CHAPTER I

INTRODUCTION AND DESIGN OF THE STUDY
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1.1 INTRODUCTION

Agriculture is the mainstay of the Indian economy because of its high share in employment and livelihood creation. Almost two-third of the Indian population still relies on agriculture for employment and livelihood. It also plays vital role in international trade of our country. About 43 per cent of India’s geographical area is used for agricultural activity. Agriculture including crop and animal husbandry, fisheries, forestry and agro processing provides significant support for economic growth and social transformation of the country. In the recent years, agriculture sector has witnessed spectacular advances in the production and productivity of food grains, oilseeds, commercial crops, fruits, vegetables, poultry and dairy. Agriculture accounts for about 10 per cent of the total export earnings and provides raw material to a large number of industries. As one of the world’s largest agrarian economies, the agriculture sector in India accounted for 13.9 per cent of the GDP in 2011-12 compared to 24.7 per cent in 2000-01. Though the share of Indian agriculture in the GDP has been steadily declining, it is still the single largest contributor to the GDP and plays a vital role in the overall socio-economic development of India¹.

Agricultural marketing plays an important role not only in stimulating production and consumption but in accelerating the pace of economic development. It implies selling of goods and services by the farmers. It includes various functions viz., assembling, transportation, storing, buying, selling, standardisation, grading, processing, sales promotion, etc. Agricultural marketing leads to the optimisation of resource use and output management. An efficient marketing system can contribute to an increase in the marketable surplus by scaling down the losses arising out of the inefficient processing, storage and transportation. A well-designed system of marketing can effectively distribute the available stock of modern inputs and thereby sustain a faster rate of growth in the agricultural sector.

Food grains production in India has shown remarkable improvement in recent years. India produced around 225-230 million tonnes of different food grains every year. The production of food grains in 2011-12 was at a record high of 259.32 million tonnes. All major grains viz., paddy, wheat, maize, barley, millets including jowar (great millet), bajra (pearl millet) and ragi (finger millet) are produced in the country. The country is self sufficient in grain production. Grain processing is the biggest component in the food sector, sharing over 40% of the total value. The basic feature of the sector is the predominance of primary processing sector sharing of 96% of the total value with secondary and tertiary sectors contributing about 4% of the total value addition.

Paddy is one of the most important food crops of India and is second in importance throughout the world. It feeds more than 50 per cent of the world’s population. It is the staple food of most of the people in South-East Asia. Asia accounts for about 90 per cent of the world’s paddy production. Maximum area under paddy cultivation is in Asia. In India, it is the most preferred staple food for about 65 per cent of the population. Among the paddy growing countries, India has the largest area under cultivation (42.56 million hectares during 2010-11\(^2\)) followed by China and Bangladesh. India is second to China in terms of volume of paddy output and accounting more than 20 per cent of global production. Productivity in India is much lower than in Egypt, Japan, China, Vietnam, United States of America and Indonesia and even below the world's average. It makes up 42 per cent of India’s total food grains production and 45 per cent of the total cereals produced in the country. Paddy provides about 22 per cent of the world supplies of calories and 17 per cent of the proteins. Average paddy yield of India is 1339 kgs per hectare. It continues to play a vital role in the country’s exports constituting nearly 25 per cent of the total agricultural exports from the country.

One-third of the world’s paddy cultivation area is in India. It is grown in almost all the states of India but is mostly concentrated in the river valleys, deltas and low-lying coastal areas of north eastern and southern India. The paddy producing states are Assam, West Bengal, Bihar, Madhya Pradesh, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra, Gujarat, Uttar Pradesh and Jammu and Kashmir which together

contribute over 95 per cent of the country’s crop. Of these, West Bengal, Odisha, Andhra Pradesh, Tamil Nadu and Bihar are the major cultivators\(^3\). About 85 per cent of the country’s total paddy output is grown during the kharif season (between June and September) while the rest of the 15 per cent is cultivated during the Rabi season (between November and February).

The State Tamil Nadu is geographically located between 8°5’ and 13°35’ North latitude and between 76°14’ and 80°21’ East longitude. As a result of this geographical position, Tamil Nadu enjoys semi-arid climate, which permits higher crops productivity under irrigation. Out of 13 million hectares of geographical area, which is 3.95 per cent of total geographical area of India, the cultivable area in Tamil Nadu is around 7 million hectares and 55 per cent of which is dryland. The red soil is the dominant soil type in Tamil Nadu and both black and alluvial soils also spread over Tamil Nadu next in extent to red soils. Monsoon rainfall is the basic resource for water availability in Tamil Nadu. The dominant monsoon for rainfall is north-east monsoon (October-December) which contributes about 42 to 48 per cent to total annual rainfall of each district of Tamil Nadu.

Agriculture is the most predominant sector of the economy of Tamil Nadu and 70% of the states population is engaged in agriculture and allied activities for their livelihood. Paddy is the main staple food of the state. Paddy is the major constituent accounting for 72.99% of the total food grains production in the state. It is the principal crop extensively cultivated in all the districts of the state having a unique three-season pattern viz., Kar/Kuruvai/Sornavari (April to July), Samba/Thaladi/Pishanam (August to November) and Navarai/ Kodai (December to March). Paddy accounted for 33.2% of the total cropped area in the state during 2010-11. The leading districts in paddy production in Tamil Nadu are kancheepuram, Thiruvallur, Cuddalore, Vilupuram, Thiruvannamalai, Erode, Thiruvarur and Thanjavur.

A BRIEF PROFILE OF THE STUDY AREA

The present study is conducted in Erode district of Tamil Nadu. This district is situated in between 10°36’ and 11°58’ of North Latitude, 76°49’ and 77°58’ of the

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Eastern Latitude and situated above the Mean Sea level of 171 Meters. Erode district is bound on the east by Salem and Tiruchirapalli districts, on the west by Coimbatore district, on the south by Dindigul district and on the north by Karnataka State.

**Area, Population and Density**

Erode district is one of the most important districts in Tamil Nadu where progressive agriculture is performed on a large scale covering an area of 5,692 square kilometres. According to 2011 census, the population of the district is 22,59,608 and it accounts for 3.13% of the State’s population. The density of population is 397. Number of literate is 15,16,380. Literacy rate is 72.96%. Erode district comprises of two Revenue Divisions viz., Erode (covers Erode and Perundurai Taluks) and Gobichettipalayam (covers Gobichettipalayam, Bhavani and Sathyamangalam Taluks).

**Agricultural Development**

As per the records of District Statistics Centre, the total geographical area of the district extends to 5,72,264 hectares. Out of total area of this district, forest covers an area of 2,27,511 hectares and Cultivable land are 2,24,786 hectares. Barren land and the land which is not used for cultivation is 6,257 hectares. Land put to non-agriculture uses is 53,174 hectares.

**Climate, Rainfall and Soils**

The climate of the district is dry throughout the year except during the period from October to January. Temperature ranges between 33.70c and 19.20c. The relative humidity ranges between 40% and 89% and the average rainfall of the district is 717 mm.

The soil of the district is predominately red sandy to red grave type. This soil occurs in a large extent in Bhavani saagar area. Red loamy soil is found at the bottom of valleys in Gobichettipalayam and Sathyamangalam Taluks. Red sandy soil is found at Perundurai and Bhavani Taluks. The agricultural activity is well supported by the Bhavani River.

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Irrigation

According to the natural divisions, the sources of irrigation also vary. Canals are the most important sources of irrigation in the district. The Lower Bhavani Project, Kalingarayan canal, Thadapalli and Arakkan Kottai channels extensively irrigate the district. But, paddy is being cultivated mainly with the help of Lower Bhavani Project and other irrigation sources. The total irrigated area is 82,559.38 hectares of the total sown area. Net area sown is 1,83,300 hectares.

Transport

Roads play an important role in connecting people with trade and industrial centre of the district. Though Erode is having a Railway junction, the study area is not well connected with Railway lines.

Cropping Pattern

Erode District is predominantly agrarian in nature. Agriculture is the most important income source of this district. Paddy, Banana, Groundnut, Cotton, Turmeric, Sugarcane, Gingelly, Sunflower, Onion and Flowers are some of the important agricultural produces. Paddy is the major food grain produced in the district. Paddy is grown in 0.038 million hectares with a production of 0.156 million tonnes and the paddy productivity of the district is 4335 kgs/hec during the year 2010-11.

ORIGIN OF PADDY

Paddy botanically belongs to Oryza sativa L. of Gramineae family. Paddy is a self-pollinated crop. A complete seed of rice is called paddy and contains one rice kernel. Outer layer of rice shell is called husk. The next layer is called rice bran and the innermost part is called rice kernel. There are two most important cultivated species of paddy namely i) Oryza sativa and ii) Oryza glaberriumn. There are around 18 wild species of paddy grown in the continents of Asia, Africa and America. While Oryza sativa is grown in most parts of the Asian and American continents, Oryza glaberriumn is grown only in Africa. There are three sub-species of paddy in the world i.e. Indica (long

grain), Japonica (round grain) and Javanica (medium grain). Indica rice is grown in warm climate zone of Indo-China, India, Pakistan, Thailand, Brazil and Southern U.S.A. Japonica is mostly grown in cold climate zone of Northern China, Korea, Japan and California. The Javanica is grown in Indonesia only. Paddy is first mentioned in the Yajur Veda (1500-800 B.C.) and then is frequently referred to in Sanskrit texts.

