CHAPTER - I
INTRODUCTION AND DESIGN OF THE STUDY

1.1 INTRODUCTION
1.2 PADDY
1.3 THE MILLING OPERATIONS
1.4 COMPOSITION AND NUTRITIONAL VALUE OF RICE
1.5 RICE TERMINOLOGY
1.6 STATEMENT OF THE PROBLEM
1.7 IMPORTANCE OF THE STUDY
1.8 SCOPE OF THE STUDY
1.9 REVIEW OF LITERATURE
1.10 OBJECTIVES OF THE STUDY
1.11 METHODOLOGY
1.12 LIMITATIONS OF THE STUDY
1.13 CHAPTERS SCHEME
1.1 INTRODUCTION

For the last several millennia, India has been known as a “Land of Agriculture”. Agriculture forms the backbone of Indian economy. Despite the concerted industrialisation in the last five decades, agriculture occupies a place of pride. Endowed with abundant natural resources, the importance of agriculture in the economy of India cannot be underestimated in view of the fact that it is being the largest industry in the country, provides employment to around 59 per cent of the total workforce and contributes about 26 per cent of the Gross Domestic Product\(^1\). Any change in the agricultural sector has a multiplier effect on the entire economy.

1.1.1 Meaning of Agriculture

The following definitions are given to highlight the meaning of agriculture:

“It is the science that treats of cultivation of soil, with a view of disseminating knowledge in the production of grasses, vegetables and cereal crops”\(^2\)

“Agriculture is the cultivation of soil, but by popular usage now includes the conversion of crops, or of natural vegetation, into animal products like meat, milk, butter, eggs etc.”\(^3\)

---

\(^1\) Datt Ruddar and K.P.M. Sundaram, Indian Economy, S. Chand & Company Limited, New Delhi, 2004, p.487.


“Agriculture is the systematic raising of useful plants by human management.”

1.1.2 Importance of Food grains Production

Indian agriculture has been the source of supply of raw materials to leading industries like cotton, jute, textiles, sugar and small scale and cottage industries. Agriculture products like tea, sugar, oilseeds, tobacco, spices constitute the main items of exports of India. Further, providing adequate basic food to all the people is the duty of the Government. Right from the beginning the Government realised the need to attain self-sufficiency in food grains as one of the goals of planning. During the first half of this century, agricultural production rose only marginally, as compared to the growth of population. Between 1901 and 1946 India’s population rose by 38 per cent, but the area of cultivated land rose by 18 per cent, the average productivity of all crops by 13 per cent and of food crops by 1 per cent.\(^4\)

With the introduction of economic planning in 1950-51 and with the emphasis on agricultural development there has been a steady increase in the area under cultivation and productivity per hectare. This increase enabled India to stock more than 60 million tonnes of food grains at the end of 2002, which was one fifth of the world’s food stocks\(^6\). Statistics indicate that a 3 per cent growth in

\(^4\) The Encyclopedia Americana, Volume 1, Grolier Incorporated, USA, 1984, p.353.
\(^5\) Datt Ruddar and K.P.M. Sundaram, op.cit., p.488
\(^6\) Madhura Swami Nathan, It’s Time to End HUNGER AMIDST PLENTY, Reader’s Digest (India), Vol.163, No.977, September 2003, p.89.
agriculture will lead to a 2.6 per cent growth in manufacturing, which will lead to an 8 per cent growth in the Gross Domestic Products. A comparison of yield per hectare in some selected crops in India with that in other countries of the world helps to realise how much India lags behind the other countries. In the case of rice, the highest yield in the world is nearly 89 quintals per hectare recorded by Egypt. In the case of wheat, the highest yield of 80.5 quintals was recorded by England. China which is the single largest producer of both rice and wheat in the world, records the average yield of 63 quintals and 40 quintals respectively. The average annual yield of 29.3 quintals of rice and 25.8 quintals of wheat in India is far less compared to that of other countries.

The progress made in food grain production has not been adequate, especially in the context of increasing population. A number of reasons may be attributed for the poor performance of India’s food grain production. The chief reasons are the dependence on agriculture of too many people, poor techniques and traditional methods of production, inadequate irrigation facilities, marginal and small size of land holdings, and pattern of land tenure. The development of agriculture to its fullest capacity is imperative for the overall development of the economy. This being the situation, a number of researches have been undertaken to study the cultivation pattern, land holdings, productivity, production, marketing of food grains, irrigation pattern and the like.

---

1.2 PADDY

Paddy is cultivated mainly for the kernel, called rice, contained under the paddy husk. The kernel of rice as it leaves the thresher is enclosed by the hull or husk or lemma and palea and is known as paddy or rough rice.\(^8\) The Oxford Dictionary of Current English also defines paddy as “Rice that is still growing or rice in the husk”. Therefore, the production of paddy is synonymous with the production of rice or growing rice plants. Paddy or rough rice can be sold in the markets before removing the husks or as polished rice after removing the husks.

1.2.1 Origin and History of Rice

Rice, a well known cereal, is the staple food of hundreds of millions of people in the world. Cultivated rice botanically called ORYZA SATIVA was first mentioned in history in 2800 B.C. when a Chinese emperor proclaimed the establishment of a ceremonial ordinance for the planting of rice. Other authorities have traced the origin of rice to a plant grown in India in 3000 B.C.\(^9\) Excavations from Non Nok Tha in Thailand yielded carbonized rice glumes, probably dating back to 3500 B.C. or earlier. The carbonized grains obtained in India could be dated around 2300 B.C. Samples from the Lothal excavations in India reveal the use of Paddy husk in potteries, bricks, etc. The Atharva Veda mentions ‘vrihi’, probably meaning wild rice.\(^10\) To some, Rice originated in South India and spread to Southeast Asia, Japan and China in about 3000 B.C. It also spread westwards to

---


\(^10\) *Hand Book of Agriculture*, ICAR, New Delhi, 2005, p.760.
Greece, Italy and Spain after the invasion of Alexander in 320 B.C. Its antiquity is supported by many references in Vedic literatures and archaeological findings of carbonized paddy in excavations at Hastinapur dating back to about 1000 B.C. In ancient literary records and medical compilations of the Hindus like *Sushruta Samhita*, rice varieties have been grouped. Rice grains have been used in rituals and ceremonies connected with births, marriages and funerals from very ancient times.\(^{11}\)

