre)	31.58	13.24	15.13	59.95	210	134

* Wage rate (Excluding Food)

Fertilizer Application

Use of fertilizer varies by location and types of farming as depicted in Table 3.5. As regard to locations, the highest usage of fertilizer was observed at Pannala while the lowest application was reported at Dedigama and Rambukkana for both seasons. In both locations, farming is carried out under rain-fed condition. There is an imbalance in application of fertilizer. For instance, farmers at Ridibendiela use more urea than other fertilizers. Fertilizer cost amounts to 45 percent of the total material cost. Since the Department of Agriculture is promoting use of straight fertilizer, farmers' adoption of this practice was examined. Findings show that application of straight fertilizer was not in practice in the study locations except in Kegalle where only few farmers used straight fertilizer.

Table No. 3.5: Fertilizer Application by Type, Quantity (kg/ac) and Cost (Rs/ac) during Yala 2001 and Maha 2000/01

Season	District/ Location	Mode of Water Supply	V Mixture Basal	Urea	TDM	Straight Fertilizer	Total Kg	Fertilizer Cost (Rs/ac)	Fertilizer Cost as % of material cost
YALA 2000	**KURUNEGALA**								
	Ridibendiela	Major Irrigation	60	86	44	0	190	2264	45
	Hettipola	Minor Irrigation	34	66	46	2	148	1583	43
	Pannala	Rainfed	56	66	80	5	207	2387	58
	KEGALLE								
	Dedigama & Rambukkana	Rainfed	40	30	32	27	129	1742	60
MAHA 2000/01	**KURUNEGALA**								
	Ridibendiela	Major Irrigation	63	79	46	0	188	2179	45
	Hettipola	Minor Irrigation	34	66	47	3	150	1609	41
	Pannala	Rainfed	56	61	74	2	193	2264	53
	KEGALLE								
	Dedigama & Rambukkana	Rainfed	38	31	33	31	133	1743	61

Cost of Cultivation by Operations

In this study, information on cost of production was obtained on operational basis. As shown in the annexes (annex tables No. 1-8) paddy farming was divided into 14 operations from nursery preparation to transport of paddy to the farmhouse. Labour is involved in all operations. Nevertheless, peak demand for labour prevailed in two stages, i.e., planting stage (nursery preparation, transplanting/broadcasting) and harvesting stage (harvesting, threshing and transport of product to homestead). The analysis of cost of production at Ridi-bendi-ela shows that cost for these two stages amounted to Rs.3370 and Rs.4345 respectively totaling Rs.7715 per acre. This represents 75 percent of the total labour cost of the entire cultivation. When the machinery cost was added to the labour cost, cost for the first stage amounted to Rs.5292 and the second stage was Rs.5330 totaling Rs.10, 622. This means that 58 percent of the total cost of production was spent at the initial stage and the final stage of cultivation.

3.2 Profitability and Yield

Profitability of paddy farming was worked out on per acre basis. Gross return or income was calculated by multiplying production and average producer price. Net return is subtraction of production cost from the gross return. Net return was calculated by two methods: including imputed cost and excluding imputed cost, which is called cash cost. In addition, return to labour, and return to capital was calculated. Return to labour means how much could be earned for a labour day. This is a value of the labour in respect to net income of paddy.

Similarly, return to capital means how much could be earned by spending one rupee in paddy farming. It is worked out dividing net return by cash cost investment. Results are presented in Table 3.6.

Table No. 3.6: Yield, Producer Price and Revenue: Paddy during Yala 2001 and Maha2000/01

Season	District/ Location	Mode of Water Supply	Yield (Kg/ac)	Farm gate Price Rs./Kg	Gross Return Rs/ac	Net Return (Rs/ac)		Return to Labour Rs/day	Return to Capital (Rs/one rupee of investment)
						1	2		
YALA 2001	KURUNEGALA								
	Ridi-bendi-ela	Major Irrigation	2216	12.15	26924	7868	14630	396	2.19
	Hettipola	Minor Irrigation	1712	12.65	21657	4486	13516	404	2.66
	Pannala	Rainfed	1259	13.80	17374	-2302	5208	165	1.43
	KEGALLE								
	Dedigama & Rambukkana	Rainfed	1070	13.66	14616	-4461	2399	88	1.65
MAHA 2000/01	KURUNEGALA								
	Ridi-bendi- ela	Major Irrigation	1953	12.22	23860	5549	12037	338	2.02
	Hettipola	Minor Irrigation	1301	12.08	15715	-1518	6870	217	1.78
	Pannala	Rainfed	1524	13.23	20159	-417	7455	217	1.59
	KEGALLE								
	Dedigama & Rambukkana	Rainfed	1248	11.93	14888	-4100	6075	144	1.69

(1) - Including imputed cost of farmer owned inputs (2) - Excluding imputed cost of farmer owned inputs

As expected, yield per acre was the highest in the major irrigation area, the second highest in minor irrigation area and the lowest is in the rain-fed area. For example, average yield at Ridibendiela under major irrigation was 2216 kg per acre in 2001 Yala season, which was 29 percent higher than that of minor irrigation and 107 percent higher than that of rain-fe condition. This is due to the differences in farming practices and water availability. In major irrigation areas, crop management such as fertilizer application and use of quality seed is high when compared to the other two areas due to assured supply of water. When the yield is compared with research level yield, a big gap exists at all locations (Table 3.7). This will be explained in detail in the section of technical efficiency (section 3.3).

Table No. 3.7: Gaps between Research yield, Actual yield among different varieties (Maha 2000/01)

Type of varieties	KURUNEGALA			KEGALLE	Recorded Highest yield in the Research Station*Bu/ac
	Major Irrigation (Bu/ac)	Minor Irrigation (Bu/ac)	Rainfed (Bu/ac)	Rainfed (Bu/ac)	
BG 304		40.0			143.5
BG 352	89.9	75.0	92.0	55.1	116.3
BG 358	98.4		104.0		184.2
BG 400/1	77.8		65.0		164.8
LD 355	80.0				87.3
BG 357	100.2		100.0	110.0	184.2
BG 450	78.7				116.3
BG 300		48.3			135.7
BG 379/2	91.6		65.0	69.6	164.8
BG 403	130.0	80.0			155.1
LD 252	110.0				87.3
BG 350		40.0			126.0
BG 11/11	100.0			68.0	126.0
AT 354		91.7			97.0
BG 345		46.7			97.0
BG 90/2				72.0	164.8
Not Known	98.3	58.7	68.2	59.5	

* Source: Research Officer in Charge at Rice Research Station in Ambalantota

In case of gross return, the maximum amount obtained was Rs.26, 924 at Ridibendiela and the lowest was Rs.14, 616 per acre at Dedigama /Rambukkana area in the 2001 Yala season. As compared to crops like onions, potatoes and chillies, gross income obtained from paddy farming is low. Due to this situation the private sector is reluctant to invest in paddy farming and the youth are unwilling to enter into the paddy farming. As mentioned earlier, net income was calculated including and excluding cost of family labour inputs. Accordingly net income per acre varied from Rs.14, 630 at Ridibendiela to Rs.2399 at Dedigama/Rambukkana. As shown in the table 3.6, net return under rain-fed conditions is considerably low but farmers are still willing to continue rainfed paddy farming due to two reasons: 1) food security at household level and 2) absence of suitable alternative crops for rainfed paddy lands. Return to labour was lower than wage rate in rain-fed areas indicating that use of hired labour is not economically viable. Nevertheless, values of return to capital were positive for all study locations indicating that investment was profitable. The findings from the major paddy producing areas of the study shows that, investing one rupee in paddy farming has generated more than one rupee as a return.

In this study an attempt was made to calculate the unit cost and break- even yield. The results are presented in table 3.8. Under the condition that own input is valued at market rate in

calculating cost, market price of paddy is lower than the unit production cost of rainfed paddy. Similarly average yield remained below the breakeven yield. In major and minor irrigation areas actual yield is higher than the break-even yield and the market price of paddy is higher than that of unit cost.