Oryza Sativa is associated with wet, humid climate, though it is not a tropical plant. It is probably a descendent of wild grass that was most likely cultivated in the foothills of the far Eastern Himalayas. Another school of thought believes that the paddy plant may have originated in southern India, then spread to the north of the country and then onwards to China. It then arrived in Korea, the Philippines (about 2000 B.C.) and then Japan and Indonesia (about 1000 B.C.). When Alexander the Great invaded India in 327 B.C., it is believed that he took rice back to Greece. Arab travelers took it to Egypt, Morocco and Spain and that is how it travelled all across Europe. Portugal and Netherlands took rice to their colonies in West Africa and then it travelled to America through the ‘Columbian Exchange’ of natural resources. But as is traditionally known, rice is a slow starter and this is also true to the fact that it took close to two centuries after the voyages of Columbus for rice to take root in the Americas. Thereafter the journey of rice continues with the Moors taking it to Spain and then the Spanish brought rice to South America at the beginning of 17th century.

The journey of rice around the world has been slow, but once it took root it stayed and became a major agriculture and economic product for the people. In the Indian subcontinent more than a quarter of the cultivated land is given to rice. It is a very essential part of the daily meal in the southern and eastern parts of India. In the northern and central parts of the subcontinent, where wheat is frequently eaten, rice holds its own and is cooked daily as well as on festivals and special occasions.

Over thousands of years, humans have found multifarious uses of the rice plant. Many of the uses come to us as a bequest from our ancient tradition and folklore. Each and every segment and part of the rice plant has found multifarious uses in society. Indeed, rice is a wonder plant and a great gift by nature to all of humankind.
HISTORY OF PADDY IN INDIA

India is an important centre of rice cultivation. The rice is cultivated on the largest areas in India. Historians believe that while the indica variety of rice was first domesticated in the area covering the foothills of the Eastern Himalayas (i.e. north-eastern India), stretching through Burma, Thailand, Laos, Vietnam and Southern China, the japonica variety was domesticated from wild rice in southern China which was introduced to India. Perennial wild rice still grows in Assam and Nepal. It seems to have appeared around 1400 B.C. in southern India after its domestication in the northern plains. It then spread to all the fertilized alluvial plains watered by rivers. Some says that the word rice is derived from the Tamil word arisi.

SYSTEM OF RICE INTENSIFICATION

The green revolution of 1960’s was oriented towards high input usage particularly fertilisers, irrigation and plant protection chemicals. As a result of excessive use of these inputs, the cost of cultivation has escalated. This is more so in irrigated crops like paddy. The spectacular increase in production of paddy was restricted to irrigated belts of the country. The skewed distribution of green revolution results and increased costs of cultivation have given alarming signals to the future needs of food security. At this juncture the System of Rice Intensification (‘SRI’- Paddy cultivation) came into light.

SRI, the System of Rice Intensification, is a system of production of paddy. SRI is considered to be a disembodied technological breakthrough in paddy cultivation. SRI involves the application of certain management practices, which together provide better growing conditions for rice plants, particularly in the root zone, than those for plants grown under traditional practices. This system seems to be promising to overcome the shortage of water in irrigated rice. SRI was developed in Madagascar in the early 1980s by Father Henride Laulanie, a Jesuit Priest, who spent over 30 years in that country working with farmers. In 1990, Association Tefy Saina (ATS) was formed as a Malagassy NGO to promote SRI. Four years later, the Cornell International Institute for Food, Agriculture and Development (CIIFAD), began cooperating with Tefy Saina to introduce SRI around the Ranomafana National Park in eastern Madagascar supported by the US Agency for International Development (USAID). It has since been tested in
China, India, Indonesia, Philippines, Sri Lanka and Bangladesh with positive results. In Sri Lanka, SRI cultivation was practiced in 18 districts with encouraging results of doubling the yields. It is in practice in Cambodia, Indonesia, Laos, Myanmar, Philippines, Thailand, Vietnam, Bangladesh, China, India, Nepal, Sri Lanka, Gambia, Madagascar, Mozambique, Sierra Leone, Ghana, Benin, Barbados, Brazil, Cuba, Guyana, Peru and USA.

Paddy is a water intensive crop. More than 70 per cent of the country’s ground and surface water is being used for agriculture and, out of this, 70 per cent is allocated to paddy cultivation. Each kilogram of paddy produced with irrigation requires 3000-5000 liters of water. Increasingly water is becoming the single most constraint to produce more paddy to meet increasing demand. Hence, India needs to invest on improving its water productivity, and any capacity to produce more rice with less water for sustainable water and food security.

SRI is a method of raising paddy that produces substantially higher yields with less water, planting of far fewer seedlings and the use of fewer inputs than traditional method. It involves using different practices for plant, soil, water and nutrient management. This System of Rice Intensification method has been successfully used in a number of countries. At present, about 42 countries have adopted SRI cultivation method. In India about 1.5 lakh farmers have adopted this method in 12000 hectares across 160 districts. Tamil Nadu and Tripura are the leading states in India adopting this SRI method.

1.2 STATEMENT OF THE PROBLEM

Cultivation of paddy is a lucrative business to various farmers and this is an important crop which helps to increase the economic condition of the paddy farmers. The cultivation of paddy is generally depending on fertility of land, climate condition, high yielding varieties of seeds and rainfall. India ranked first in area under paddy production and second in terms of production of paddy. But the productivity of paddy in India is low when compared to some major paddy producing countries. This shows that considerable scope exists for raising productivity and income of the farmers by improving their efficiency.

In recent years, various technological options have been tried by farmers to increase their paddy crop productivity and income. Introduction of new method of paddy
cultivation like SRI method and adoption of farm mechanisation have been taken place in the recent years to increase paddy productivity and reduce cost of paddy cultivation. But still most of the farmers are not reaping the benefits of such modernisation. Moreover, the paddy farmers those who adopted such new methods and technologies are not completely relieved from their worries till now. Lack of training is also a major cause which restricted the rice farmers to adopt the specified crop management practices. The paddy farmers are also affected by various problems in cultivation of paddy viz., non availability of labourers, high wage rate, poor quality of fertilisers, non availability of fertile seeds, loss due to pests and diseases, inadequate technical know-how etc.

The process of production ends only with final consumption and its marketing which provides a link between production and consumption. The success of any agricultural development programme rests ultimately on the efficiency of the marketing system. Marketing of agricultural goods is more complicated than the marketing of non-agricultural goods. Agriculture marketing in India is always hampered by several bottlenecks. There is limited access to the market information, low literacy level among the farmers and presence of too many intermediaries who eat away the pockets of both farmers and consumers. Also in the absence of any regulated market, the produce is sold at irregularly held markets in a nearby village or town. Although it is said that technology has improved but it has not gone to the rural levels as it is confined to urban areas alone.

There are several loopholes in the existing marketing system and no organised and regulated marketing system for marketing the agricultural produce. The farmers have to face so many hardships and have to overcome several hurdles to get fair and just price for their produce. The problems such as lack of storage facilities, unremunerative price, high transportation cost, high storage cost, price fluctuation and lack of grading facilities are still prevailing. It is commonly seen that the difference between the price received by the paddy farmers and the price paid by the consumers is too large. Lack of Government intervention to control the intermediaries and price of paddy is another major problem in paddy marketing which needs to be addressed.

Increasing the marketed surplus should be one of the important goals of agriculture sector in this liberalised era. Improving marketing facilities for agricultural crops in general and paddy crop in particular would enable the farmers to plan their
production more in line with market demand, to schedule their harvests at the most profitable times, to decide which markets to send their produce to and negotiate on a more even footing with traders. Besides, a proper paddy marketing system also helps to increase production and marketing efficiency.

Keeping all these aspects in view, the present study is a modest attempt to find out answers to the following questions:

- What is the trend in area, production and productivity of paddy at world level, national level, state level and district level and trend in export of rice?
- What are the cultivation practices being followed by the farmers in cultivating paddy?
- What is the cost of cultivation incurred by the farmers in cultivating paddy?
- How the farm mechanisation practices are being adopted by the paddy farmers?
- What is the producer’s share in the consumer’s price and efficiency of the identified marketing channels?
- To what extent the paddy farmers are satisfied with the functioning of existing marketing system?
- What are the cultivation and marketing problems faced by the paddy farmers?