### 1.2.2 Botanical Description:

Rice botanically belongs to *Oryza sativa* L. of the Gramineae family. Paddy is a self-pollinated crop. A complete seed of rice is called paddy and contains one rice kernel. The outer layer of rice shell is called husk. The next layer is called rice bran and the innermost part is called rice kernel. Rice belongs to the genus *ORYZA*. There are 18 valid species distributed mainly in Asia, Africa and America. Of the two cultivated species *ORYZA SATIVA* and *ORYZA GLABERRIMA*, the former is cosmopolitan and the latter is confined to Africa. The Sativa rice varieties are grouped into three sub-varieties as indica, japonica and javanica. The variety grown in India belongs to indica. The most significant characteristic of the paddy or rice crop is that it grows best when its roots are submerged. The plant has a special tissue through which oxygen is transported from the leaves to the submerged roots. Rice crop varies in height according to the variety from a few inches to the floating type that exceeds 16 feet. It consists of a shallow fibrous root system, culms, leaves and panicles. The leaf blades vary in

---

width from about half to over whole centimeters, and the colour ranges from a pale yellowish green to dark green. At the apex of the culm is the seed-bearing panicle, with branches arranged in single or in pairs.

1.2.3 Paddy Cultivation

All cultivated varieties of rice can be grouped into lowland and upland types. Low land rice, produced under irrigation or flood conditions, is normally submerged during the greater part of the growing season, whereas, upland varieties are not irrigated, and the land is never submerged. The yield of upland variety is much less than that of rice grown under irrigation. Rice adapts easily to a number of climatic and soil conditions and produces abundantly on land that is unsuitable for any other crop. Clayey soil is best suited as paddy crop requires water stagnation. It grows best in river valleys, on deltas and on coastal plains where the temperatures are between 70.0 F and 100.0 F. Rice needs an average of at least 70.0 F during the growing season of about 18 weeks, and an average rainfall of at least 130 mm. unless irrigation is used. Most of the world’s rice crops depend on rainfall and natural moisture. In addition, soil must be physically structured so as to hold a flood of water and the terrain must be smooth but sloped so that water can be added or drained as needed.

The growth of rice plant can be divided into three stages: vegetative, reproductive and maturating or ripening. The vegetative stage begins with the germination of seeds and ends with the initial development of panicles, which marks the beginning of the reproductive stage. The appearance of panicles starts the maturation stage, which is completed when the grain is ripe and has a moisture content of about 18% to 21%.
The rice crop cultivation begins with the breaking of the land. Disking and ploughing are usually done in fields divided into cuts by small dikes, or levees made from the soil obtained from the fields. Paddy seeds are broadcast thickly in small fertile nurseries and tended for about 30 or 40 days. Then the plants are transplanted in the main fields which are flooded and worked into soft mud. This system of transplanting seedlings saves irrigation water and permits the fields to grow another crop while the smaller-sized seedling bed is being grown. A good supply of fresh water is extremely important. The water either pumped from deep wells or taken from nearby rivers or reservoirs is supplied through a series of field canals. Flooding increases yield and tends to inhibit the growth of weeds. Rice land is covered with 8-10 cm. of water and the depth is maintained throughout most of the growing season.

1.2.4 Diseases and insects

Like most other crops, rice is affected by many pests, diseases, insects, worms, birds, crustaceans, and rodents in all the stages from seeding through harvesting, storing and processing. The most damaging rice disease is blast caused by the fungus Pyricularia Oryzae. It occurs in the all rice-growing areas of the world and attacks the plant in all stages of development after seedlings emerge. The insects attacking the plant include caterpillars, grasshoppers, thrips and leafhoppers. Insects are controlled by the use of resistant varieties and insecticides.

1.2.5 Weeds

Because of the peculiar conditions of growing the rice crop submerged in water and raising two or more successive crops, the lands are pastured or fallowed to control weeds. The tropical conditions are also conducive to rapid and heavy
growth of weeds during the rainy season and many of these weeds are even adapted to survive a dry season and bush burning.\(^{12}\) Therefore controlling weeds is a problem wherever rice is grown. Many grasses, sedges and broadleaf weeds are troublesome in rice fields. Weeds effectively compete with the transplanted rice and reduce the crop yield to an extent of 40 to 55 per cent\(^{13}\). Weeds can be controlled by proper land preparation, good management, and the use of herbicides. Chemical weed control of weeds is gaining ground because of the high cost of labour, lack of timely availability of labourers and continuous raining during the wet season, which do not allow timely control of weeds by manual methods.

1.2.6 Fertilisers and manures

Fertilizers and manures are essential inputs needed for increasing the production of good grains and other agricultural commodities. Medicine is sprayed for maximum production and protecting the crops from diseases. The quantity of fertilizers, manures and medicines applied depends on the fertility of the soil, crop rotation and crop intensity.

1.2.7 Paddy Harvesting

When the rice approaches maturity, the water is drained off 10 to 14 days before harvesting. Harvesting is one of the vital operations in crop production and


timely harvesting is essential for getting optimum yields. The percentage of ripe grains in the panicles determines the harvesting time. The crop is ready for harvest when 80 percent of the panicles turn straw-coloured and the grains in the lower portions or the panicles reach hard-dough. But, if the moisture content is outside the 18 percent to 21 percent range it results in a loss of quality. Crops are harvested by using combine harvester that cut and thresh simultaneously or by hand methods. Then harvested paddy is threshed. Threshing is the detachment of paddy kernels from the panicle of the plant. The separation of rice grain from the panicles occurs due to the rubbing action by trampling by man, animals or by tractors.