Table No. 3.8: Unit cost and Break-even Yield: Paddy during Yala 2001 and Maha 2000/01

District/ Location	Mode of Water Supply	Yala 2001				Maha 2000/01			
		Unit Cost Rs/Kg		Break-even yield Kg/ac		Unit Cost Rs/kg		Break-even yield Kg/ac	
		1	2	1	2	1	2	1	2
KURUNEGALA									
Ridebendi ela	Major Irrigation	8.60	5.55 (12.15)	1568	1012 (2216)	9.38	6.06 (12.22)	1498	967 (1953)
Hettipola	Minor Irrigation	10.03	4.76 (12.65)	1357	644 (1712)	13.25	6.80 (12.08)	1427	732 (1301)
Pannala	Rainfed	15.63	9.66 (13.80)	1426	882 (1259)	15.82	9.77 (13.23)	1555	960 (1524)
KEGALLE									
Dedigama & Rambukkana	Rainfed	17.83	8.26 (13.66)	1397	647 (1070)	15.22	7.06 (11.93)	1592	739 (1248)

(1) - Including imputed cost of farmer owned inputs

2) - Excluding imputed cost of farmer owned inputs

**Figures in the parenthesis under the unit cost column indicates the farm gate price of paddy and figures in the parenthesis under the break-even yield column shows the average paddy yield prevailed in the area.

3.3 Technical Efficiency

Technical Efficiency was measured using the maximum Likelihood - frontier production function. In this model each farmer efficiency level was measured with the best farmers efficiency level. The value of the Technical efficiency coefficient varies between zero to one, meaning that close to one is increasing efficiency while close to zero increasing inefficiency. The value of the mean technical efficiency provides the average situation. Results are presented in Table 3.9.

As shown in the table, values of the technical efficiency coefficient varies significantly, indicating that there is vast difference of production efficiency of farmers, though they operate under similar conditions. This may be due to different farming practices adopted by farmers and their entrepreneurship. For instance, some farmers used old seeds, which were used in the farmers' fields repeatedly while others used new certified seeds. Similarly, application of fertilizer and use of agro-chemical varies by farmers. According to the results of the mean technical efficiency, there is room to increase production without increasing the input level. For instance, value of the mean technical efficiency in Kurunegala was 0.76 for major irrigation, which indicates that production could be increased by another 24 percent if

all farmers achieved the technical efficiency of the best farmers. This does not need increasing of input levels. As regard to Yala season technical efficiency is high in major and minor irrigation areas while it is very low in rain-fed areas as indicated by low mean efficiency value of less than 0.50. This means that rain-fed paddy production in Kurunegala and Kegalle districts could be doubled without adding any additional cost.

Table No. 3.9: Technical Efficiency

Maha 2000/2001	**KURUNEGALA**			**KEGALLE**
	Major	Minor	Rainfed	Rainfed
Variation	0.99-0.19	0.98-0.24	0.98-0.22	0.95-0.16
Mean Efficiency	0.76	0.62	0.69	0.54

Yala 2001	**KURUNEGALA**			**KEGALLE**
	Major	Minor	Rainfed	Rainfed
Variation	0.99-0.55	0.95-0.21	0.99-0.12	0.99-0.11
Mean Efficiency	0.83	0.84	0.47	0.47

Based on the mean and the standard deviation of technical efficiency, farmers were grouped into three: high efficiency (TE < 91%), average efficiency (61% < TE < 90%) and low efficiency (TE < 60%). Table 3.10 compares farming practices of each group. As shown in the table, the number of low efficiency farmers in the sample is high in minor and rain-fed areas compared to that of major irrigation. Of 123 rain-fed paddy farmers in the sample in the two districts, 71 or 57 percent belongs to the category of low efficiency; where as the figure for major irrigation is only 6 out of 39 farmers, representing only a 15 percent. Another important point is that yield is substantially high among high efficiency farmers as against the low efficiency farmers but there is hardly any variation in cost. Average yield per acre was 110 bushels for high efficiency farmers compared to 55 bushels for low efficiency farmers under major irrigation. The same is true for minor and rain-fed condition.

Table 3.10: Farming Practices of Paddy Cultivation by Level of Efficiency of the Farmers during 2000/01 Maha season

Important measurements in related to Paddy	KURUNEGALA									KEGALLE		
	MAJOR IRRIGATION			MINOR IRRIGATION			RAINFED			RAINFED		
	High Efficiency	Average Efficiency	Low Efficiency	High Efficiency	Average Efficiency	Low Efficiency	High Efficiency	Average Efficiency	Low Efficiency	High efficiency	Average efficiency	Low efficiency
Average land cultivated (ac)	1.35	1.17	1.29	1.20	1.01	0.87	0.84	0.88	0.70	0.58	0.66	0.66
Yield per acre (Bu/ac)	110	93	55	97	64	47	85	81	55	102	78	47
Seed rate (Bu/ac)	2.19	2.01	1.94	2.17	2.85	2.55	1.85	2.45	2.22	1.77	1.68	1.83
Seed Cost (Rs/ac)	256	319	283	270	322	422	492	458	550	562	575	594
Fertilizer rate (Kg/ac)	199	178	207	118	165	170	155	212	198	118	110	143
Fertilizer Cost (Rs/ac)	2209	2082	2464	1231	1706	1659	1840	2410	2370	1652	1435	1895
Agro-Chemicals Cost(Rs/ac)	1591	2073	1856	1088	1354	1541	768	1296	1289	173	236	501
Power (Rs/ac)	2973	3147	2907	3361	3754	3831	3836	4550	4185	3527	2886	3129
Labour including FL (Rs/ac)	10005	10588	10511	6732	8759	11530	11706	11602	12657	13260	12817	13182
Labour excluding FL (Rs/ac)	5377	5529	5708	1763	2760	4922	6013	5332	5058	2773	3539	4088
Man days including FL (md/ac)	48.25	52.92	50.16	34.81	40.39	53.73	52.98	54.74	55.23	64.72	61.24	60.31
Man days excluding FL (md/ac)	25.46	27.60	26.56	8.76	12.59	22.83	26.99	28.93	25.38	30.32	30.67	28.48
Cost per Kg (Rs/kg)	7.62	9.58	21.64	6.53	12.32	19.79	10.30	12.36	18.46	8.99	11.00	20.48
No. of farmers included for FP*	10	23	6	5	15	18	8	13	16	5	26	55
Percentage of farmers	26	59	15	13	39	47	22	35	43	6	30	64
Cost per acre (Rs/ac)	17543.03	18665	18412	13170	16505	19493	18923	20819	21329	19217	17997	19436

* Frontier Program

Low efficiency = less than 60% of technical efficiency

Average efficiency = 60 – 90% of technical efficiency

High efficiency = above 90% of technical efficiency

3.4 Cobb-Douglas Production Function Results

The Cobb-Douglas production function was fitted to paddy output. The model was constructed considering production as a function of land size, cost of fertilizer, cost of seed, cost of farm power and labour use.

$$\text{Ln } Y_I = \beta_0 + \beta_1 \text{Ln} X_{1i} + \beta_2 \text{ Ln } X_{2i} + \beta_3 \text{Ln } X_{3i} + \beta 4 \text{ Ln } X_{4i} + \beta_5 \text{Ln} X_{5i}$$

Ln denotes logarithms to base e

Y_I = Output (Kg of paddy)
X_I = Extent of land (ac)
X_2 = Labour cost (Man days)
X_3 = Seed cost (Rs)
X_4 = Fertilizer cost (Rs)
X_5 = Cost of power (Rs)

Coefficient of variables obtained from the regression analysis directly provides elasticity of the respective variable in terms of production. Results are presented in Table 3.11 and 3.12. In case of major irrigation only land and agro chemical usage has significant relationship with production during Maha season. In Maha, farm size having the highest co-efficient of elasticity. It shows that doubling the farm size in major irrigation with other inputs at constant level would increase the production by about 56 percent, which is significant even at 1% level. In case of minor irrigation land elasticity with respect to production is greater than one, showing that one percent increase in land leads more than one percent increase in production during the Maha season.