1.3 IMPORTANCE OF THE STUDY

Despite the significance of paddy in the livelihood of many farmers and income generating crop in the study area, it has not been given due attention. It is only recently that few studies have been done on paddy. However, most of these studies have focused only on traditional method of production of paddy. No study has focused on adoption of System of Rice Intensification (SRI) method of paddy production and its comparison with the traditional method of paddy production. Adoption of farm mechanisation in paddy production has also been given due focus in this study. Moreover, no single study has been taken up for paddy covering numerous aspects such as cost of cultivation, constraints in adoption of both traditional and modern method of paddy production i.e.
SRI, marketing channels, marketing cost, marketing margin, marketing efficiency, price spread, marketing problems and trends in area, production and productivity of paddy at World level, India level, Tamil Nadu level and Erode District level and trends in export of rice. Further, paddy marketing channels, marketing efficiency and perception of the farmers on the existing marketing system for paddy have not yet been studied in detail. Hence, this study attempts to fill in these gaps. This study would be more useful to the paddy farmers, traders, consumers and the policy makers for their respective purpose.

1.4 REVIEW OF LITERATURE

In any study, the review of previous studies are considered as important for getting a better understanding of the problem, the methodology followed and to identify the unexplored part of the field of study under consideration. To frame the objectives, hypotheses and methodology, various relevant studies both at National level and International level have been reviewed and presented in the following section.

Bhatia (1996) examined the marketing costs and margins of some important agricultural commodities including paddy. Results of the study revealed that the share of the producer in private channels is lower than in institutional channels. It was also found that the marketing margins in private channels were higher than in institutional channels.

Farooq et al. (1999) estimated the costs of production of paddy in Punjab. It was found that family labour, harvesting and threshing, irrigation and ploughing are the major variable costs involved in paddy production. The itemized comparison of the difference between imputed and cash costs show that land and family labour are the most significant inputs contributed by farm households.

Parmod Kumar (1999) made a study on marketed surplus of different crops across farm size in Haryana. The results revealed that marketed surplus (% to total production) of


paddy for marginal farmers was 90.82, for Small farmers was 90.73, for Semi medium farmers was 94.39, for medium farmers was 96.39 and for large farmers was 98.14. It was also found that the total marketed surplus of all paddy farmers was 96.31.

Radha and Prasad (1999)\(^\text{10}\) examined the changes in area, production and productivity of rice and the factors contributing for this in Andhra Pradesh. Results revealed that the per cent change in area, production and productivity was low but positive and production recorded the highest change (34.45\%) and this indicated that increased production was mainly due to increase area under rice. Further the stability indices of rice were high for production followed by area and this revealed that higher instability in rice production was mostly due to area i.e. wide fluctuations in area under rice.

Sarma (1999)\(^\text{11}\) conducted a study in Titabor sub-division of Jorhat district of Assam on the impact of farm mechanisation through power tiller on productivity and employment. The findings revealed that farms with mechanisation appeared to have higher farm size, higher rate of literacy and greater participation of their work force and thereby indicating better economic status. The findings also revealed that mechanisation allows farmer to allocate more area to high income crops, increase cropping intensity and to incur lower cost per cropped hectare. It was also found that there has been an increase in productivity with the increase in levels of mechanisation. Further it was also found that with the increase in levels of mechanisation, there has been a decrease in the level of human labour employment.

Dhanapala et al. (2000)\(^\text{12}\) indicated that yield gap was due to compound effects of many factors attributed to the farmers’ perception and adoption of production


technologies. In many instances, the predominant factors were weeds, pest and diseases management, fertilizer use and inefficient management practices.

Kamal and Meenu (2000)\textsuperscript{13} worked out the compound growth rate for paddy in Punjab using data on area, production, and yield for the three periods viz., period I (1970-71 to 1983-84), period II (1984-85 to 1997-98) and overall (1970-71 to1997-98). Chow-test was applied to test the difference in the growth rate between two time periods. The null hypothesis of no difference between the growth rates was tested against the alternative hypothesis that the growth rates for the two periods were significantly different. Results indicted that the annual compound growth of the area, production and yield of paddy was 6.90, 8.82 and 1.79 per cent respectively for the whole period. Results of the Chow-test showed that there was a marked difference in the growth rates of area, production and yield between the two periods showing a significant decline in area, production and yield during the second period.

Mythili and Shanmugam (2000)\textsuperscript{14} measured the technical efficiency in paddy cultivation in Tamil Nadu using an unbalanced panel data of 234 farms for the period 1990-91 to 1992-93. The study used the stochastic frontier production function approach and the Cobb-Douglas functional from. Output was expressed as a function of human manpower (man hours), area (hectares), fertilizer (kilograms) and capital expenditure incurred on bullock labour, machinery and pesticides (rupees). The maximum likelihood method was used to estimate frontier function. The study found that the technical efficiency varied from 46.5 per cent to 96.7 per cent with a mean value of 82 per cent. The mean technical efficiency indicated that on average, the realized output could be increased by 18 per cent without any additional resources. The study recommended the need for improving farmers’ practices through extension services and training programmes.


Gyanendra and Chandra (2001) estimated growth rates of area, yield, production, cost and profit of paddy in India by fitting different functional forms on time series data from 1975 to 1998. The compound growth analysis showed that overall growth rate in area under paddy was small (0.47 per cent per annum) during the period concerned. The maximum growth rate in area was 1.57 per cent per annum, which was recorded during the period of 1986-87 to 1990-91. Linear trend analysis on yield revealed a growth rate of 2.58 per cent per annum with a maximum rate of 5.24 per cent per annum for the period 1986-87 to 1990-91. The results indicated that the overall growth rate in paddy production was 3.06 per cent per annum. The maximum growth rate was observed during 1986-87 to 1990-91 (6.89 per cent per annum). Growth trend in cost of production showed 8.09 per cent increase per annum during the period 1975-76 to 1996-97. The growth rate in minimum support price, which was worked out using the similar functional form, was 8.27 for the whole period. It was found that the best function for estimation of growth rate in profit was cubic function. It was found that margin of profit had tendency to get reduced in due course of time. This may discourage farmers’ investment in increasing productivity. The study concluded that higher growth rate of paddy yield had been the major factor to increased production and increase in net profit was very low due to higher rate of increase in cost.

Visva (2001) estimated the producer’s share for paddy (rough rice) in West Bengal for three selected markets using time series data. Producer’s share in consumer rupee was expressed as a percentage of the retail price. The study found that variation in producer’s share was more pronounced in Sainthia market than that in Bolpur and Rampurhat. In case of month wise variation, the study revealed an abrupt up and down in producer’s share throughout the study period. In December 1995 producer’s share was 76.56 per cent, which suddenly fell to 66.2 per cent in the next year.

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Chauhan and Singh (2002)\textsuperscript{17} measured the level of marketed surplus and the extent of relation of identified variables with marketed surplus. Results revealed that major portion of marketed surplus was contributed by large farms followed by medium and small farms. Regression analysis showed that production, size of family, consumption and area for all farms were significant in determining the marketed surplus.

Gauraha et al. (2002)\textsuperscript{18} analysed the present marketing strategies of rice and the producer’s share in consumer’s rupee in different marketing channels of Durg market, Chattisgarh. Results showed that price paid by consumer per quintal of rice were same in all three marketing channels and producer’s share in consumer’s rupee was the highest in channel I i.e. producer to consumer followed by channel II and III. Analysis of marketing efficiency showed that channel I was the efficient one than other two channels as there was no intermediaries’ involvement.

Atteri and Bisaria (2003)\textsuperscript{19} analysed the marketable surplus of rice and wheat. It was concluded that 60 per cent of the farmers are marginal farmers and did not have marketable surplus. The estimated marketable surplus with small, semi medium, medium and large farmers was 51.81, 59.75, 68.52 and 88.69 per cent for rice and 8.74, 60.24, 71.53 and 85.00 per cent for wheat, respectively ignoring losses. The farmers sold a wide range of products surplus like food grains, pulses, oilseeds and spices immediately after they harvest the produce, for various reasons like low storage capacity, need for money, uniform procurement price throughout the year etc. Further, the quality and quantity loss as well as value loss risk acts as deterrent for storing the products. It was suggested that the farmers will be benefited if the rural godowns are constructed for rice and wheat and the credit policy for credit against stored products would help in increasing withholding capacity of the farmers.


Jyothirmai et al. (2003)\textsuperscript{20} studied the resource efficiency of paddy in Andhra Pradesh. It was found that at head region seed, labour and management index were found positive and significant and at middle region the coefficient of labour was positive and significant and at tail region coefficient of irrigation water was positive and significant. It was also found that 56 to 61 per cent realisation of the maximum possible income by the farmers was from their given set of resources.

Narasimham et al. (2003)\textsuperscript{21} estimated the cost and returns of paddy in Ynam region of Union territory of Pondicherry. They found that the cost of production of paddy per hectare was highest among all the size groups. The total costs per hectare were high in large farms in both crop I (kharif) and crop II (rabi) with ₹ 18,094.26 and ₹ 19,071.29, respectively. Rental value on own land in the cost of production of crop II was more than crop I in all size groups. Gross return per hectare was the highest on large farms followed by medium and small farms in both crop I and crop II. Net returns also showed direct relation with the farm size.