The harvested rice is put through a drying process which is subjected to forced warm air. This reduces the moisture level and increases the storage life of the paddy. For rice milling, the rough rice or paddy, with the husk intact and with no adhering stalk, is cleaned by selective screening separators, and air aspirations systems to remove dirt, stone, chaff, and other extraneous materials. When the drying process is complete, the paddy is either sold or stored. Harvested paddy is milled to make it rice and available for consumption. Paddy when milled gives rice and byproducts and there are two processes to do it. In one process the paddy is directly fed to the milling machines and in the other, boiled (par boiled) wherein the paddy is boiled and dried. Then it is taken for milling.
1.3 THE MILLING OPERATIONS\textsuperscript{14}

The coarse husk of paddy is loosened from the kernel by either disk or rubber roll shellers. Paddy passes from the centre of the sheller to its periphery by tumbling centrifugal action. This abrasive action removes the husk. Following the sheller operation, the low density husks are lifted and separated by air aspiration. Hulls are used as boiler feed stock and as a press aid in juice extraction.

The remaining paddy and dehulled kernels are conveyed to a separator which is commonly called a paddy machine. This unit separates the less coarse paddy from the dehulled kernels. The dehulled kernel with seedcoat intact is termed “brown rice”. Brown rice is further milled to remove bran and thus produce a whitened product by progressive abrasion in a series of measures referred to as hullers or pearlers. As the brown rice passes between the abrasive surfaces the outer bran layer is removed. The fine particles are then removed through sieve. Further whitening of rice may be accomplished by brushing or polishing to remove the inner white bran. The abrasive action is obtained among the kernels and bran separated by screening. This procedure develops light-coloured fines termed rice polish.

Milled kernels are separated by size by using a variety of systems. Brewers’ rice is the smallest kernel fragment screened and is used as fermentation feed stock. Medium-sized pieces (less than one third kernel) are termed as screenings; second heads include large pieces up to three-fourths of a kernel, while the whole unbroken kernels are classified as heads. Polished rice may be surface-coated with

glucose by tumbling to improve its gloss, sheen and uniformity. The difference is
the head yield of rice received. It is much more in boiled rice. On an average 100
kgs of paddy gives 70 kgs. of rice. The rice milling operations and products can
be explained with the help of the following diagram.

Figure 1.1
General Rice Milling Operations and Products
1.4 COMPOSITION AND NUTRITIONAL VALUE OF RICE

1.4.1 Composition

After the harvested paddy or rough rice is put into milling processes paddy becomes rice, obtains a good cooking quality and is available for consumption or storage. The composition and the level of nutrient values of rice differ according to the variety grown, the soil in which it is grown and the fertilizers and the manures applied. Proteins, fats, vitamins and minerals are present in greater quantity in the germ and outer layers of paddy grain than in the starchy endosperm. Due to milling and polishing of rice considerable losses of these nutrients take place. The degree of milling polishing determines the amount of nutrients removed. The composition of husked rice and polished rice and the loss on milling and polishing are given in the following table.

Table 1.1

Composition of Rice-Husked and Milled
(Percentage on moisture free basis)

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Husked</th>
<th>Polished</th>
<th>Losses on milling and polishing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat</td>
<td>2.23</td>
<td>0.36</td>
<td>85.33</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>0.83</td>
<td>0.25</td>
<td>64.76</td>
</tr>
<tr>
<td>Ash</td>
<td>1.43</td>
<td>0.55</td>
<td>57.30</td>
</tr>
<tr>
<td>Protein</td>
<td>9.03</td>
<td>7.48</td>
<td>15.60</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>80.03</td>
<td>87.06</td>
<td>-5.5</td>
</tr>
</tbody>
</table>

Source: “Rice” (book) issued by The Fertilizer Association of India, New Delhi 1969
1.4.2 Nutritional Value of Rice

Rough rice or paddy is used for seed and as feed for livestock, whereas, polished rice is used for human consumption. Rice is available cooked or uncooked, canned or dry, or frozen. Probably no other food is offered in so many combinations. Its versatility in breakfast cereals, soups, salads, dinners, desserts, and baby food is unsurpassed. The various types of rice are the products of several different milling processes. The simplest and the most widespread product is ordinary milled white rice, which is sold everywhere ready to cook. Broken rice is used as a livestock feed and for the production of alcoholic beverages. Rice bran has a pericarp, aleuronic layer, germ and endosperm. The raw rice bran contains about 18 to 20 per cent oil and the parboiled rice bran contains about 22 to 25 per cent oil. The de-boiled bran containing protein (17 per cent) and vitamins is used for livestock feed: the hulls are used for fuel and cellulose and in the manufacture of insulation materials, cement and cardboard. The straw is used for thatching roofs, woven into rope and used as cordage for bags. This crop serves a multitude of purposes in the regions where agriculture depends largely on rice.\(^{15}\)

Rice is primarily a high energy calorie food. The major part of rice consists of carbohydrate in the form of starch, which is about 72-75 percent of the total grain composition. The protein content of rice is around 7 percent. The protein of rice contains glutelin, which is also known as oryzinen. The nutritive value of rice protein (biological value = 80) is much higher than that of wheat (biological value = 60) and maize (biological value = 50) or other cereals. Rice contains most

\(^{15}\) Ibid., p. 563.
of the minerals mainly located in the pericarp and germ and about 4 percent phosphorus. Rice also contains some enzymes.

Table 1.2

<table>
<thead>
<tr>
<th>Type of Rice</th>
<th>Energy (Calories)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Calcium (mg)</th>
<th>Fe(Iron) (mg)</th>
<th>Thiamine (Vitamin B1) (mg)</th>
<th>Riboflavin (Vitamin B2) (mg)</th>
<th>Niacin (Vitamin B5) (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Milled</td>
<td>345</td>
<td>6.8</td>
<td>0.5</td>
<td>10</td>
<td>3.1</td>
<td>0.06</td>
<td>0.06</td>
<td>1.9</td>
</tr>
<tr>
<td>Parboiled Milled</td>
<td>346</td>
<td>6.4</td>
<td>0.4</td>
<td>9</td>
<td>4.0</td>
<td>0.21</td>
<td>0.05</td>
<td>3.8</td>
</tr>
<tr>
<td>Flakes</td>
<td>346</td>
<td>6.6</td>
<td>1.2</td>
<td>20</td>
<td>20.0</td>
<td>0.21</td>
<td>0.05</td>
<td>4.0</td>
</tr>
<tr>
<td>Puffed</td>
<td>325</td>
<td>7.5</td>
<td>0.1</td>
<td>20</td>
<td>6.6</td>
<td>0.21</td>
<td>0.01</td>
<td>4.10</td>
</tr>
</tbody>
</table>


1.5 RICE TERMINOLOGY

1.5.1 Rough rice or paddy: Defined as rice in the husk after threshing.

1.5.2 Stalk paddy: Defined as unthreshed in the husk, harvested with part of the stalk.

1.5.3 Husked Rice: Rice from which the husk only has been removed retaining still the bran layers and most of the germs. Such rice is sometimes erred to as bran rice even though there are variations with red or white bran coats.