In Kurunegala district, there is no strong relationship with labour use and production under irrigated condition. In other words increasing number of labour has no significant impact on production under irrigated agriculture in Kurunegala. However, labour has a significant and positive elasticity under rainfed condition in Kegalle district and minor irrigation cultivation in Kurunegala district during Maha season. The scarcity of labour in Kegalle district was observed during the field survey, which might indicates the potential of mechanization in paddy cultivation.

The relationship with fertilizer use, the key material cost of paddy cultivation (over 45% of total material cost) shows a negative co-efficient under major and minor irrigation condition (but non significant) during Maha season. The finding indicates that the further increase of fertilizer application has no impact on production in these areas. However, the finding from rainfed areas shows a positive coefficient (non significant) with fertilizer usage.

Table No. 3.11: Maximum Likelihood Estimates for Parameters of the Stochastic frontier Production Function for Paddy Cultivation in Kurunegala and Kegalle District during Maha 2000/2001

Variables	KURUNEGALA DISTRICT						KEGALLE	
	Major irrigation		Minor irrigation		Rainfed		Rainfed	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Intercept	1.5848	*1.6220	15.1352	***11.9246	-2.9924	**-2.5687	-0.2634	-0.2174
Land (ac)	0.5689	***3.0189	1.9227	***13.5634	-0.3697	*-2.0542	0.0851	0.4457
Labour (Man days)	0.0367	0.1110	0.1422	1.4558	0.8553	***3.0278	0.5825	***3.1042
Seed (Rs.)	-0.1498	-1.1056	-0.5835	***-9.6346	-0.0158	-0.2362	0.1724	1.2864
Fertilizer (Rs.)	-0.1043	-0.9466	-0.5454	-1.1745	0.1837	0.8820	0.0910	0.8736
Agro-chemicals (Rs)	0.1224	*2.1001	-0.0860	-1.5043	-0.0299	-0.4103		
Power (Rs.)	0.4949	1.5702	-0.3161	***-3.7921	0.3698	***3.87149	0.1001	1.5710
Sigma squared	**0.2615**	***3.8774	**0.5270**	***5.5271	**0.2152**	***3.8991	**0.2262**	***2.6835**

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

Table No. 3.12: Maximum Likelihood estimates for parameters of the stochastic frontier production function for paddy cultivation in Kurunegala and Kegalle District during Yala 2001

Variables	KURUNEGALA DISTRICT						KEGALLE	
	Major irrigation		Minor irrigation		Rainfed		Rainfed	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Intercept	2.3625	**2.3899	-3.3062	***-2.6964	-7.9347	-4.1263	1.33053	0.7659
Land (ac)	0.5775	1.0899	0.0320	0.1723	-0.7717	-2.5296	0.3347	1.1677
Labour (Mandays)	0.1841	0.2207	0.1988	1.1558	2.0259	8.0345	0.2504	0.9344
Seed (Rs.)	0.0660	0.0790	0.5653	***3.6535	-0.4997	-2.1502	0.1159	1.1568
Fertilizer (Rs.)	0.0090	0.0133	-0.0427	-0.3035	0.1304	1.0470	0.1521	1.2748
Agro-chemicals	0.0750	0.4787	0.0358	0.5465	0.2981	2.6865		
Power (Rs.)	0.0873	0.1096	0.3828	***2.8372	-0.5173	-0.9300	0.0149	0.1094
Sigma squared	**0.0580**	**0.4581**	**0.3161**	**2.1789	**0.6567**	**3.1161**	**1.0661**	**1.1260**

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

The factors influencing the technical inefficiencies were analyzed using the model specified by Battese and Coelli (1995). Age of farmers (years), experience of farmers (years), occupation (full time/part time farmers, dummy) and education level (dummy variable) were taken as causing variation in technical inefficiency. The results are given in table 3.13 and 3.14.

Age co-efficient in minor irrigation during Maha season is positive and significant, which indicates that younger farmers are more efficient than older ones. Negative and significant co-efficient among minor irrigation farmers of Kurunegala district with education and occupation (part time/full time) in Maha season indicates that increasing education and experience has led to higher efficiency. When farmers are full time farmers, they devote more time on cultivation, which led to increased farm efficiency. However, findings from Yala season data (Table 3.14) indicate a low level of association between these variables (age, experience, occupation) and their technical efficiency.

Table 3.13: Results of the Inefficiency Model Obtained from Cobb-Douglas Model, Maha 2000/01.

Variables	KURUNEGALA DISTRICT						KEGALLE	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Age (years)	0.2316	0.5900	2.1769	*** 4.9045	-0.7219	-1.5508	0.1984	0.6153
Experience (years)	0.0205	0.0724	-0.7228	*** -3.6266	0.4523	1.2645	-0.1556	-0.8035
Education (dummy)	1.5215	**2.2816	-2.7048	*** -3.4692	-0.0246	-0.0444	-0.5002	-1.6082
Occupation (dummy)	0.4552	0.7716	-0.4667	-1.3224	0.0945	0.2015	-0.1866	-0.6482

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

Table 3.14: Results of the Inefficiency Model Obtained from Cobb-Douglas Model, Yala 2001.

Variables	KURUNEGALA DISTRICT						KEGALLE	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Age (years)	0.0511	0.0922	0.6214	0.6731	-0.1936	-0.3311	-0.9372	-0.5622
Experience (years)	-0.0618	-0.1383	-0.1283	-0.7692	0.2750	0.3814	0.2609	0.4286
Education (dummy)	0.0138	0.0144	4.4530	*1.9056	-0.0053	-0.0062	-1.1591	-0.9726
Occupation (dummy)	0.0126	0.0134	3.5961	1.5193	-0.3629	-0.4503	-0.8304	-0.8197

*** Significant at 1% level, ** Significant at 5% level, * Significant at 10% level

CHAPTER FOUR

INSTITUTIONAL ASPECTS OF PADDY CULTIVATION

4.1 Farm Support Services

This section deals with various farm support services such as purchased inputs, irrigation water, extension system, credit and marketing system etc that influenced the present paddy production process and productivity.

4.1.1 Purchased Inputs

Purchased inputs of paddy production include chemical fertilizers, agro-chemicals and seed paddy which are integral components of green revolution technology.

(a) Seed Paddy

Use of New Improved Varieties (NIVs) was the main reason for the success in paddy grain production programme. The findings of the study reveals that almost 100% of the farmers use NIVs for paddy cultivation irrespective of water regimes. Over 65% of farmers in minor irrigation and rainfed cultivation and 50% of farmers in major irrigation system obtain seed paddy from private farmers or use their own seed stock (Table 5.1 and 5.2), while the rest of the farmers obtain seeds from private traders, Agrarian Development Centres and Co-operatives. One of the important sources of seed paddy for Ridi Bendi Ela (major irrigation) farmers was from Farmer Company established in the scheme recently by the Irrigation Management Division (IMD) of Ministry of Irrigation and Power. The findings also indicates that, the role of government departments like Department of Agrarian Services and Department of Agriculture is considerably higher in rainfed areas in regard to seed paddy supply compared to irrigated areas.

In depth analysis on use of seed paddy from neighbouring farmers and farmers' own paddy field reveal that, most of these high yielding seed have not being replaced for many years. However, it is recommended by Department of Agriculture to renew the seed paddy with certified seed preferably every season or at least once in 4-5 seasons in order to maintain the seed quality. Otherwise poor quality seeds would lead to low levels of yield. The main reasons for the use of poor quality seed were the unawareness among the farmers about the repercussions of the use of uncertified seed for a longer period, higher price of certified seed paddy and difficulties in obtaining certified seed at the required time and right quantity.