Rama Rao et al. (2003)\textsuperscript{22} examined the levels of technical efficiency in the production of rice in Andhra Pradesh through application of stochastic frontier production function. Yield responded significantly to all the inputs namely, labour, seed, farmyard manure, plant protection chemicals, except fertilizer. Analysis of frontier production function indicates the presence of significant inefficiency in the production of rice. The average level of technical efficiency was estimated to be about 0.85 indicating that it was possible to improve yield by 15 per cent by following the efficient crop management practices. The differences in technical levels were significantly influenced by age and education of the farmers and the area under rice to total cropped area. The negatively significant coefficients for age and education suggest that as the age and


the education of the farmer improve, the efficiency decreases. However, farm size was not found to have any significant relationship with technical efficiency. The study pointed out that increasing technical efficiency by following the best farmers’ practices could increase profitability from rice farming.

Debapriya and Jain (2004)\textsuperscript{23} studied the cost efficient yield levels for paddy of eight major states viz., Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Odisha, Punjab, Uttar Pradesh and West Bengal. The results show that fertiliser input was the most significant factor responsive to paddy yield in Andhra Pradesh and Punjab, area under High Yield Varieties was the significant factor in Uttar Pradesh and West Bengal, fertiliser and rainfall were the significant yield increasing input factors in Odisha, machine use was the significant factor in Assam and human labour use and rainfall were the significant factors in Madhya Pradesh. It was also found that Assam turned to be the low yielding and low cost state for paddy and Punjab had the lowest cost of production along with the highest productivity levels.

Elsamma and Nandamohan (2004)\textsuperscript{24} analysed the trends in rice production in Kerala using exponential function both in linear and quadratic form. The study referred to the period 1975–2000. The results of the exponential linear model (compound growth) showed a negative growth in area (-3.15%) and production (-1.80%) while productivity was positive but not statistically significant. The findings of the growth rates estimated using log quadratic equation revealed that area and production of rice showed significant deceleration with significant acceleration in productivity during the period under reference. The conclusion made in the study was declining trend in area under rice with positive trend in yield. The said reasons for declining area were unprofitable price situation and difficulties in cultivation with high cost of labour and other inputs. Study recommended need of attention on increasing yield by reducing yield gap through eliminating constraints to potential productivity.


Saxena et al. (2004)\textsuperscript{25} analysed the growth rates and variabilities in area, production and productivity of paddy crop in Haryana State as a whole as well as in the different regions using the time series data from 1965-66 to 1995-96. Results revealed that the coefficient of variation in area and productivity ranged from 8.41% to 19.92%. The coefficient of variation was as high as 33.16% in the phase-I (1965-66 to 1974-75) but decreased in subsequent phases to tolerable limits. Total average production of paddy was recorded as 1094.90 thousand tons and the maximum in 1994-95 as 2230 thousand tons.

The average yield was obtained as 2012.42 kg/ha. Positive and significant growth rates for area and production were observed. For the productivity, the growth rates were non-significant in II and III phases.

Sikander and Sandeep (2004)\textsuperscript{26} examined the profitability of paddy, maize and wheat crops grown in Himachal Pradesh for the year 2001-2002. In this study, different cost concepts of Cost A1, Cost A2, Cost B and Cost C were calculated. As regard to Cost C, paddy was the highest cost (\textdollar 20835) followed by maize (\textdollar 18709) and wheat (\textdollar 17102) per hectare. For all the crops, the lion’s share of cost was incurred by labour. In respect of gross returns per hectare, it was highest on paddy crop followed by wheat and maize. The study further found that net returns were positive on paddy crop as compared to the wheat and maize crop where net return was negative. The negative return was due to low yield. However, net profit per quintal was negative for all three crops.

Balasubramani et al. (2005)\textsuperscript{27} analysed the yield gap prevailing on popular varieties and the constraints faced by the rice growers in adopting the recommended rice technologies. Findings showed that a maximum gap of 34.33% was found among marginal farmers while 24.21% gap was found among small farmers. Regression analysis showed that low fertility of soil, high cost of agricultural inputs, contract system of transplanting, weeding and harvesting operation, application of fertilisers not based on


soil testing recommendation and insecticide resistance in paddy pests maintained positively and highly significant relationship with the yield gap in paddy. The major biological problem was inadequate organic inputs. The major bio-physical problem was adopting specific fertiliser application. The major socio-economic constraint was high cost of labour. Lack of training facilities was the major problem in other constraints.

Mendis and Udomsade (2005)\(^{28}\) made an attempt to determine the relationship between socio-economic factors and recommended crop management practices and identify the problems faced by farmers and their suggestions and alternate solutions to improve adoption of recommended crop management practices in paddy cultivation. Hypotheses testing revealed that adoption of recommended crop management practices significantly related to education, land, land tenure, income, credit, sources of information, extension activities, extension officer visits, and membership of farmers organizations. It was identified that major problems of farmers were high cost of inputs, drainage and irrigation difficulties, and unavailability of paddy seeds. Farmers suggested government intervention is essential to solve the problems.

Olubanjo and Oyebanjo (2005)\(^{29}\) analysed the effect of farm inputs use on the profitability of rain-fed paddy rice production in Ikenne Agricultural Zone, Ogun State, Nigeria. Results revealed that the elasticity of the profit function increased with quantity of fertiliser applied and farm size cultivated, and decreased with respect to increased use of hired labour and seeds. Fertiliser should thus be made available and affordable to rice farmers since this will enhance farm productivity and ensure increased profitability of rain-fed paddy rice production.


Pouchepparadjou et al. (2005)\textsuperscript{30} employed two separate production functions of Cobb-Douglas type for adopting farms and non-adopting farms for paddy grown in the Union Territory of Pondicherry. Output was regressed with seed, urea, other inorganic fertilizer, labour, operational cost, land area, water and plant protection chemicals. All variables were measured in value term. The model was estimated using the corrected least square technique. In addition, the logistic regression model was used to understand the degree and direction of each factor in the adoption of the technology. The independent variables included in the regression were age, agricultural income, other income, education, experience, livestock, non-land assets and operational area. The results of the frontier functions revealed that the average level of technical efficiency was 0.35 among adopters and 0.37 among non adopters. The levels of technical efficiency were more or less the same, for both adopters and non-adopters. This implied that there was great potential for IPM adopters to further increase output using available inputs and technologies more efficiently. The results of the regression model run for examining factors influencing adoption of IPM indicated that the education of the farmer and contacts made with agricultural extension personal had significant and positive influencing the rate of adoption of IPM. The study recommended the need of policies to improve education and extension services by further investment in human capital and related factors.

Rajendra (2005)\textsuperscript{31} studied the performance of System of Rice Intensification of Bansahan variety in Magan district, Nepal. The per hectare yield of SRI was 8.5 tonnes as against 4 tonnes of traditional method. He observed that SRI required less seed rate (5-10 kgs) and small quantities of water to achieve the mentioned yield level.

Ratna Reddy et al. (2005)\textsuperscript{32} made an attempt to study the water use efficiency by adopting the system of rice intensification. Required field survey data were collected


from Anantapur district of Andhra Pradesh. The study revealed the yield increase of 29.80 per cent in SRI method over the traditional method.

Reddy et al. (2005)\textsuperscript{33} while comparing the economics of normal rice (transplanted) and SRI method rice found that the total operations cost of SRI method of rice (₹ 9456.29/acre) was higher than the total operational cost of normal rice (₹ 235.72/acre). However, a net return per acre was high in the case of SRI method of rice (₹ 7805/acre) than the normal rice (₹ 5915/acre). The major attributing factor for the high operational cost in SRI method of rice was human labour. The study revealed that the higher total operational costs were compensating the yield advantage of SRI method of rice. Nevertheless, SRI method of rice reduced the water requirement, which was not accountable in the free-regime of power supply to agriculture.

Singh et al. (2005)\textsuperscript{34} examined the generic issues of the development and different characteristics of the evolving rice economy and trade prospects in India. The study concluded that technology and increased use of inputs, government interventions and support in terms of minimum guaranteed prices of output and large scale procurements from producers at remunerative prices have played a key role in the growth of rice economy.

Bhujel and Ghimire (2006)\textsuperscript{35} estimated the production function of Rice in Morang District of Nepal during the year 2002-2003. The findings show that the model of Cobb Douglas production function was significant at 1% level and defined 95% variation in Hiunde rice production due to variation in independent variables included in the model. The coefficient of area, nitrogen, phosphorous and tractor hour were found significant. The effect of human and bullock labour was found insignificant. Cost that was incurred in land preparation and transplanting was the highest among operations.