1.5.4 Milled rice: Rice from which husk, germs, bran layers have been substantially removed by blower machinery, also known as polished rice and if milled to high degree it is called white rice.
1.5.5 **Under milled rice:** Rice from which the husk germs and bran layers have been partially removed by power machinery and is also known as unpolished rice.

1.5.6 **Hand produced rice:** Rice from which the husk, germ and bran layers have been partially removed, without the use of power machinery, also known as “home produced” or “hand milled rice”.

1.5.7. **Parboiled rice:** Rice, which has been specially processed by steaming or soaking in water, heating usually by steam and drying. Parboiled paddy can be milled to various degrees or home produced in the same way as ordinary paddy. It is called parboiled milled or parboiled hand pounded.

1.5.8. **Raw milled:** The paddy, which is milled not after giving heat treatment, such as parboiling.

1.5.9 **Coated rice:** Defined as rice milled to a high degree and then coated with glucose.

1.5.10 **Whole grain:** Refers to husked, milled or hand produced rice which does not contain any broken grains smaller than 3/4 the size of the whole kernel.

1.5.11 **Broken rice:** Husked, milled or hand produced rice consisting of broken grains of less than 3/4 th size of the whole grain but not less than 1/4 th.

1.5.12 **Fragmented rice:** Small broken rice upto 1/4 th size of the whole grain.

1.5.13 **Husk:** The by-product from the milling of rice consisting of the outermost covering of the rice kernels.
1.5.14 Bran: A by-product from the milling of rice consisting of the outer layer of the kernels with part of germ.

1.5.15 Rice polishing: Now defined as the by-product from milling rice, consisting of the inner bran layer of the kernel with part of the germ and a small percentage of the stony interior also known as rice meal or rice flour elsewhere.

1.5.16 Glutinous rice: A type of rice, which after cooking has a peculiar stickiness regardless of how it is cooked.

1.5.17 Scented rice: A type of rice, which contains aroma and gives scented smell on cooking.

1.6 STATEMENT OF THE PROBLEM

Even though agriculture is the linchpin of Indian economy, the farmers, especially those with mean landholdings, feel that what they earn from paddy cultivation is not sufficient to meet even their basic needs. Besides, the pressure on population has reduced the area of cultivated land per cultivator from 0.43 hectares to 0.20 hectare during 1901-1998\textsuperscript{16}. The overall land under food grains has remained at 120 million hectares and is showing signs of dropping further. The public investments in agriculture as a percentage of Gross Domestic Production (GDP) has dropped from 3 percent to around 1.7 percent in the last decade, the annual per capita food production has declined from 207 Kgs. in 1995 to 186 Kgs.

in 2006, the average annual growth rate of agriculture from 2002 has been 1.87 per cent; still 60 per cent of the rural households own less than one hectare of land. As a result the contribution of agriculture to the GDP has declined from 38 per cent in 1975 to around 19 per cent in 2006 and farmers’ incomes rose by a measly 0.28 per cent as compared to the 4 per cent in other sectors.\textsuperscript{17} The changes in climatic conditions, the markets and resource decision in other sectors of the economy and major diversion of land meant for food grain cultivation into commercial crops such as oil seeds and cotton also place paddy cultivators in a contemptible state. With commencement of farming operations the tribulations begin to creep up and continue to exist till putting the marketable surplus for sale. As poor farmers are reluctant to switch over to other activities or occupations for their livelihood they continue to be cultivators throughout their life facing the same type of problems with no let up.

The problems encountered by paddy cultivators can be stated as of two types, the one relating to production and the other relating to marketing. Increased cost of inputs, low productivity, frequent monsoon failures resulting in crop loss, pest and diseases menace and inadequate Government’s support are some of the problems relating to production, while forced sale to pay off loans, unremunerative prices, higher commission rates of middlemen, unethical market practices and absence of adequate market and storage facilities are a few of those relating to marketing.

In India the problems of paddy producers are the same across the length and breadth of the country. But the magnitude of the problems may vary depending upon the regions they belong to and the seasons of cultivation. Paddy producers supplying nearly half the food grain requirements of the Indian population are no exception to the problems generally faced by agriculturists. Therefore, a study of the paddy production by analyzing the factors of production, resource-use efficiency, impact of production factors on productivity, and discovering and describing the problems in cultivation will pave the way for increasing the productivity by implementing the optimum utilization of resources.

Equally important is marketing paddy. It is one of the manifold problems which have a direct bearing upon the cultivators. The Royal Commission on Agriculture in India (1928) rightly remarked that “until agriculturist realizes that as a seller of produce he must study the art of sale either as an individual or through combination of other producers, it is inevitable that he must come off second best in the contest with highly specialized knowledge and vastly superior resources of those who purchase his produce”\(^\text{18}\). The prevailing system of paddy marketing is considered as ‘Not cultivator-friendly’. The presence of superfluous middlemen, the seasonal production, absence of competitions, weak channels of distribution, and reluctance in supplying market information make paddy marketing imperfect and ultimately needs a thorough overhauling.