Table 4.1 Source of Seed Paddy – Yala 2001

Source	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No. of respondents	%	No. of respondents	%	No. of respondents	%	No. of respondents	%
Own seed	10	25	14	35	9	24	41	46
Neighbour farmers	13	32.5	14	35	17	46	26	29
Private traders	1	2.5	5	12.5	2	5.5	2	2
Agrarian Development Centre	1	2.5	2	5	6	16	14	16
Department of agriculture	1	2.5	3	7.5	2	5.5	5	5.5
Land lord	-	-	1	2.5	1	3	1	1
Co-operative	1	2.5	1	2.5	-	-	-	-
Farmer company	13	32.5	-	-	-	-	-	-

Source: HARTI Survey

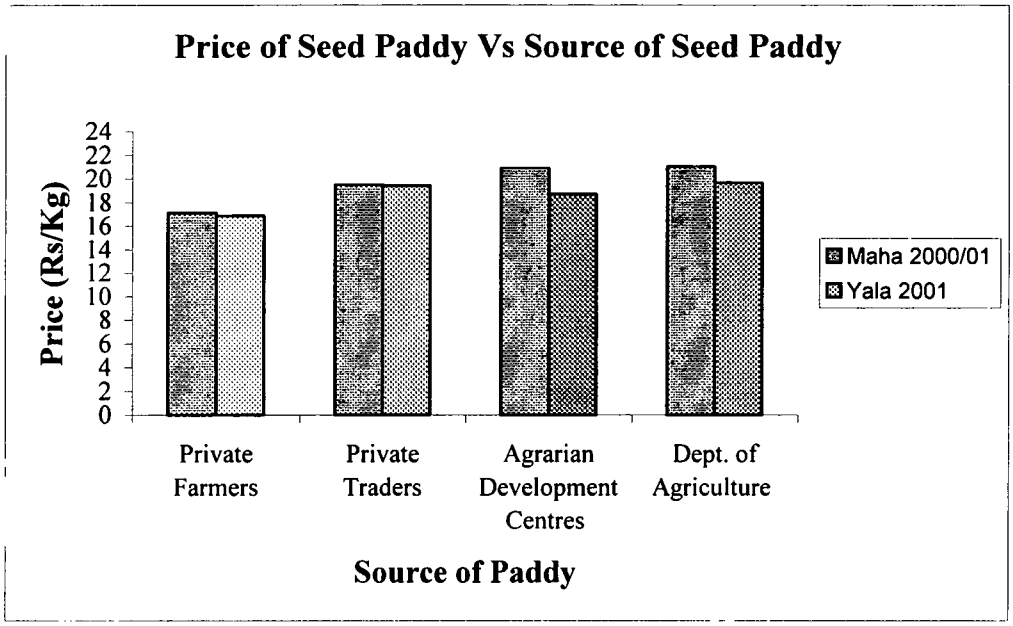
Table 4.2: Sources of Seed Paddy -Maha 2000/01

Source	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No. of respondents	%	No. of respondents	%	No. of respondents	%	No. of respondents	%
Own seed	7	17.5	9	22.5	3	8	45	52.5
Private farmers	13	32.5	17	42.5	13	34	18	21
Private traders	2	5	5	12.5	5	13	2	2
Dept. of agriculture	3	7.5	3	7.5	8	21	4	4.5
Agrarian Development Centre	-	-	4	10	9	24	15	17.5
Land lord	-	-	1	2.5	-	-	1	1
Co-operative	-	-	1	2.5	-	-	1	1
Farmer company	15	37.5	-	-	-	-	-	-

Source: HARTI Survey 2001

Figure 4.1 illustrates the average price of seed paddy among different sources during Maha and Yala season. According to the information, the cheapest source of seed paddy is from private traders, where quality of seed is not assured. The overall seed paddy price is comparatively higher in rainfed areas mainly due to poor infrastructure and transport cost.

Figure 4.1 Price of Seed Paddy Vs Source of Seed Paddy



(b) Fertilizers

Application of correct amount of fertilizers is most convenient and simplest method of increasing yield. Therefore, availability of proper fertilizer at the correct time is very important aspect in increasing the productivity of paddy. Table 5.3 and 5.4 describes the main sources of fertilizer during Yala 2001 and Maha 2000/01 respectively in the study locations. The findings show that, private traders are the major source of fertilizer for farmers in the minor irrigation schemes. In Ridi Bendi Ela (major irrigation), the bulk of the fertilizer was handled by the Farmer Company, while the Agrarian Development Centres and co-operatives were the major suppliers of fertilizer in rainfed areas.

Majority of the sample farmers (95%) in major and minor irrigations systems, and farmers in rainfed areas in Kurunegala district declare that they have no difficulties in obtaining required amount and type of fertilizer at right time. However, 31% of rainfed farmers in Kegalle district stated that, they have experienced problems in obtaining required amounts and quality of fertilizers at right time and at reasonable price.

Table 4.3 Sources of Fertilizer – Yala 2001

Source	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No. of Respondents	%	No. of Respondents	%	No. of Respondents	%	No. of Respondents	%
Private Traders	17	42.5	32	80	12	32.5	38	43
Farmer Company	19	47.5	-	-	-	-	-	-
Agrarian Development Centre	-	-	5	12.5	12	32.5	47	47
Farmer Organization	04	10	-	-	1	2.5	1	1
Co-operatives	-	-	3	7.5	12	32.5	8	9

Source: HARTI Survey 2001

Table 4.4 Sources of Fertilizer – Maha 2000/01

Source	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No. of Respondents	%	No. of Respondents	%	No. of Respondents	%	No. of Respondents	%
Private Traders	18	45	34	85	11	29	35	41
Farmer Company	17	42.5	-	-	-	-	-	-
Farmer Organization	5	12.5	-	-	1	2.5	1	1
Agrarian Development Centre	-	-	2	5	13	34	40	46.5
Co-operatives	-	-	4	10	12	31.5	10	11.5

Source: HARTI Survey 2001

(c) Agro-chemicals

The study findings reveal that private traders were the major source of agro-chemicals in all locations except in rainfed areas of Kurunegala. Farmer Company in Ridi Bendi Ela also performs an equal role as private traders in supplying agro-chemicals. However, 57% of farmers in the sample rainfed areas of Kurunegala district declare that, their major agro-chemical sources are co-operatives and Agrarian Development Centres.

About 95% of farmers in major irrigation (Ridi-bendi-ela), minor irrigation and rainfed areas of Kurunegala revealed that they have not experienced difficulties in regard to

availability of agro-chemicals. Nevertheless, farmers in rainfed areas of Kegalle stated that, they had various problems in obtaining agro-chemicals as previously described in supply of fertilizer.

4.1.2 Non-purchased Inputs

(a) Extension

Agriculture education and awareness creation plays an important role in reducing existing yield gap between research yield and farmers yield and also minimize the yield differences between farmers at various efficiency levels. However, over 50% of sample farmers in all locations were not satisfied with the existing extension and knowledge creation system (Table 4.5). Inefficiency in the present extension system and lack of enthusiasm among extension officers was the major reason given by about 70% of farmers for their dissatisfaction on present extension system (Table 4.6).

Table 4.5 Degree of Farmers Satisfaction on Present Agriculture Extension Services

Level of Satisfaction	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No	%	No	%	No	%	No	%
Not Satisfied	23	57.5	29	72.5	19	50.0	50	55.6
Satisfied	17	42.5	11	27.5	18	47.4	40	44.4
Undecided	0	0.0	0	0.0	1	2.6	0	0.0
TOTAL	**40**	**100.0**	**40**	**100.0**	**38**	**100.0**	**90**	**100.0**

Source: HARTI Survey 2001

Table 4.6 Reasons for the un-satisfaction over present agricultural extension system (As perceived by farmers)

Reason	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	N = 23		N = 29		N = 19		N = 50	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No	%	No	%	No	%	No	%
1. Lack of efficiency/enthusiasm among extension officers	16	69.6	23	79.3	14	73.7	37	74.0
2. Lack of proper relationship between officials and farmers	6	26.1	4	13.8	2	10.5	10	20.0
3. Inadequacy of knowledge among extension officers.	2	8.7	3	10.3	3	15.8	6	12.0
4. Lack of awareness among farmers about present extension services.	1	4.3	3	10.3	2	10.5	4	8.0

Source: HARTI Survey 2001

There are mainly two sets of officers attached to present agricultural extension system, namely Agricultural Instructors (AI) and Agricultural Research and Productivity Assistants (ARPA). The area covered by AIs, who are the trained agricultural extension officers is extensive and therefore it is practically not possible for them to approach each

farmer individually. About 60-80% of farmers declare that, extension officers (AI) have never visited their fields during the last Maha and Yala seasons. The number of visits made by extension officers during Maha 2000/01 and Yala 2001 is given in table 4.7 and 4.8. The study team realized that, the level of necessary knowledge of the grass root level extension-linking officers such as ARPA is very low.