Jain (2006)\textsuperscript{36} studied the role of various institutions in marketing of paddy and rice in Chattisgarh. Results revealed that in paddy maximum arrival was observed about 96.40\% in regulated markets. The farmers borne loading and unloading, transport, wastage and miscellaneous charges together accounted for about 79 per cent of the total marketing cost. It was found that cost incurred per quintal of paddy worked out to ₹ 14.25 for the farmer, ₹ 15.00 for the village trader, ₹ 58.90 for the wholesaler, Rs.70.50 for the rice miller and ₹ 5.50 for the commission agent.

Kaul et al. (2006)\textsuperscript{37} attempted to study the growth of yield of rice crop for different states from 1951 to 2002. Results indicated that there was a significant improvement in productivity of rice crop in the beginning of advent of new technology. Gross revenue had been rising over the years but the net revenue was negative. It was also found that the operating cost and productivity were highly correlated to each other and it was positive and highly significant in the study period.

Nguyen and Baldeo (2006)\textsuperscript{38} attempted to find out the constraints faced by farmers in rice production and export. Results showed that dependence on monsoon was identified as major problem in agro-ecological constraints for Indian farmers. Lack of water was the major problem in agro-ecological constraints for Vietnamese farmers. In technical constraints, disease and inadequacy in post-harvest technology were identified as the major problems for Indian and Vietnamese farmers respectively. Poor infrastructure and credit problems were the major issues in socio-economic constraints of Indian and Vietnamese farmers respectively.

Pouchepparadjou and Sendhil (2006)\textsuperscript{39} analysed the marketable and marketed surplus of paddy in cauvery delta zone. The results revealed that marketable surplus was found to be very high than the quantity retained for various purposes like family


consumption, seed, wages and distribution to friends and relatives. It was also found that there was a positive correlation between the total production and marketable and marketed surplus of paddy. It was evident from the regression analysis that size of the farm, output of the crop, wages in kind and dummy variable for family type and education were the most important factors affecting the marketed surplus of the paddy in the study region.

Yadav et al. (2006)\textsuperscript{40} examined the price spread and marketing. Results indicated that the marketable surplus and marketed surplus of paddy were 18.19 quintals (62.89\%) and 17.72 quintals (97.42\%) respectively. Marketable surplus and marketed surplus of paddy were the highest in large farms and lowest in small farms. Results also revealed that medium sized farmers received the highest net price of ₹ 550 (60.59\%) and the producer’s share in consumer’s rupee was 50.01\% only. Majority of the farmers preferred the channel I i.e. producer-village trader-rice miller-retailer-consumer. High commission charges, high cost of transportation, packing charges, delay in payment and unawareness of market price were identified as their marketing problems.

Dinesh et al. (2007)\textsuperscript{41} studied the economics and marketing of Aromatic rice in Chattisgarh. The results showed that the yield levels of aromatic rice categories were quite low but due to high market prices the returns to farmers were generally much higher in aromatic than non-aromatic rice. A large proportion of the produce was retained for home consumption and seeds. The producer’s share in consumer’s rupee was found as 62 per cent. Susceptible to pests/diseases and low productivity were identified as major constraints to farmers. Financial constraints and movement restrictions on aromatic rice across states was recorded as the important constraints to rice millers.


Kachroo and Dileep (2007)\textsuperscript{42} analysed the economics of basmati rice and the production efficiency with which farmers use their resources. Results showed that the operational costs were to the tune of 52.42% to that of total cost. Results also indicated that human labour and seeds were expensively used and production could be increased by decreasing the cost of human labour and cost of seed. It was also found that variables like plant protection, irrigation and fertiliser were under utilised whereas other variables were over utilised.

Moses and Adebayo (2007)\textsuperscript{43} examined the factors determining rainfed rice production in Adamawa state (Nigeria). Production function analysis was used to analyze the factors. The result showed that two of the variables used (farm size and seed) were significantly affect the production. Also resource productivity analysis revealed that seed was over utilized, while land and herbicide were underutilized. It was suggested that decreasing the quantity of seed use and increasing the size of land and quantity of herbicide respectively could increase efficiency.

Samson and Kadiri (2007)\textsuperscript{44} examined the problems and prospects of rice production in central district of Edo state, Nigeria. Results show that ageing and illiterate people dominate the farming. All the respondents indicated finance as the most intractable problem confronting rice farmers followed by attack of pests, diseases and rodents. It is also found that more than 80% of the farmers are wary about the future of rice farming in the area.

Babu et al. (2008)\textsuperscript{45} examined the growth and variability of area, production and productivity of major crops and supply response of major crops with the changes in price. The findings revealed that negative growth was recorded in area for paddy for the study.


period from 1970-71 to 2005-06 and this was due to volatility in prices during the period. Compound Growth Rate (CGR) for production of paddy was positive during the study period. The CGR for productivity of paddy was also positive during the study period. Lagged area, lagged price and lagged yield were identified as the significant factors affecting the decision of farm to allocate the area under crops.

Bagheri et al. (2008) investigated the perceptions of paddy farmers towards applying sustainable agricultural technologies and factors influencing their perceptions. The results of the study showed that farmers had good perception about sustainable technologies such as diversification and rotation, application of manure but in general, they preferred modern technologies to local ones. They perceived agrochemicals as the best means to combat against pests and to increase rice production. Their perception of intangible impacts of modern technologies was weak. It was found that there should be a relationship between a numbers of socio-economic factors, such as human capital factors, information sources use, extension participation and landholding size and the perception towards selected sustainable agricultural technologies. Also, educational level, contact with agricultural experts and extension participation were best predictors of their perceptions.

Hussain et al. (2008) conducted a study in district Swat during 2007 to make comparative cost benefit analysis of per acre rice production of different rice varieties. Primary data were collected through structured questionnaire. Five villages from three tehsils namely Kabal, Barikot and Matta were randomly selected. For comparison, Cost-Benefit Analysis approach was used. The total per acre rice production of these varieties was amounted to ₹ 40000, ₹ 52500, ₹ 33600, ₹ 34000, ₹ 30400, ₹ 30400 and ₹ 68750 respectively. The same average cost amounted to ₹ 13565 was observed for all the varieties. The Benefit Cost Ratio (BCR) of variety JP-5, Basmati-385, Sara Saila, Dil Rosh-97, Swat-1 and Swat-2 and Fakhr-e-Malakand was 2.24, 3.20, 1.80, 1.80, 1.46, 1.54 and 4.36. The highest BCR value is observed for variety Fakhr-e-Malakand indicted the most

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profitable variety in terms of net production. Awareness about the cultivation of Fakhre-Malakand variety should be given as against the growing traditional varieties in district Swat.

Khattak and Hussain (2008)\textsuperscript{48} conducted a study in district Swat during 2007 to investigate the socioeconomic profiles of rural rice farmers. Rice farmers were found associated with agriculture sector. Income and, consumption pattern was found substandard. Major occupations were teaching, fishing and daily wage earners. Most of the rice farmers were found uneducated and tenants. Men generally made decisions. Villagers used to derive their food sustenance from their own farm products. Cattle, buffalo, cow and poultry were the major livestock. The major sources of income were farm incomes and foreign remittances. The major heads of expenditures were food items, clothing, education, health, electricity, house rent, sui-gas, water and investment activities. The total expenditures recorded were ₹ 14060 per month. They were found engaged in subsistence level of farming. It was suggested that the Government should take steps to improve their standard of living.

Oniah et al. (2008)\textsuperscript{49} studied the allocative efficiency of resources used in small scale swamp rice production in Nigeria. The findings showed that the farmers were allocatively inefficient in their resource use and more so these resources were under utilized. The multiple regression analysis showed that the coefficients of labour, seeds and fertilizer were significant at 5% while farm size was at 10%. The results also indicated that 97% of the variation in the output of paddy is jointly explained by the explanatory variables.

Priya and Radhakrishnan (2008)\textsuperscript{50} aimed to fit a best regression model for the five food crops including paddy for the state Tamil Nadu in order to forecast the crop yield. Results indicated that non-linear regression was better for prediction due to its high regression value and among the five principal food crops paddy had the highest


regression value. It was also revealed that paddy explained the variations of crop yield to the extent of 80 per cent. Paddy yield was found to be influenced by the variables like wholesale price, area and cropping pattern.

Sajjad et al. (2008)\(^{51}\) aimed at determining the distributive marketing margins of rice and the shares of different marketing functionaries involved in the marketing margins in Batkhela Tehsil of Malakand district during the year 2004. It was observed that two marketing channels 1) Producer-wholesalers-retailer-consumer and 2) Producer-beopari-wholesaler-retailer-consumer, involved in trading of rice in the study area. In channel 1, the producer received 17.90\% net margin and 41.04\% gross margin. However, in channel 2, it was found that the producer gained less net margin 36.36\% and 14.54\% gross margin. The main reason behind the reduction into net margin and gross margin was observed to be relatively low involvement of farmer in the marketing activities. Furthermore it was also observed that the lack of capital, poor extension services, high input price and lack of marketing channels were the main marketing problem of rice producers in the study area. Additionally total production, marketing intelligence, education, marketable surplus and marketing price are important variables affecting marketing margin.