The Cumbum Valley in Theni district is one of the most important paddy cultivation areas of the district. The district known for its green fields and water

resources occupies a unique place in the agriculture map of Tamil Nadu state. The total cultivated area of the district is 3,20,735 acres, of which paddy alone is cultivated in 45,916 (14% of cultivated area) acres. The study area, Cumbum Valley is located in the South western part of Theni District. The western and southern boundaries of the valley are marked by the Western Ghats, whose watershed also marks the boundary with Kerala; the eastern wall of the valley is formed by an off-shoot of the Ghats with Highwayvys and the Erasakkanaykkanur Hills. The Periyar River, the lifeline of the district, enters the valley from its south-western apex and runs in a southwest and north east direction of the district. It is a distinct geographical and agricultural unit within the district and one with a relatively developed level of agricultural technique, particularly on the surface irrigated lands. The Periyar River also called the Mullai Periyar River Scheme irrigates 20060 acres of paddy land of which 14707 acres are double cropped area under the old ayacut and 5353 acres are single cropped under the new ayacut schemes. The Manjalar River Scheme and the Sothuparai Reservoir Project respectively irrigate 3148 and 1040 acres of single cropped areas in other parts of the district. The total rice growing lands irrigated by these schemes are 24,248 acres. Raising rice crops using ground water is also carried out in the district.

In the agricultural year 2004-05 paddy production in the district was 67,094 metric tonnes. The district holds 0.89 percentage of the total area of Tamil Nadu and contributes 1.33 percentage of production. The district’s average yield of 4033 Kgs per hectare has placed the district in the third position in productivity ranks.
The population of the district is 10,93,950 (census 2001) spread across 3242.30 square kilometers. Of the total population 1,09,343 (9.99 % of total) are cultivators and 5,91,006, representing 54.02 % of the total population, are engaged in agricultural activities. Since a significant proportion of the population is engaged in agricultural activities the district may be said to be agriculture-centered. Hence the selection of the area and the present study.

1.7 IMPORTANCE OF THE STUDY

Among the rice producing countries of the world, India occupies an important place in terms of total area under cultivation and total production but as far as productivity and growth rate are considered it is not in a place of pride. Anindya Bhukta\textsuperscript{19} said that during the decade 1991-2001 the growth rate of food grain was only 1.66 percent per annum, whereas the population growth rate was 1.9 percent over the same period and some of the reasons behind this slow growth rate are the fall in public investment in agriculture, the liberalization of agricultural trade, the falling prices of the agricultural products in the world market, the withdrawal of input subsidies and the disproportionate use of fertilizers. It is said that the annual average farm growth rate has declined from 4.9 per cent in the Eighth Plan to 1.3 per cent in the Tenth Plan. The average size operational holding declined from 2.28 hectares in 1970-71 to 1.41 hectares in 1995-96. In other words, 78.7 per cent land holding is of the size of less than two hectares. The reduction in land holding size is one of the major causes for worry\textsuperscript{20}.


\textsuperscript{20} \textit{The Hindu (Daily)}, Vol.128, No.228, dated September 26, 2005.
In same way the compound growth rate of production and productivity fell to 1.74 and 0.92 per cent in the 1990s from 3.55 and 3.47 per cent in 1980’s.\(^{21}\)

With 4,23,00,000 hectares of land under paddy cultivation and 12,90,00,000 metric tonnes of production in the year 2004, India ranks first in total cultivated area and second in total production, the percentages being 27.96 and 21.30 respectively of the world total. The productivity is also increasing from year to year except for the years with less than average annual rainfall. But a comparison of the productivities in major rice producing countries with that of India indicates its poor performance in increasing productivity. The per hectare yield of paddy by the major producers India, China, Viet Nam, Indonesia, Japan, Philippines and Egypt were respectively 2000.2, 4143.5, 2079.8, 3292.8, 5127.9, 2210.5 and 5833.1 Kgs. in the year 1980 and 3049.6, 6263.8, 4852.1, 4539.7, 6415.1, 3513 and 9685 Kgs. in 2004. Egypt is on the upper rung of productivity ladder followed by Japan and China\(^{22}\). Thus major producers except India have shown a manifold increase in productivity.

The fast increasing population builds up the need for tapping the vast opportunities to increase food production, particularly paddy. Rice is a water-intensive crop and given the restricted availability of irrigation potential, increasing the area under the crop to increase rice production calls for huge investments in irrigation. Hence, the increase in production can be made by making a breakthrough in productivity and increased efficiency in production.


\(^{22}\) Food and Agriculture Organisation’s (Rome) Statistics.
Vyas\textsuperscript{23} after analysing India’s agricultural performance in the last 25 years concluded that the rate of growth in the agricultural sector was sluggish as compared to the needs. He opined that the rate of growth should be 3.9 per cent per annum. If the rate of growth is lower than this the problems of food security will aggravate.

In India paddy cultivation is carried out in almost all the states, but prominently in West Bengal, Uttar Pradesh, the Punjab, Andhra Pradesh, Tamil Nadu, Bihar and Haryana. Even among these states equality in productivity is not maintained because of the presence of different agro-climatic conditions. Besides, some other reasons may also said to be the causes for poor and varying levels of yield.

Another major factor affecting the paddy farmers is the uncertainty of remunerative prices. Therefore, marketing of paddy also assumes significance, because any increase in the consumer price will affect the people and at the same time the producers should get remunerative prices for their produce. S.S. Acharya\textsuperscript{24} opined that apart from performing physical and facilitating functions of transferring produce from producers to consumers, the agricultural marketing system also performs the function of discovering the prices at different stages of marketing and transmitting the price signals in the market chains. Therefore, removing the obstacles in marketing the produce is essential to ensure that paddy


producers get remunerative prices for their produce. At this juncture, tracing the bottlenecks in production and marketing of paddy, and suggesting ways and means to accomplish the task of increasing paddy production are vital.

The increase in paddy production will help develop rice processing industries. These agro-based industries will create backward linkages like supply of credit, inputs and production enhancement services, and also forward linkages like processing and marketing. Such a development will add to the value of farmers’ produce, generate employment opportunities and increase the incomes. This, in turn, will lead to industrial and economic development.