Also since ARPA are under the supervision of Divisional Officers (DO), AIs have difficulties in utilizing the ARPA cadres for grass root level extension work. Poor knowledge level of ARPA in the relevant subject and their lack of capacity and the low level of recognition given to them in the present village set up are main constraints of the present extension system. The farmers reflected this situation by stating their lack of confidence in ARPA cadres for agricultural extension work.

One of the major problems of present extension services is obtaining correct guidance for pest and disease management. Farmers were questioned about their ways of obtaining advices on pest and diseases control during the past season. The results are shown in table 4.9. The findings indicate that majority of the farmers who have obtained advices for pest and diseases management have relied on agro-chemical traders, neighbouring farmers and farmer organizations. However, over 50% of sample farmers have not received any advice on pest and diseases control and have used their own experiences.

Table 4.7 Frequency of visits made by the Extension Officers to the farmers' field - Maha 2000/01

Frequency of Visits	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
No visits	24	60.0	28	70.0	23	60.5	60	66.7
Once in the season	8	20.0	3	7.5	7	18.4	5	5.6
Twice in the season	5	12.5	2	5.0	6	15.8	12	13.3
Thrice in the season	2	5.0	2	5.0	1	2.6	4	4.4
Four times in the season	0	0.0	3	7.5	0	0.0	0	0.0
More than 4 times	1	2.5	2	5.0	1	2.6	9	10.0
TOTAL	**40**	**100.0**	**40**	**100.0**	**38**	**100.0**	**90**	**100.0**

Source: HARTI Survey 2001

Table 4.8 Frequency of visits made by the Extension Officers to the farmers field - Yala 2001

Frequency of Visits	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
Not visits	32	80.0	29	72.5	25	65.8	60	66.7
Once in the season	1	2.5	2	5.0	5	13.2	5	5.6
Twice in the season	3	7.5	2	5.0	5	13.2	9	10.0
Thrice in the season	2	5.0	6	15.0	2	5.3	9	10.0
Four times in the season	0	0.0	1	2.5	1	2.6	2	2.2
More than 4 times	2	5.0	0	0.0	0	0.0	5	5.6
TOTAL	**40**	**100.0**	**40**	**100.0**	**38**	**100.0**	**90**	**100.0**

Source: HARTI Survey 2001

Table No. 4.9: Source of Information for Pest and Disease Control - Yala 2001

	KURUNEGALA						KEGALLE	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	N = 15		N = 16		N = 16		N = 36	
	No.	%	No.	%	No.	%	No.	%
AI	6	40	9	50	8	50	27	75
ARPA	6	40	3	19	6	37	13	36
Neighbours	2	13	3	19	2	13	2	6
Traders	4	27	6	38	5	31	5	14
FOs	2	13	2	12	1	6	2	6

* Some farmers have given multiple responses on sources of information

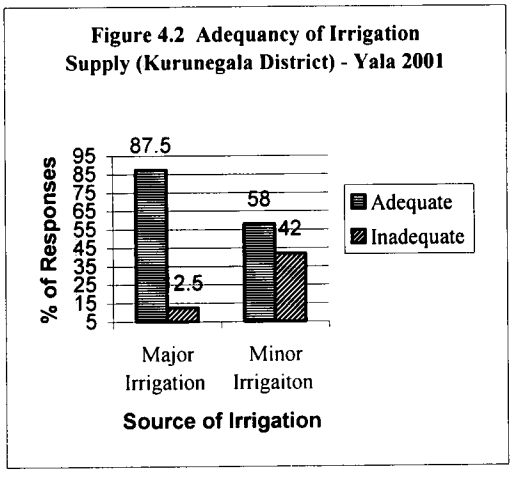
Source: HARTI Survey 2001

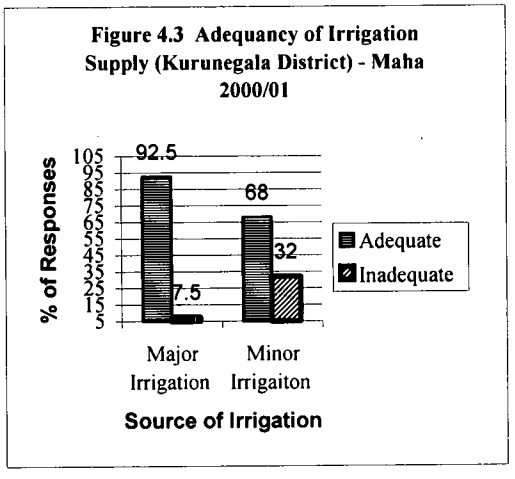
(b) Irrigation / Water

As other inputs, water is also a crucially important factor to maintain high level of yield for high breed paddy. Under the irrigated agriculture, issue of sufficient amount of water at the later stage of cultivation of paddy is sometimes not issued due to scarcity of water. However, supply of sufficient water during maturing phase is critically important to maintain high level of yield. The low level of irrigation supply at the maturing phases of the season was common in minor irrigation schemes, especially during Yala season.

Figure 4.2 and 4.3 illustrates the percentage of farmers who received the inadequate water supply during Maha 2000/01 and 2001 Yala season respectively. According to the findings, about 42% and 32% of farmers in the minor irrigation schemes have received inadequate supply of irrigation water during Yala 2001 and Maha 2000/01 respectively. The study team made an attempt to analyze the impact of inadequate water supply on the yield during the respective seasons.

Farmers' perception on impact of inadequate water issues on yield reduction clearly indicates that yield reduction due to water shortage is comparatively higher in minor irrigation system during both Maha and Yala seasons. 47% and 25% of farmers in minor irrigated condition in Kurunegala district perceived that, they have experienced a yield reduction due to inadequate water issues during Yala and Maha respectively.





Irrigation water management is mainly handled by the farmer company in the major irrigation scheme (Ridibendiela) and by Farmer Organization (FO) in minor irrigation schemes. The sample farmers were asked, who should handle the irrigation management activities at distributory level in order to increase the efficiency of irrigation management from the present level. According to the farmers perception, 25% of the farmers in major irrigation and 13% of farmers in minor irrigation believe that, irrigation management task should be handed over to the relevant government institution in order to increase efficiency. The details of the findings are given in table no. 4.11.

Table No. 4.11 Appropriate institution to manage irrigation water at distributory channel level (As perceived by farmers in Kurunegala district)

Name of Institution	Major Irrigation		Minor Irrigation	
	No.	%	No.	%
Farmer Company	30	75	-	-
Dept. of Irrigation	10	25	-	-
Farmer Organization	-	-	33	87
Dept. of Agrarian Services	-	-	05	13
Total	**40**	**100**	**38**	**100**

Source: HARTI Survey 2001

(c) Credit

As discussed earlier, credit has strong linkages with the use of green revolution technologies, since they rely heavily on purchased inputs. The survey findings indicate that, 75-80% of farmers in Rainfed cultivation areas, 60% of minor irrigation and major irrigation farmers belong to the annual income category of less than Rs. 180,000. The existing income level elaborates the subsistence nature of the farmers who engaged in paddy cultivation and also their necessity of credit. During the Maha 2000/01 season, 72% of major irrigation farmers, 32% of minor irrigation farmers, 37% of rainfed farmers in Kurunegala and 16% of rainfed farmers in Kegalle have obtained agricultural credit. Moreover, majority of the farmers who have obtained credit have done so by borrowing from informal and semiformal credit sources. Only 17-35% of farmers have received their loan from formal credit sources (Government and private banks).