Vijay Kumar et al. (2008)\(^{52}\) conducted a study in Sitamarhi district of Bihar State. Use of exploratory design of social research was made in the investigation. Sonbarse, Bazpatti, Riga, Runnisaidpur and Nanpur blocks from Sitamarhi district were randomly selected on the basis of maximum area under paddy cultivation. It was concluded that majority of the respondents did not have marketable surplus. Major Problems faced by the respondent paddy growers were lack of capital or fund (66.67 per cent), weak market infrastructure (46.67 per cent), limited transport facilities (41.43 per cent), fluctuating market prices (20.95 per cent). The major suggestions made by the respondent paddy growers for minimizing (overcoming) the technological gap, Development of irrigation

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network with government aid, provision of quality seeds with technical know-how and training on major practices to needy farmers.

Alagesan and Budhar (2009)\(^{53}\) studied the level of adoption of SRI in krishnagiri district, Tamil Nadu. Results revealed that only 30% of the sample respondents adopted the recommendation regarding seedling age, 86% of the respondents adopted only one seedling per hill and 42% of the respondents adopted the spacing recommendation. More than half (58%) of the respondents adopted the SRI system for one or two seasons. Lack of skill in handling young seedlings and shortage of skilled labour are found as major reasons for discontinuance of this method.

Hadassah et al. (2009)\(^{54}\) studied the cost and returns of paddy on different farm size in Guntur district of Andhra Pradesh. The study revealed that human labour constituted the major cost component among the operational costs. It was also revealed that the total cost per hectare for small farmers was lesser than the large farmers. The study concluded that operational costs and fixed costs are higher as a result of higher inputs like fertilizers, plant protection, chemicals and also due to higher per hectare yields.

Shelke et al. (2009)\(^{55}\) studied the marketing of paddy in Maharashtra. The study revealed that in channel I (Producer - Commission agents - Wholesalers/rice millers - Retailers - Consumers) the producer’s share in consumer’s rupee is 55.52%, 51.95% and 55.76% in the case of coarse, medium and fine varieties respectively. In channel II (Producer - Commission agents - Wholesalers/rice millers - Fair price shop dealers - Consumers) the producer’s share in consumer’s rupee is 63.77%, 60.05%and 80.62% in the case of coarse, medium and fine varieties respectively. It is also found that marketing cost is higher in channel II as compared to channel I due to involvement of Government Agency between the rice millers and the fair price shop dealers.


Sita Devi and Ponnarasi (2009)\textsuperscript{56} made an attempt to study the economics of modern rice production technology and its adoption behaviour in Cuddalore district of Tamil Nadu. The results revealed that the total cost of cultivation per hectare was lower by about 10 per cent in SRI method than traditional method. It was identified that age, farm size, income of the farm, number of earners in the family and number of contacts with extension agencies are positive and significantly influencing the adoption of SRI method whereas literacy level of the respondents was negative and not significant. It was identified that lack of skilled labour was the major constraint in the adoption of SRI method.

Das et al. (2010)\textsuperscript{57} studied the farmers’ perception on the appropriateness of rice cultivation technologies. Findings revealed that the small farmers perceived half of technologies as not appropriate whereas medium farmers perceived three technologies as not appropriate. As far as large farmers were concerned, most of the technologies were perceived as highly appropriate and they did not feel any technology as not appropriate.

Ghosh (2010)\textsuperscript{58} attempted to study the determinants of farm mechanisation in west Bengal. Results revealed that the factors such as irrigation, access to institutional credit, size of land holding were found to have positive significant influence on the level of farm mechanisation. The study also revealed that younger generation was more opt for mechanisation than the old. It was also evident that the size of land holding acts as a constraint for farm mechanisation in the study area. Also small assets base of small and marginal farmers prevents their access to institutional credit and this in turn affects the utilization of agricultural machinery and implements. The farmers were also not well trained to use the modern costly machineries efficiently.


Narwade et al. (2010)\textsuperscript{59} analysed the growth of food grain crops including rice in the state of Orissa during the post and pre-reform periods and the instability in food grain crops output growth. Results indicated that rice output growth was declined during the post-reform period as compared to pre-reform period. Rice output growth was decelerated from significant 4.69\% per annum during pre-reform period - 2.98\% per annum during post-reform period and this was mainly due to decline in yield growth rate. Output instability in rice was observed to be relatively lower during the post-reform period.

Nwaru and Iheke (2010)\textsuperscript{60} designed a study to examine resource use efficiency in rice production systems in Abia State of Nigeria. Results indicated that the upland rice farmers are technically more efficient than the swamp and inland rice farmers and that there is no difference in technical efficiency between the swamp and inland rice farmers. None of the farmer groups achieved absolute allocative efficiency. The upland rice farmers achieved least allocative efficiency, underutilized all farm resources while both the inland valley and the swamp rice farmers under utilized farmland, other inputs and capital and over utilised family labour and hired labour. There was no significant difference in the mean output of rice from the production systems; upland, inland valley and swamp while each operated in region one on the production surface indicating that overall, resource levels could be increased to achieve higher levels of productivity in each system.

Odoemenem (2010)\textsuperscript{61} investigated the economic factors which contributed to the adoption of new and improved farm technology. The results revealed that extension contact, mass media exposure, cooperative credit and age were positively correlated with the adoption of high yielding varieties of rice. It was identified that 37.3\% of the farmers stated disease as main constraint in production of rice and 33.3\% of the farmers did not know about the recommended practices.


Taru et al. (2010)\textsuperscript{62} examined the structural analysis of paddy markets in the southern part of Taraba state using total value of sales as index of measurement of the market share in 2007/2008 season. A total of 289 respondents categorised into wholesalers/ producers (95 respondents) and retailers/ producers (194 respondents) according to their proportionate quantity sold in 10 purposively selected markets were randomly sampled and used in the analysis. The marketers had diverse socioeconomic characteristics with female (63\%) participated in paddy rice marketing than male (37\%). Most of the marketers had formal education (71\%) and were experienced marketers with family size above 5 persons (90\%). The sellers’ concentration was high with high income inequality in paddy rice retail than wholesale in the area with Gini coefficient value of 0.74 and 0.53, respectively. This could result from the differences in their access to ownership and control of physical marketing facilities, funds availability and market behaviour and conducts. The markets therefore, exhibit features of imperfect markets of monopolistic competition. To reduce high concentration and income inequality among sellers especially in retail business, funds, security and physical market facilities should be provided to the paddy rice marketers in the area.

David and Shabu (2011)\textsuperscript{63} examined the resource use efficiency in rice production in Nigeria using Cobb Douglas production function. It was revealed that all the inputs were positively related to the output of rice and 89\% of the variation in the output of rice is explained by the inputs specified in the production function analysis. It was also revealed that farm size and fertiliser significantly affect the output of rice at 1\% and 5\% level of significance.

Huynh and Yabe (2011)\textsuperscript{64} analysed the technical efficiency in rice production in Vietnam. The analysis estimated the technical efficiency level to be 81.6 per cent. These


results suggest that increase in output and decrease in cost could be obtained using available technology. For analysis the stochastic frontier analysis method in the cobb-douglas production function was used. The study demonstrated that the intensive labour, irrigation and education are the factors having positive impacts on technical efficiency.

Jamala et al. (2011)\textsuperscript{65} examined the factors influencing farmers’ adoption of irrigated rice production. The results showed that five variables had significantly influenced adoption of rice production. These were farming experience, household size, gender, market availability and labour availability. The result of logit regression model showed a statistical significance (P<0.01) of the X1. It indicated that holding other variables constant, if years of experience increase by a unit, on the average, the logit of the odds in favour of sole rice production increases by 5.33 units. Other variables such as level of education influenced adoption as it eases understanding, interpretation and acceptance of the newly introduced techniques. These would enhance purchasing power of materials inputs, like fertilizer, pesticides, improve seeds.

Kumbhare and Singh (2011)\textsuperscript{66} carried out a study to determine the farmers’ adoption behaviour on wheat and paddy production technologies. The farmers were selected from Samasripur, Darbhanga and Muzaffarpur districts who demonstrated wheat and paddy technologies during 2002-03 to 2004-05. Findings of the study revealed that 53.75 per cent respondents had adopted the wheat production technology at higher level followed by 31.25 per cent and 15.00 per cent respondents had adopted the wheat production technology at medium and low level respectively. Also in paddy, 60.00 per cent respondents had adopted the production technology at higher level followed by 21.25 per cent and 18.75 per cent respondents had adopted the paddy production technology at medium and low level respectively. The major technical, resource and market related constraints perceived by farmers in wheat and paddy were perceived by farmers were non-availability of quality seeds of wheat, non-availability of rubber milling


facility in their locality for rice processing, breakage of grain during milling/processing, lack of transportation facilities, and lack of market facility.