1.8 SCOPe OF THE STUDY

The fluctuations in rice production and its prices would affect both consumers and farmers. A study of the cost and return structure of paddy plays no less a role in finding the economics of paddy cultivation. The cost of production also varies across seasons and the size of land holdings. An analysis of the factors influencing the yield and the degree of their impact, and the relationship between the size of land holdings and the productivity will also help in formulating suitable agricultural policies. Thus, the present study includes the productivity of paddy, the benefits to costs of production and the marginal productivity of factors involved in production. Further it includes the functioning of agencies engaged in the distribution and also the price spread. It takes account of the problems in the production and marketing at the micro level. The results of the study may help solve the problems faced by the paddy cultivators in the study area. The findings also provide guidelines to farmers on the rational use of resources. The present
study covers the irrigated double cropped paddy cultivation area of Cumbum Valley in Theni district. The respondents were the farmers cultivating paddy in owned, leased or tenancy lands, the middlemen and the rice millers trading and/or processing paddy.

1.9 REVIEW OF LITERATURE

A review of previous literatures on the study and the concepts used in the study are offered in this section. This section is divided into

i) Studies relating to Cost

ii) Studies relating to Production/Yield

iii) Studies relating to Marketing

iv) Concepts used in the study

1.9.1 Studies relating to Cost

This part of the review includes references relating to the cost of production, cost structure, factors of production or inputs and also cost components.

Nirmala after analyzing the rice cultivation found that operational cost forms about 70 per cent of the total cost and rice cultivation is labour intensive. The other conclusions arrived at are: (i) female labour was preferred for nearly all farm activities as they are paid relatively lower wages than their male counterparts; ii) higher production was achieved by small farmers than by large
farmers but the large farmers earned greater profits due to their better credit position, storage and other facilities.\textsuperscript{25}

V.Gurusamy\textsuperscript{26} observed that the demand for labour was likely to increase with an increase in price of rice, area and capital. In the case of high yielding varieties an increased amount of capital had the capacity to absorb more labour compared to traditional varieties and in terms of technology high yielding variety was not a labour-intensive one.

A study on the farm size and returns to scale in paddy cultivation in a village in Tamil Nadu was conducted by Subramaniyan and Chelladurai\textsuperscript{27}. They used human labour, bullock labour, fertilizer and pesticides as the variables to measure the profit function and concluded that the demand for labour was more responsive to paddy than wage rate and there were constant returns to scale.

D.C. Shah and Amita Shah\textsuperscript{28} showed that the opinion “increasing fertilizer use will result in economic gains” was prevalent with all categories of farmers, and they noticed the “excessive use of fertilizers” was also widespread, particularly among the farmers who had received soil test recommendations.


\textsuperscript{26} V. Gurusamy, \textit{The Impact of Technological Change on Agricultural Production with Special Reference to Paddy Cultivation in Nellai Kattambomman District, Tamil Nadu}, Unpublished Ph.D., Thesis, Madurai Kamaraj University, Madurai, 1995.

\textsuperscript{27} G. Subramaniyan and S.Chelladurai, \textit{Farm- Size, Returns to Scale and Absorption of Labour in Tamil Nadu Agriculture: A Micro Analysis}, Paper presented at 23\textsuperscript{rd} All India Econometric Conference, Osmania University, Hyderabad, January 3, 1985.

These observations were made in a study examining input use efficiency in Gujarat.

Govindadass in his study “Education and Agricultural Innovations” concluded that the cultivation of paddy seemed to be highly risk oriented. The small and marginal farmers were mostly risk-conscious and this was found to be a cause for low adoption of modern innovations in paddy cultivation. The level of information-seeking increased as the level of education of sample respondents improved.29

An attempt to measure the existing economic efficiencies and to estimate the cost and production potential of reclaiming salt-affected soils, and also to decide the investment priorities to increase wheat and paddy production was made by K.K.Datta and P.K.Joshi30 in Aligarh district of Uttar Pradesh. The conclusions to emerge from the study were: yields on normal soils could be increased by reducing the gap between the best adopted and the average levels of technology, salt-affected soils had also enough production potential with the available technology and the cost of producing additional output was significantly lower on normal soils by achieving economic efficiencies in comparison to the salt-affected soils and the investment priorities may be developed accordingly.

According to Nilabja Ghose\textsuperscript{31} labour cost was a component of the broad category of the operational cost that included items such as fertilizers, pesticides, fuel, fodder, seeds, and irrigation charges. An above normal rainfall pushed up cost in paddy cultivation, especially the labour cost. It was further articulated that the output value of paddy influenced the cost and the larger revenue came with greater input use and communication facilities were likely to bring down the input cost of cultivation.

In a micro level study by Joydeb Sasmal\textsuperscript{32} the input set considered was seed, fertilizer, pesticides and labour. The study was carried out to empirically estimate the production function for the High-yielding Variety (HYV) of paddy during rainy and dry cropping seasons in a district of West Bengal. In the study seed, fertilizer and pesticide were measured in terms of value, and the labour in terms of man-days of male workers. The output was measured in terms of kilograms. The findings were that the coefficient of labour was positive and highly significant in influencing the mean output. The other outputs had also a significant impact on mean output in both the seasons.

M. Mahadevappa\textsuperscript{33} in his study of potentials of organic farming, suggested the application of organic farming method in rice cultivation. According to him

\begin{flushleft}


\end{flushleft}
though the yield obtained per unit of land by this method is low the rice produced by this method would fetch premium prices. Further, organic farming practices would involve the use of inputs like farmyard manures, animal droppings, bio fertilizer and bio-control agents like earthworms. The increase in demand for these inputs would bring about increase in employment generation.

M. Mahadevappa\textsuperscript{34} in another study of strategies for enhancing rice production, said that the adoption of Madagascar method, the Aerobic method and the System of Rice Intensification (SRI) method would help save nearly 30 per cent of water from the present water requirement for cultivation. The implementation of this method in rice growing areas would enable the cultivators to extend the cultivation areas by utilizing the water saved.

Vishwa Ballabh and Sushil Pandey\textsuperscript{35} highlighted the economic and institutional changes occurring in rice production in Eastern India. Two sample villages in Uttar Pradesh, an Indian state, were taken for the study. It was exposed that Eastern India, because of the rainfed nature of agriculture, made slower growth and this continued to be a cause for concern. As agriculture was further intensified, off-farm and non-farm opportunities expanded leading to the labour markets by market forces rather than by the social and communal factors.