There are various constraints in obtaining agricultural credit as perceived by farmers in various water regimes. The major constraints are listed below;

1. Difficulties in obtaining loan at required time.
2. High level of interest rate.
3. Problems in findings guarantors to obtain credit from formal sources.
4. Long processing time taken by formal credit sources.
5. Credit given is not sufficient to do paddy cultivation.
6. Credit in kind given by government authorities is some times not matching with the farmers' requirement in the given time. Eg: Fertilizer

4.1.3 Other Support Services

(a) Agricultural Marketing

Marketing is an important aspect in paddy production, especially in the irrigated condition. Farmers' knowledge on various aspect of the marketing was tested. The results are given in table 5.12. According to these findings, knowledge on wholesale price of paddy was poor among majority of the farmers irrespective of water regimes. Only 17-26% of farmers have sufficient knowledge on wholesale price of paddy. It should to be noted that, only about 22% of farmers in rainfed areas of Kegalle district have sufficient knowledge in various aspects of market information, which are listed in the table No.4.12. However, farmers must have the sufficient knowledge on these aspects in order to increase their income level.

The study findings reveals that, as paddy crop is cultivated on full extent of land in major irrigation schemes during both Maha & Yala season, marketing aspect is important for all farmers in major irrigation systems. However, in rainfed cultivation, only about 12-14% of farmers have marketable surplus of paddy during Yala season. The table No.4.13 provides the details on numbers of farmers marketed their paddy production during Maha & Yala season.

Table No. 4.12 Farmers Knowledge on Selected Aspects of Market Information of Paddy

Type of market information/level of knowledge	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
1. Consumer Preference on Rice								
No knowledge	8	20	5	12.5	9	24.0	24	27.0
Some knowledge	19	47.5	20	50.0	20	52.0	48	53.0
Sufficient knowledge	13	32.5	15	37.5	9	24.0	18	20.0
2. Wholesale Price of Rice								
No knowledge	17	42.5	17	42.5	16	42.0	51	57.0
Some knowledge	16	40.0	14	35.0	12	32.0	21	23.0
Sufficient knowledge	7	17.5	9	22.5	10	26.0	18	20.0
3. Knowledge on various marketing channels and the purchase price of paddy								
No knowledge	1	2.5	4	10.0	16	16.0	49	55
Some knowledge	16	40	17	42.5	18	47.0	21	23
Sufficient knowledge	23	57.5	19	47.5	14	37.0	20	22

Source: HARTI Survey 2001

Table No. 4.13 Production of Surplus Paddy for Marketing (Number of farmers)

Category of Farmers	Maha 2000/01		Yala 2001	
	No.	%	No.	%
Major Irrigation (Kurunegala)	40	100	40	100
Minor Irrigation (Kurunegala)	31	82	28	73
Rainfed (Kurunegala)	24	60	3	12.5
Rainfed (Kegalle)	30	33	13	14

Source: HARTI Survey 2001

Table 4.14 and 4.15 shows the quantity of surplus paddy produced by farmers under different water regimes in Maha and Yala seasons respectively. According to these findings, over 50% of farmers in major irrigation scheme have more than 100 kg marketable surplus in both seasons. Under rainfed cultivation, the majority of the farmers, who produced marketable surplus, have less than 40 kg of surplus paddy.

Table No. 4.14: Quantity of Surplus Paddy Production – Maha 2000/01

Quantity (kg)	KURUNEGALA DISTRICT (Number Of Farmers)						KEGALLE DISTRICT (Number Of Farmers)	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
No surplus	0	0	9	22.5	13	35.1	55	64
01-20	1	2.5	5	12.5	5	13.5	12	14
21-40	4	10	3	7.5	9	24.3	12	14
41-60	5	12.5	6	15.0	6	16.2	3	3.5
61-100	9	22.5	6	15.0	3	8.1	3	3.5
> 101	21	52.5	11	27.5	1	2.7	1	1.0

Source: HARTI Survey 2001

Table No. 4.15 Quantity of Surplus Paddy Production – Yala 2001

Quantity (kg)	KURUNEGALA DISTRICT (Number of Farmers)						KEGALLE DISTRICT (Number of Farmers)	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
No surplus	0	0	10	25	32	86.5	77	86
01-20	0	0	4	10	2	5	7	8
21-40	3	7.5	3	7.5	2	5	3	3
41-60	2	5.0	4	10	0	0	2	2
61-100	10	25.0	6	15	1	3	0	0
> 101	25	62.5	13	32.5	0	0	1	1

Source: HARTI Survey 2001

Farmers mostly sell their paddy to the private traders, especially to the paddy collectors living within the village. Rice millers are the major paddy purchasers in minor irrigation schemes in Kurunegala district. It is interesting to note that; no one has marketed their paddy to CWE or co-operatives during Maha 2000/01 at any of the study locations. During Yala 2001, only 4 farmers (9% of total major irrigation farmers) have chosen CWE/co-operative as their surplus paddy buyer. Table 4.16 and 4.17 describes the status of paddy purchasing by various purchasers during Maha 2000/01 and Yala 2001 respectively.

Table No. 4.16 Main Paddy Purchasers – Yala 2001

Paddy Purchaser	KURUNEGALA						KEGALLE	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
Collectors within the village	21	49	5	33	3	100	2	50
Collectors outside the village	7	16	1	7	0	0	0	0
Rice millers	7	16	7	47	0	0	0	0
CWE	3	7	0	0	0	0	0	0
Co-operative	1	2	0	0	0	0	0	0
Farmer Organization	0	0	0	0	0	0	0	0
Neighbours (for household consumption)	4	9	2	13	0	0	2	50

Source: HARTI Survey 2001

Table No. 4.17 Main Paddy Purchaser – Maha 2000/01

Paddy Purchaser	Kurunegala						Kegalle	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
Collectors within the village	20	50	15	48	8	40	15	50
Collectors outside the village	7	17.5	0	0	6	30	8	26
Rice millers	10	25	11	35	6	30	2	7
CWE	0	0	0	0	0	0	0	0
Co-operative	0	0	0	0	0	0	0	0
Farmer Organization	1	2.5	0	0	0	0	0	0
Neighbours (for household consumption)	2	5	5	16	0	0	5	17

Source: HARTI Survey 2001

The reasons for choosing private traders as the main paddy purchaser are given in table 4.18 & 4.19. The major reasons given were, payment of higher price by private traders, provision of transport from farm gate and cultivation loan obtained at the beginning of the season from same private traders.

Table No. 4.18 Reasons for selecting Private Traders to Sell Surplus Paddy, during Yala 2001

Reason	Kurunegala						Kegalle	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	N = 35		N = 13		N = 3		N= 2	
	No.	%	No.	%	No.	%	No.	%
Payment of higher price	24	68.6	8	61.5	2	66.7	0	0.0
Conditional loans borrowed for cultivation	5	14.3	2	15.4	0	0.0	0	0.0
Provision of transport	0	0.0	1	7.7	0	0.0	1	50.0
Paying ready cash	2	5.7	1	7.7	0	0.0	1	50.0
Less quality controlling	2	5.7	0	0.0	0	0.0	0	0.0
Closeness to the farm gate	1	2.9	1	7.7	1	33.3	0	0.0
Better relationship with private traders	1	2.9	0	0.0	0	0.0	0	0.0

Note: N denotes number of farmers sold their paddy to private traders

Table No. 4.19 Reasons for selecting Private Traders to Sell Surplus Paddy, during Maha 2001

Reason	KURUNEGALA						KEGALLE	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	N = 37		N = 26		N = 20		N= 25	
	No.	%	No.	%	No.	%	No.	%
Payment of higher price	22	59.5	13	50.0	10	50.0	8	32.0
Conditional loans borrowed for cultivation	5	13.5	5	19.2	0	0.0	2	8.0
Provision of transport	1	2.7	1	3.8	2	10.0	4	16.0
Less quality controlling	5	13.5	0	0.0	0	0.0	0	0.0
Closeness to the farm gate	1	2.7	4	15.4	3	15.0	6	24.0
Better relationship with private traders	1	2.7	0	0.0	4	20.0	4	16.0

Note: N denotes number of sold their paddy to private traders.

The major difficulties faced by the farmers in major irrigation schemes in marketing of surplus paddy were expectation of high quality standards of paddy by the purchasers and lack of transport facilities. The problem experienced by minor irrigation farmers in selling their paddy is lack of proper marketing channels. The rainfed farmers encounter problems of malpractices in weighing of paddy, maintenance of high quality standard of paddy and non-payment of ready cash for the sold paddy stock. However, about 25%, 50% and 15-30% of farmers in major irrigation, minor irrigation and rainfed cultivation respectively were willing to stock the surplus paddy (fully or partially) in order to seek higher price during off seasons.