Odoemenem and Inakwu (2011)\textsuperscript{67} undertook a study to examine the economic analysis of rice production in cross river state of Nigeria. The findings revealed that majority of the farmers employed both family and hired labour as their source of labour. The multiple linear regression analysis showed that variation in output of rice is explained by variation in pesticides application and the varieties of rice planted i.e. local or improved.

Pandian et al. (2011)\textsuperscript{68} studied the resource use efficiency of different energy inputs for small and large farmers in Thoothukudi district. It was observed that there was a significant difference in yield per acre between the small and the large farmers. It was found that for every additional rupee spent on human energy, bullock energy, fertilizer energy and irrigation energy, the gross revenue of paddy could be increased by ₹ 0.11, ₹ 0.85, ₹ 0.48 and ₹ 0.67 of small farmers respectively. It was also found that for every additional rupee spent on human energy fertilizer energy, irrigation energy and mechanical energy of large farmers, gross revenue could be increased by ₹ 0.10, ₹ 0.12, ₹ 0.59 and ₹ 0.22 respectively. It was concluded that the largest share in the production paddy was recorded by the fertilizer energy and the least by seed energy.

Rao and Rama (2011)\textsuperscript{69} assessed the economics and sustainability of SRI (System of Rice Intensification) and traditional method of paddy cultivation in North Coastal Zone of Andhra Pradesh for the period 2008–09 based on the data of costs and returns of crop. The study revealed that Benefit Cost Ratio is higher for SRI (1.76) than traditional (1.25) methods. Further, there was a 31 per cent yield gap between SRI and traditional methods, in which cultural practices (20.15\%) showed a stronger effect than input use

\begin{itemize}
\item \textsuperscript{69} Rao, I.V.Y. and Rama, (2011), “Estimation of Efficiency, Sustainability and Constraints in SRI (System of Rice Intensification) \textit{vis-a-vis} Traditional Methods of Paddy Cultivation in North Coastal Zone of Andhra Pradesh”, \textit{Agricultural Economics Research Review}, Vol.24, No.2, pp. 325-331.
\end{itemize}
(10.85%). The most important constraint in SRI cultivation was identified as ‘nursery management’. The SRI method being more skill oriented, the study observed that yields could be made sustainable if constraints are addressed on war-footing basis.

Tulole et al. (2011)\textsuperscript{70} analysed the perception of rice farmers on rice varieties and factors that leads to reduced yield in rice production in Tabora region, Tanzania. The study explored that high yielding, good aroma, marketability, grain heaviness and disease and drought resistance were considered as prime traits in rice variety selection. Low yield, disease susceptibility, high water demand and late maturing were identified as the reasons for abandoning rice varieties. It was also identified that source of agriculture information was the important factor which resulted in increasing the income from rice production and majority of the farmers got their information from extension officers.

Nagaraj et al. (2013)\textsuperscript{71} investigated the extent of adoption of farm mechanisation practices by paddy growers in Sindhanur and Manvi talukas of Raichur district. The results revealed that 96.67 per cent of the farmers were using mouldboard plough in the field, by maintaining its depth of operation i.e. 15-30 cm. With regard to harrowing operations 93.33 per cent farmers regularly use this operation after ploughing the land. Nearly 89.17 per cent of the paddy growers possessed a skill on the use of cultivators. They used in the field by maintaining its depth of operation i.e. 10-20 cm. With regard to rotavator, 48.33 per cent of respondents had applied rotovator in the field and mainly they used the L-type and helical type blades. However, in overall adoption, nearly 50 per cent of the respondents belonged to medium category. It is due to the fact that the farm mechanisation in paddy cultivation is gradually increasing in the study area and the growers are slowly coming forward to adopt these implements. The paddy growers were still resistant to adopt paddy transplanter due to its high cost and its dwindling yield.


The preparation of mat nursery, the use of the specific aged seedlings, the preparation of main field for transplantation etc, were the factors responsible to hinder the adoption process.

1.5 SCOPE OF THE STUDY

This study is primarily undertaken with a view to examine the marketing practices of paddy farmers in the Erode district of Tamil Nadu. Though paddy is grown in most of the districts in Tamil Nadu, this study confines itself to Erode district only as this district is one of the leading districts in paddy cultivation in the state. This study proposes to examine the growth in area, production and productivity of paddy at world level, national level, state level and district level and growth in export of rice. This study also analyses the cultivation practices, cost of cultivation and the farm mechanisation pattern in paddy cultivation. This study further analyses the price spread and marketing efficiency along with the level of satisfaction of farmers about the functioning of the existing marketing system for paddy. This study also aims to analyse the cultivation and marketing problems of the paddy farmers in the study area.

1.6 OBJECTIVES OF THE STUDY

The present study has been undertaken with the following objectives.

- To examine the growth in area of cultivation, production and productivity of paddy at World level, India level, Tamil Nadu level and Erode District level and export of rice in terms of quantity and value.
- To analyse the cultivation practices and cost and returns of paddy farmers.
- To analyse the farm mechanisation pattern in paddy cultivation.
- To measure the marketing efficiency of the identified marketing channels for paddy and the farmers’ satisfaction on the functioning of the existing marketing system for paddy.
- To identify the cultivation and marketing problems faced by the paddy farmers.
- To offer suggestions to improve the cultivation and marketing of paddy.
1.7 HYPOTHESES

The following null hypotheses (H₀) have been framed by considering the objectives of the study.

- There is no significant positive growth in area, production and productivity of paddy at World level, India level, Tamil Nadu level and Erode District level.
- There is no significant positive growth in export of rice in terms of quantity and value.
- The independent input variables viz., paddy land, farm yard manure, seeds, chemical fertilisers, pesticides, weedicides and labour cost do not influence the production of paddy under traditional method, SRI method and both methods together.
- There is no significant impact of variables such as age, farm size, education, family size, farm experience, paddy land, extension contact, income from paddy and input cost on the decision of the sample paddy farmers to adopt SRI method.
- The socio-economic variables of the sample SRI paddy farmers like age, education, farm size, farm experience, family size, extension contact, paddy land, income from paddy and source of market information have no significant association with their level of awareness towards SRI features.
- There is no significant association between the socio-economic variables of the sample paddy farmers such as age, education, farm size, farm experience, family size, source of information, land tenure, extension contact, cultivation method adopted and agricultural income and their adoption behaviour towards crop management practices.
- Farmers’ decision on adoption of farm mechanisation is independent of the variables such as age, farm size, education, family size, farm experience, paddy land, extension contact, number of labours, wet land size and income from paddy.
- Independent variables like farm size, paddy output, home consumption, wages in kind paid to farm labourers, seeds used for raising paddy crop, selling price, education and family size do not influence the marketed surplus of paddy.
There is no significant impact of variables such as age, education, family size, farm experience, paddy land, extension contact, paddy output, marketed surplus and price received on the satisfaction score of the sample farmers about the existing marketing system for paddy.

There is no significant association between the socio-economic variables of the sample paddy farmers viz., age, education, farm size, farm experience, family size, extension contact, paddy land, income from paddy, source of market information and marketing channel preferred and their level of satisfaction on the existing marketing system for paddy.

The average satisfaction scores of the sample paddy farmers on the existing marketing system for paddy classified on the basis of socio-economic variables like age, education, farm size, farm experience, family size, extension contact, paddy land, income from paddy, source of market information and marketing channel preferred are the same.

1.8 PERIOD OF THE STUDY

The study includes both primary and secondary data. The primary data relating to the cultivation and marketing of paddy have been collected from the paddy farmers and the intermediaries relating to the year 2011-12. The required secondary data have been collected for the period of ten years from 2001-02 to 2010-2011 for analysing the area of cultivation, production and productivity of paddy and export of rice in terms of quantity and value.

1.9 RESEARCH METHODOLOGY

1.9.1 SAMPLING DESIGN

This study is an empirical research based on survey method. The present study is confined to Erode district of Tamil Nadu. Erode district, where the paddy farmers are following both traditional method and SRI method of paddy cultivation, has been purposively chosen for the study considering its huge contribution in paddy production in the state.

SELECTION OF BLOCKS

In Erode district, there are 14 blocks. Out of 14 blocks in the district, five blocks namely Gobichettipalayam, T.N.Palayam, Modakurichi, Bhavani and Erode have been
purposively selected for the present study as they contribute huge in terms of area of paddy cultivation and production of paddy during the year 2010-2011 (vide Appendix-iii).

**SELECTION OF FARMERS**

The sample size of the present study is 500 farmers. The farmers who cultivate paddy at least in one acre of land with 2 years of continuous experience in cultivation of paddy in the selected blocks have been considered for the study. From each selected block, 100 farmers have been selected purposively. Out of 100 paddy farmers considered from each block, 80 farmers who follow traditional method of paddy cultivation and 20 farmers who follow system of rice intensification method of paddy cultivation have been purposively selected. Hence, the total sample size of the study is 500 farmers consisting of 400 farmers following traditional method of paddy cultivation and 100 farmers following SRI method of paddy cultivation.