Innovative technological policy and institutional interventions were needed to guide the process of economic growth.

In a study pertaining to Manipur, a North-Eastern state of India, to evaluate the “effects of change in rice production technology on functional income distribution” by W. Kumar Singh the following observations were made: the new technology introduced in the state has been biased towards the use of land and fertilizer; the technical bias in favour of fertilizers and labour was present among small size of holdings; with the increase in the level of literacy farmers were more likely to use more chemical fertilizers; and, to avoid technical bias against the use of labour the land reform policies should be effectively implemented.36

S. Subrahmanyam et al.,37 examined the major changes brought about in the agricultural economy of Andhra Pradesh in terms of irrigation, cropping pattern, and the land holding distribution and the implications of these changes on energy use. They came out with many conclusions: paddy and cotton consumed more energy compared with pulses and millets; small farmers used more energy than large farmers per unit of land; but large farms used more irrigation energy; the contribution of traditional inputs was higher than that of modern inputs, perhaps, because of the high energy intensity of ground water.

J.S. Awotundun states that the cost of weed control exceeded that of any other crop pest. Farmers spent more time and money on weed control than any other production factor.\(^{38}\)

W.M.H. Hasneen Jahan and Jaim\(^{39}\) studied the changes in cost and return structure in Bangladesh and indicated that farming had become more capital intensive rather than labour intensive and cash need was on the increase in the recent years.

Sikander Kumar and Sandeep Kumar measured the gross yield at the harvest price irrespective of the output being consumed, sold or maintained in the stock. They measured the land input in terms of hectare, human labour in terms of hours of labour actually put in, bullock labour in terms of eight hour day worked, the manures, fertilizers and seeds in the value of their respective market prices.\(^{40}\)

The Directorate of Economics and Statistics\(^{41}\) applied four cost concepts in many of the production and farm management studies. According to the Directorate farm costs can be grouped into Cost A1, Cost A2, Cost B and Cost C. The components included in each of the group are discussed below.

---


**Cost A1:** It includes expenditure incurred in cash and kind. It consists of the value of hired labour, the value of bullock labour (owned and hired), machine labour, the value of seeds, manures and fertilisers, plant protection chemicals, irrigation charges, land revenue, cess, water tax, interest paid on working capital, depreciation on implements, machinery, farm equipment and the like.

**Cost A2:** Cost A1 + Rent paid for leased land

**Cost B:** Cost A2 + rental value of owned land plus interest on fixed capital excluding land.

**Cost C:** It includes Cost B + imputed value of family labour.

Rajagopalan\(^{42}\) in his study of the cost and return structure of principal crops in the districts of Tamil Nadu used only two cost concepts namely Cost A (Variable cost) and Cost C (Fixed Cost). The following components are included in Cost A and Cost C.

**Cost A:**

i. Value of human labour including family labour
ii. Value of bullock labour
iii. Value of machinery charges
iv. Value of seeds
v. Value of insecticides
vi. Value of manures and fertilisers

---

vii. Cost of irrigation
viii. Interest on working capital

**Cost C:**

Cost A plus rent (including rent paid by tenant or rental value of owned land) + Interest on fixed capital excluding land + land revenue, cesses and taxes + depreciation of implements and machinery.

**1.9.2 Studies relating to Production /Yield**

Observations on the previous studies relating to production, productivity/yield and resource use efficiency of inputs on yield as viewed by the researcher are outlined in this section.

The economic contribution of education and extension contacts on farm production was estimated by P. Duraisamy\(^{43}\) in East Coimbatore (Periyar) and North Salem districts of Tamil Nadu. In the survey, 70 per cent of sample farmers were paddy cultivators. The following conclusions emerged from the study.

i) Education had a positive and significant effect on farm production.

ii) One yearly increase in education of the head of the farm household increased paddy output by one per cent and the gross sales value from all crops by 4 per cent in monetary units.

iii) Above middle school level of education was needed to have a significant impact on farm productivity.

iv) The average education of adult males of the household had a little bigger effect than the education of the head of the household on farm production.

v) The extension effect on paddy output was about 6 per cent and on the gross value was about 10 per cent.

On the basis of these conclusions the suggestion put forth was to invest more in formal schooling in rural areas and extension services to accelerate the agricultural growth.

Gyan Prakash, Ramkumar Jha and R.C. Sharma estimated the growth rates of food grains production in India and observed that the Compound Growth Rate of Areas, Production and Yield of rice were respectively 1.4, 2.7 and 1.4 during the Pre-Green Revolution period (1955-56 to 1965-66), and the growth rates have changed to 0.8, 2.5, and 1.7 in the Green Revolution period (1966-67 to 1976-77), to 0.3, 2.0 and 2.8 in Post-Green Revolution/Pre-economic Reform period(1977-78 to 1991-92), and to 0.7, 2.0, and 1.0 in Post- economic Reform period(1992-93 to 1998-99). The overall growth rates for the whole period (1955-56 to 1998-99) were 0.7, 2.7 and 2.0. Their study further showed that future growth in food grains production would be extremely demanding and therefore more emphasis should be laid on technology-based growth in agriculture, and the adoption of growth promoting inputs like HYV, chemical fertilisers and irrigation. These inputs should be arranged and made available in time and in adequate quantities.

---

The difference in the rate of growth of rice yield in India was studied by Parthasarathy and Prasad\(^\text{45}\) and the study showed that the difference in yield was due to the difference in factors such as infrastructural development, environment, the level of input use and the development of institutions.

B.C. Barah and Shusil Pandey\(^\text{46}\) tested the inter-regional disparities in rice yields in eight states of Eastern India and found the existence of yield variations across the states despite differences in production practices and adoption of modern varieties. The reason for variations in yield was due to the absence of uniform or balanced cultivation of modern varieties; and because of this, farmers had to grow the same variety in all the seasons under different ecosystems. They proposed providing infrastructure such as affordable irrigation, other input supply facilities like stress resistant varieties and encouraging a farmer-friendly practices in cultivation.