4.2 Role of Institutions in Providing Farm Support Services

4.2.1 Public Institutions

There are number of public institutions involved in providing farm support services in the study area at varying levels of effectiveness and efficiency. State Banks, Agrarian Development Centres, Agricultural Development Authority, Samurdhi Secretariat and Government Farms are a few of them. Among the sample areas, the role of government institutions was very prominent in rainfed areas, where functions of private organizations were very minimal due to poor infrastructure and subsistent nature of the production. Agricultural Development Authority has given loans and subsidies in order to construct agro-wells and also to install micro-irrigation equipment. Samurdhi Secretariat has provided loans to poor farmers to do the cultivation and to start rice-processing industries.

Although, there are number of state institutions involved in providing farm support services, farmers were not satisfied with the reliability and timeliness of the services provided by them. In addition, long procedural delays and malpractices in government institutions were other major problems perceived by farmers.

4.2.2 Private Institutions

Role of private institutions in providing farm support services was prominently observed in major irrigation areas. Private sector institutions and private traders largely handled the supply of credit, seed paddy, fertilizers and agro-chemicals. Private sector also provides necessary instructions and advices for farmers regarding crop management. Wayamba Seed Company and CIC are two private institutions involved in seed paddy production in Ridi Bendi Ela area.

4.2.3 Farmer Organization

Farmer Organizations (FOs) exist in all sample locations where a majority of the farmers were members of the FOs. Farmers' mainly contribute to FOs by providing their labour for volunteer works (Shramadhana). However, the provision of cash and materials for the organizational activities were comparatively low. The main reason for the situation as explained by farmers was lack of financial transparency in the FOs.

Farmers were asked about the services provided by FOs for their agricultural activities. The results are depicted in Table 4.20. The major activities of FOs in all locations were organizing Shramadhana works, supply of agricultural inputs (fertilizers and agro-chemicals) and help to obtain the cultivation loans from Agrarian Development Centres. Nevertheless majority of the farmers were not satisfied with the performance of FOs activities except in Ridibendiela (major irrigation) (Table 4.21). At the meantime FOs leadership explained that, majority of their members are passive members.

Table No. 4.20 Type of Services Provided by FOs

Services	KURUNEGALA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
Organizing Shramadana works	26	67	22	59	9	32	25	33
Supply of Agric. Inputs	16	41	9	24	12	43	26	34
Assisting to obtain loans from ASC	9	23	4	11	11	39	3	4
Managing the water distribution among farmers	0	0	21	57	0	0	0	0
Preparing a cropping calendar	1	2.5	7	19	10	36	2	3
Farmers' conflict resolution	4	10	0	0	1	3.5	5	6.5
No services	5	13	4	11	0	0	27	36

Source : HARTI Survey 2001

Table No. 4.21 Farmers' Satisfaction on FOs Activities

	KURUNEGLA DISTRICT						KEGALLE DISTRICT	
	Major Irrigation		Minor Irrigation		Rainfed		Rainfed	
	No.	%	No.	%	No.	%	No.	%
Satisfied	33	85	17	42.5	17	49	30	36
Not satisfied	6	15	23	57.5	18	51	54	64
Total	**39**	**100**	**40**	**100**	**35**	**100**	**84**	**100**

Source: HARTI Survey 2001

CHAPTER FIVE

CONCLUSIONS AND POLICY IMPLICATIONS

1. The average yield per hectare in major irrigation, minor irrigation and rainfed condition in Kurunegala district during Maha 2000/01 was 4.6mt, 3.2mt and 3.7mt respectively, while in the Kegalle district under rainfed conditions the yield was 2.9mt/ha. Therefore, the yield obtained from major irrigation areas is about 30 percent higher than minor irrigation and over 100 percent higher than rainfed farming. The yield obtained from various water regime conditions indicates that, there are significant yield gaps exist between actual yield and the yield achieved under Yaya demonstration programmme implemented by Department of Agriculture. The Yaya block demonstration programme has given the yield level of over 7.6mt/ha on average dry zone condition under major and minor irrigation. It was around 6mt/ha under rainfed condition during Maha. Therefore, there is a strong possibility of increasing national average paddy yield significantly, by expanding and promoting the Yaya programme national wide.

2. In paddy cultivation cash cost represents about 50 percent of the total cost on average. However the rate is over 60 percent in major irrigation areas because of high wage rate and high level of fertilizer application. Labour and material cost contributes nearly 80 percent to of the cash cost. When total cost, which includes both cash, and imputed cost for family labour, considered labour cost is the highest cost representing 50 percent of the total cost and 40 percent of the cash cost. Labour requirement for cultivation per acre varies from 38 to 60 man-days depending on the farming practices. Use of labour is high when the exchange labour is used because of low productivity. On average labour requirement is around 50 man-days per acre.

3. Paddy farming under rain-fed is not profitable when the imputed cost is added to the cash cost. Return to labour is lower than wage rate. Similarly, unit cost is higher than the value of unit output. Nevertheless, return to investment is profitable meaning that investing one rupee generates more than one rupee.

4. Technical efficiency values indicate that farmers in major and minor irrigation areas are more technically efficient in Yala than Maha. However, rainfed farmers are more technically efficient in Maha compared to Yala. The mean technical efficiency of Kurunegala under irrigated condition ranges from 62% to 84%. The same values in Kurunegala district under rainfed condition vary from 47% to 69%. It is 54% to 47% under rainfed situation in Kegalle district. The technical efficiency values indicate that, there is a tremendous scope for increasing technical efficiency without any addition to the present input level. For instance, present technical efficiency level of irrigation farmers could be increased by 16% to 38% without any additional cost.

5. Under the rainfed farming and minor irrigation about 57% and 47% of paddy farmers belong to the category of low efficiency, where as, the figure for major irrigation is only 15 percent. Average yield per acre is about 110 bushels for high efficiency farmers compared to 55 bushels for low efficiency farmers under major irrigation. However, there is not much of a variation in the cost of production.

6. Regression analysis shows that further increase in fertilizer usage has no impact on production in irrigated areas. The findings also show that there is an imbalance in fertilizer application specially irrigated farmers use more area than other fertilizers. Farmers' adoption of straight fertilizers is very minimal in all locations, although it was introduced to increase the fertilizer use efficiency and productivity.

6. Age, farming experience and level of education are major factors contributing to inefficiency among farmers in minor irrigation. Therefore skills, knowledge, entrepreneurship of the farmers need to be enhanced through awareness creation and demonstration in order to improve the farming efficiency.

7. Farmers mainly use seed paddy produced from their own paddy field or neighbouring farmers mainly due to higher price and difficulties encountered in obtaining certified seed at required quantity and required time. The major drawback in use of seed paddy in the current context is non-replacement of seed paddy by certified seed at least once in 4-5 seasons. This has been one of the reasons for low level of productivity in paddy production, especially in rainfed areas.

8. The major source of fertilizer and agro-chemicals for the farmers in major irrigation areas was private traders, but the state institution like Agrarian Development Centres was the major source for the farmers in poorly developed rainfed areas. Problems in regard to supply of fertilizer and agro-chemicals (quantity and quality) were experienced by rainfed farmers, which implicate the inefficiency of fertilizer and agro-chemical supply by state institutions.

9. Above 50% of sample farmers in all study locations were not satisfied with the present extension system. Lack of enthusiasm and morale among trained extension officers (Agricultural Instructors), poor knowledge level of grass root level officers such as agricultural research and productivity assistants and wider field area to be covered by Agricultural Instructors were the two major reasons for the existing inefficiency of present extension system.

10. Limited irrigation water issues at the maturity phase of paddy crop in minor irrigation schemes have led to reduction in yield than expected level. The yield reduction due to water shortages was significantly higher during Yala season.

11. About 72%, 32% and 37% of farmers in major irrigation, minor irrigation and rainfed areas in Kurunegala district and 16% of rainfed farmers in Kegalle district are dependent on agricultural credit for the paddy cultivation. However, only 17-35% of farmers have obtained their loan from formal credit lenders.