**SELECTION OF INTERMEDIARIES**

For the purpose of measuring the marketing efficiency, data relating to marketing costs and marketing margin of village traders, commission agents, rice millers, wholesalers and retailers are required. Required data have been obtained from 50 village traders, 15 commission agents, 25 rice millers, 20 wholesalers and 75 retailers in the study area. Convenience sampling technique has been employed to select the required sample intermediaries.

**1.9.2 COLLECTION OF DATA**

Primary and secondary data have been used in this study. Required primary data have been collected from the farmers and intermediaries with the pre-tested, well structured and non-disguised Interview Schedule. Required secondary data used for analysis have been collected from the Website of Directorate of Economics and Statistics of Government of India, Season and Crop Reports of Government of Tamil Nadu, Website of Ministry of Agriculture of India, Website of USDA (United States Department of Agriculture), District Statistical Office, Erode and Block Statistical Office, Gobichettipalayam. The libraries of Tamil Nadu Agricultural University, Coimbatore, Madurai Kamaraj University, Madurai and Bharathiar University, Coimbatore have been visited for the collection of required information for the present study. The data relating
to the theoretical portions have been collected from various books, journals, magazines, newspapers and websites.

1.9.3 TOOLS USED FOR DATA ANALYSIS

- For analysing the primary and secondary data, the statistical tools such as Percentage analysis, Mean, Sum, Standard Deviation, Co-efficient of Variation, Compound Growth Rate, Cobb-Douglas Production Function Model, Factor Analysis, Scaling the Ranking Analysis, Garrett Ranking Analysis, Mean Score Ranking Analysis, Analysis of Variance (ANOVA -‘F’ Test), Chi-square Test, t Test, Logistic Regression Model, Multiple Regression Analysis, Shepherd’s Method, Acharya and Agarwal Method and Composite Index Method have been used in this study.

- Percentage analysis has been used for analysing the paddy cultivating seasons, source of paddy seed, paddy seed varieties used, source of agriculture information, cost of cultivation of paddy, source of information on crop management practices, opinion of farmers on level of adoption of the recommended crop management practices, farm machineries owned by the paddy farmers, extent of adoption of farm mechanisation implements by the paddy farmers, time of selling paddy, source of selling, source of information for market and price, preference of marketing channel, distribution of marketable and marketed surplus of paddy, satisfaction of farmers on existing marketing system, marketing costs, marketing margins and price spread.

- Mean has been used for analysing the cost of cultivation of paddy, cost and returns of paddy farmers, comparison of SRI farm practice versus traditional paddy cultivation practice, usage pattern of different farm machineries, distribution of marketable and marketed surplus of paddy, satisfaction of farmers on the existing marketing system for paddy, marketing costs, marketing margins and price spread.

- Sum has been used for analysing the cost of cultivation of paddy, source of information on crop management practices, distribution of marketable and marketed surplus of paddy, satisfaction of farmers on existing marketing system for paddy, marketing costs, marketing margins and price spread.
Compound growth rate, standard deviation and co-efficient of variation have been used to study the trends in area, production, and productivity of paddy and export of rice in terms of quantity and value.

Cobb–Douglas production function model has been used to analyse the resource use efficiency in cultivation of paddy under traditional method, SRI method and both methods together.

The ‘t’ test has been used to identify the significance of the identified variables in evaluating the resource use efficiency, significance of the factors influencing the marketed surplus, significance of the factors influencing the satisfaction score of the sample paddy farmers and significance of the growth in terms of area, production and productivity of paddy and growth of export of rice in terms of quantity and value.

Logistic regression model (Logit model) has been used to analyse the relative influence of various factors in the decision of the respondents to adopt SRI method or traditional method of paddy cultivation and the influence of various factors in the decision of the respondents to adopt mechanisation in paddy cultivation.

Multiple linear regression analysis has been applied to measure the nature and extent of relation of identified variables with the marketed surplus and relation of identified variables with the satisfaction score of the sample paddy farmers.

Chi-square test has been used for assessing the significance of the association between the socio-economic characteristics of the sample SRI paddy farmers and their awareness level on SRI features, significance of the relationship between socio-economic factors of sample paddy farmers and adoption of recommended crop management practices and significance of the relationship between socio-economic factors of sample paddy farmers and their level of satisfaction on the existing marketing system for paddy.

ANOVA (F test) has been used for finding out the significance of the association between the socio-economic characteristics of the sample paddy farmers and their awareness level on SRI features and significance of the relationship between socio-economic factors of sample paddy farmers and their level of satisfaction on the existing marketing system for paddy.
Garrett ranking analysis has been used to analyse reasons for preferring SRI method of paddy cultivation, reasons for not adopting SRI method of paddy cultivation, reasons for preferring a particular variety of paddy, reasons for preferring a particular marketing channel and cultivation problems faced by the SRI paddy farmers.

Factor analysis (Principal component with application of varimax rotation) has been used to study the reasons for preferring paddy cultivation, problems in cultivation of paddy and problems in marketing of paddy.

Mean score ranking analysis has been used to identify the reasons for abandoning a particular variety of paddy, reasons for preferring mechanisation in paddy cultivation, reasons for selling paddy immediately after harvesting, reasons for selling paddy after storing for sometime after harvesting and farmers’ opinion on improving the present marketing system for paddy.

Scaling the ranking analysis has been used to identify the reasons for not adopting the recommended crop management practices and problems in adopting mechanisation in paddy cultivation.

Shepherd’s method, Acharya and Agarwal method and Composite Index method have been used to measure the marketing efficiency of the identified channels in marketing of paddy.

Statistical Package for Social Sciences (SPSS) software version 17.0 and MS –Excel software have been used for making necessary calculations of the present study.

1.12 OPERATIONAL DEFINITIONS

1.12.1 Paddy

It is an erect grass that grows on wet ground and has drooping flower spikes and yellow oblong edible grains that become white when polished.

1.12.2 Cultivation

Cultivation means production of food by preparing the land to grow crops.

1.12.3 Farm mechanisation

Farm mechanisation means using improved farm implements and machinery for different farm operations to increase productivity of land and labour through timeliness of
operations, efficient use of inputs, improvement in quality of produce, safety and comfort of farmers and reduction in loss of produce and drudgery of farmer.

1.12.4 Crop management practices

Crop management practices means the group of agricultural practices used to improve the growth, development and yield of agricultural crops.

1.12.5 Cost of cultivation

Cost of cultivation includes factor costs up to the stage of gathering the harvest.

1.12.6 Productivity

Productivity refers to the volume of output produced from a given volume of inputs or resources. It is a measure of the efficiency of production in the form of an average expressing the total output of paddy divided by the total area of land used for the production of paddy.

1.12.7 Marketing cost

The cost incurred to move the product from the producer to the consumer is known as marketing cost.

1.12.8 Marketing margin

Marketing margin involves the cost of moving the product from the point of production to the point of consumption and the profit of various market functionaries.

1.12.9 Price spread

Price spread refers to the difference between the price paid for by the consumer and the price received by producer for the same quantity of product. It consists of marketing cost and margin of the intermediaries.

1.12.10 Marketing efficiency

Marketing efficiency means the movement of goods from producers to consumers at the lowest possible cost, consistent with the provisions of the services desired by the consumer.

1.12.11 Eigen value

The Eigen value represents the total variance explained by each factor.
1.13 LIMITATIONS OF THE STUDY

The study has the following limitations:

❖ The study is restricted to farmers cultivating paddy and intermediaries residing in the Erode district of Tamil Nadu. Besides, only five blocks have been considered for this study. Hence, the general application of the results may be restricted only to similar socio-economic environment.

❖ Farmers are not able to provide accurate information regarding cost, return and price in their paddy cultivation and marketing as they have not maintained any proper records. Hence, the information from the memory of the paddy farmers might be subjected to recall bias.

❖ In some cases, the farmers failed to give their opinion categorically. In such situations, further questions are asked and logical conclusions are drawn based on their replies.

❖ The results cannot be generalised and extended to other districts due to difference in agro-climatic conditions, soil conditions, irrigation facilities and labour availability.

❖ The size of the sample is restricted only to 500. Therefore, the limitations of a restricted sample size are applicable to the present study.

1.14 CHAPTER SCHEME

Keeping in view of the objectives mentioned earlier, the present study is comprised of seven chapters.

Chapter I : Introduction and Design of the Study

Chapter II : Growth in Area of Cultivation, Production and Productivity of Paddy and Export of Rice

Chapter III : Cultivation Practices and Cost and Returns of Paddy

Chapter IV : Farm Mechanisation Pattern in Paddy Cultivation

Chapter V : Marketing Efficiency and Farmers’ Satisfaction on the Existing Marketing System for Paddy

Chapter VI : Cultivation and Marketing Problems of Paddy Farmers

Chapter VII : Summary of Findings, Suggestions and Conclusion