12. Farmers' knowledge on wholesale paddy market was very poor irrespective of the study locations. Further, the level of knowledge on various aspects of paddy marketing was not sufficient among rainfed farmers, since they are not producing a considerable amount of marketing surplus.

Annexes

Annex I: Cost of cultivation per acre of Paddy (Major Irrigation)

District: KURUNEGALA **Season: Maha 2000/01**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	76.33			76.33
Cleaning Bunds and Canals	693.38			693.38
1st ,2nd Ploughing& Leveling	425.80	1960.62		2386.43
Plastering Bunds	809.38			809.38
Broadcasting/Transplanting	1365.08		754.77	2119.85
Weed Controlling	487.09	13.58	834.40	1335.07
Fertilizer Application	253.31		2179.17	2432.47
Pest & Diseases Controlling	210.24	136.27	1069.43	1415.94
Water Management	965.04	2.49		967.53
After Care	782.46			782.46
Harvesting	2337.34			2337.34
Threshing	1339.37	573.06		1912.43
Winnowing	516.82	203.47		720.29
Transport	150.95	170.78		321.73
TOTAL	**10412.60**	**3060.26**	**4837.77**	**18310.63**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex II

Cost of cultivation per acre of Paddy (Minor Irrigation)

District: KURUNEGALA **Season: Maha 2000/01**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	20.35			20.35
Cleaning Bunds and Canals	602.25			602.25
1st ,2nd Ploughing& Leveling	467.43	2481.06		2948.48
Plastering Bunds	758.85			758.85
Broadcasting/Transplanting	1075.28		903.22	1978.50
Weed Controlling	485.57	4.19	709.47	1199.24
Fertilizer Application	288.27		1608.80	1897.07
Pest & Diseases Controlling	314.98	130.99	681.06	1127.02
Water Management	1285.61	27.06		1312.67
After Care	899.42			899.42
Harvesting	1619.45			1619.45
Threshing	1148.42	650.88		1799.30
Winnowing	522.31	167.93		690.24
Transport	119.58	260.62		380.20
TOTAL	**9607.76**	**3722.73**	**3902.54**	**17233.04**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex III

Cost of cultivation per acre of Paddy (Rainfed)

District: KURUNEGALA **Season: Maha 2000/01**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	158.44			158.44
Cleaning Bunds and Canals	647.71			647.71
1st ,2nd Ploughing& Leveling	569.13	2957.44		3526.57
Plastering Bunds	685.12			685.12
Broadcasting/Transplanting	2547.22		866.30	3413.52
Weed Controlling	245.84	0.00	448.76	2509.47
Fertilizer Application	259.80		2263.63	2523.43
Pest & Diseases Controlling	194.01	163.94	723.32	1081.28
Water Management	966.29	0.00		966.29
After Care	944.59			944.59
Harvesting	2689.70			2689.70
Threshing	1366.43	611.17		1977.60
Winnowing	610.72	284.30		895.02
Transport	142.65	229.66		372.31
TOTAL	**12027.65**	**4246.51**	**4302.01**	**20576.17**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex IV

Cost of cultivation per acre of Paddy (Rainfed)

District: KEGALLE **Season: Maha 2000/01**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	294.12			294.12
Cleaning Bunds and Canals	588.44			588.44
1st ,2nd Ploughing& Leveling	1431.34	2033.92		3465.26
Plastering Bunds	673.20			673.20
Broadcasting/Transplanting	2612.86		689.80	3302.66
Weed Controlling	404.56	0.02	203.16	2147.54
Fertilizer Application	270.37		1742.96	2013.33
Pest & Diseases Controlling	98.64	72.05	200.67	371.36
Water Management	741.70	0.00		741.70
After Care	976.46			976.46
Harvesting	2711.88			2711.88
Threshing	1316.05	739.05		2055.10
Winnowing	723.86	75.65		799.51
Transport	231.91	155.12		387.04
TOTAL	**13075.38**	**3075.81**	**2836.60**	**18987.79**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex V

Cost of cultivation per acre of Paddy (Major Irrigation)

District: KURUNEGALA **Season: Yala 2001**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	44.25			44.25
Cleaning Bunds and Canals	635.41			635.41
1st, 2nd Ploughing& Leveling	381.23	2204.74		2585.97
Plastering Bunds	820.56			820.56
Broadcasting/Transplanting	1137.90		741.02	1878.92
Weed Controlling	568.40	9.47	868.61	1446.49
Fertilizer Application	240.79		2264.45	2505.24
Pest & Diseases Controlling	194.95	147.45	1111.92	1454.32
Water Management	1022.49	2.96		1025.45
After Care	820.39			820.39
Harvesting	2469.32			2469.32
Threshing	1410.54	661.76		2072.30
Winnowing	622.59	228.88		851.47
Transport	221.52	224.93		446.45
TOTAL	**10590.32**	**3480.20**	**4986.00**	**19056.53**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex VI

Cost of cultivation per acre of Paddy (Minor Irrigation)

District: KURUNEGALA **Season: Yala 2001**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	20.89			20.89
Cleaning Bunds and Canals	641.91			641.91
1st ,2nd Ploughing& Leveling	474.56	2707.91		3182.47
Plastering Bunds	768.09			768.09
Broadcasting/Transplanting	996.42		968.49	1964.91
Weed Controlling	306.94	6.51	730.48	1043.93
Fertilizer Application	325.06		1583.25	1908.30
Pest & Diseases Controlling	177.72	119.26	375.38	672.36
Water Management	1212.81	199.36		1412.17
After Care	1112.52			1112.52
Harvesting	1569.47			1569.47
Threshing	1076.45	735.33		1811.78
Winnowing	529.71	147.32		677.03
Transport	89.48	295.41		384.88
TOTAL	**9302.03**	**4211.10**	**3657.60**	**17170.72**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex VII

Cost of cultivation per acre of Paddy (Rainfed)

District: KURUNEGALA **Season: Yala 2001**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	39.48			39.48
Cleaning Bunds and Canals	557.49			557.49
1st ,2nd Ploughing& Leveling	461.26	3596.25		4057.50
Plastering Bunds	550.06			550.06
Broadcasting/Transplanting	1704.74		791.26	2496.01
Weed Controlling	188.53	0.00	405.80	2576.02
Fertilizer Application	290.28		2387.49	2677.77
Pest & Diseases Controlling	188.37	176.52	504.10	868.98
Water Management	839.54	812.29		1651.83
After Care	999.87			999.87
Harvesting	2315.16			2315.16
Threshing	1133.53	589.08		1722.61
Winnowing	560.22	237.20		797.42
Transport	173.97	173.72		347.69
TOTAL	**10002.49**	**5585.05**	**4088.65**	**19676.19**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

Annex VIII

Cost of cultivation per acre of Paddy (Rainfed)

District: KEGALLE **Season: Yala 2001**

Operations	Labour Cost Rs/ac	Machinery & Equipment Cost Rs/ac	Material Cost Rs/ac	Total Cost Rs/ac
Preparation of Nursery	257.50			257.50
Cleaning Bunds and Canals	538.96			538.96
1st ,2nd Ploughing& Leveling	1434.09	2366.30		3800.39
Plastering Bunds	697.32			697.32
Broadcasting/Transplanting	2588.65		737.34	3325.99
Weed Controlling	253.62	1.59	140.40	1997.51
Fertilizer Application	260.43		1742.30	2002.73
Pest & Diseases Controlling	95.90	76.79	246.09	418.78
Water Management	818.79	0.00		818.79
After Care	927.20			927.20
Harvesting	2687.32			2687.32
Threshing	1264.81	798.53		2063.34
Winnowing	676.05	79.93		755.98
Transport	210.54	175.04		385.58
TOTAL	**12711.17**	**3498.18**	**2866.14**	**19075.49**

Note:- Machinery and Equipment Cost

Weed controlling: Cost only for weeder

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DATE	BORROWER'S NAME & SIGNATURE	DATE RETURNED
04/05/05	Panditharatne	
03/05/08	Wijenthna Dr. Vasantha	
27/10/09	M.W.A.C.S. Wijetunga	