V. Ratna Reddy et al.,\(^\text{47}\) analysed the potentials of the System of Rice Intensification (SRI) in Andhra Pradesh state. According to them the gain from SRI was water saving rather than yield improving capability. They were for Government promoting the SRI especially in the water-scarce regions which


experienced a low employment rate and a large scale seasonal migration of agricultural labourers.

In an attempt to highlight how the farmers of Mandya district of Karnataka exploit their resources in the production of rice, H. Jayaram et al.,\textsuperscript{48} observed the over-use of resources in the production of rice. The high subsidy, both implicit and explicit, accorded to the resources like irrigation was the cause for inefficient use. Hence, steps should be initiated to rationalise the prices of resources used in production so as to improve the efficiency of farmers in resource use.

In a study by Krishna Reddy et al.,\textsuperscript{49} of resource productivity and resource use efficiency in paddy cultivation the following findings were made

i) On small farms the ratio of marginal variable product to the opportunity cost was greater than unity indicating less utilizations of area.

ii) The ratio was less than unity in medium farms and negative in large farms indicating higher utilization of the area.

iii) The production function result shows that reallocation of resources among the three types of farms has to be adopted.

iv) The rental charges have to be reduced and the area under this crop for small farms has to be increased significantly to get more profits.


The production function framework involves a notion of the optimality of levels of use of all inputs\textsuperscript{50}. Production function is said to be a mathematical expression of the relationship between the quantities of inputs employed and the quantity of output produced. The process of expressing the relationship can be carried out in terms of the physical relationship between inputs and outputs or in terms of the levels of output and levels of costs.\textsuperscript{51}

Production function consists of those combinations of inputs so that the corresponding amount of output can be produced from the given inputs. Production function is the relationship between inputs and outputs so that inputs are combined to produce the output in the most efficient way.\textsuperscript{52}

In the context of production function analysis, the optimum level of production yielding the maximum profit occurs at a point of tangency of the production. When farmers operate at this point, they are economically efficient and maximizing the profits.\textsuperscript{53}

Production function expresses a functional relationship between quantities of inputs and outputs. It shows how and to what extent output changes with variations in inputs.\textsuperscript{54}


U.L. Jyothirmai et al., defined production function as the relationship between gross returns of the crop output and the specified variables.\textsuperscript{55}

The basic assumption of production function is that output alone is subject to random errors.\textsuperscript{56}

In an effort to draw attention to the variability in crop yields of five major cereals grown in different agricultural regions of Andhra Pradesh, Ganesh Kumar\textsuperscript{57} stated that none of the crops did show falling yields. The yield disparities for rice are low and remained unchanged over time and the superior cereal rice had experienced growth in all the regions.

B.C. Roy and K.K. Datta,\textsuperscript{58} identified ten production constraints causing production losses in the rice-wheat system. The study was undertaken in the Trans-Gangetic plains of Haryana. According to the study irregular power supply, non-availability of labour during peak periods and high cost of plant protection chemicals were the three top-most problems.


In evaluating the trend and instability in rice production in Kerala state, Elsamma Job and V. Nandamohan,\(^{59}\) summarised that the area and production of rice in Kerala had shown a declining trend and the rate of decline in growth had been steeper in area than in production. That is, the declining trend in production has been less than that of area. The lesser decline in production growth rate was mainly due to the disappearance of marginal lands, whereas the decline in growth rate of the area was because of the farmers’ preference to cultivate in the most suitable lands only.

C.Hazarika and S.R Subramanian\(^ {60}\) studied the technical efficiency of the tea estates in Assam to help to formulate policy measures to remove the production constraints. They came to the conclusion that even under the present technology potentials there were chances for improving the productivity with proper allocation of existing resources, and they further emphasized the significance of educating the tea planters on the rational use of inputs.

According to Nivedita Deka and B.C. Bhowmick\(^ {61}\) factors like age, education, number of farm workers and irrigated area of paddy influenced the technical efficiency positively, while upland and lowland areas had influenced the technical efficiency negatively. They were of the opinion that to increase the yield of rice, cultivation of this cereal in the medium land with proper irrigation should


be undertaken. These conclusions were arrived at in a study on the technical
efficiency in rice production in selected areas of Assam state.

In another study on resource use efficiency in Indian agriculture between
1970-71 and 1997-98 R.S.Singh et al.,\textsuperscript{62} showed that over the years gross cropped
area, cropping intensity, net irrigated area and gross irrigated area have increased,
whereas the net sown area has decreased. As per the study irrigation was found to
be the most determining factor in the productivity of food grain. This was
followed by animate and mechanical power. The study proposed for provision of
long-term low interest credit facilities, especially for marginal and small farmers
for the installation of irrigation facilities.

In assessing the economic viability of small and marginal farmers of
Northern Karnataka L.K.Wader and A.K. Koulagi\textsuperscript{63} explained that small and
marginal farmers exclusively dependent on rainfed farming have failed to achieve
economic viability. They proposed the promotion of agri-based subsidies and the
development of non agri-based subsidies so as to enable them to achieve economic
viability.

K.R.Shanmugam\textsuperscript{64} in analyzing the economics of the cultivation of major
principal crops including rice in the state of Tamil Nadu, brought to light the fact

\textsuperscript{62} R.S. Singh, V.V.Singh and Pradeep Shrivastava, \textit{Resource Use Efficiency For Food Grain

\textsuperscript{63} L.K. Wader and A.K. Koulagi, \textit{Constraints in Agricultural Production to Attain
Economic Viability on Small & Marginal Farms: A Study}, \textit{Southern Economist}, 2006,
Vol.44, No.18, pp.21-22.

\textsuperscript{64} K.R. Shanmugam, \textit{Technical Efficiency of Rice, Groundnut and Cotton Farms in Tamil
that land and labour were the significant determinants of the output of all crops; the returns to scale parameters for all crops show constant return to scale, the average technical efficiency of raising rice was 82 per cent, and he further said there was considerable room for improvement in the productivity.

In examining the levels of technical efficiency in the production of rice, groundnut and cotton in the state of Andhra Pradesh Rama Rao et al., concluded that the intensity of rice yields to fertiliser nutrient could be due to factors like the high rates of fertiliser use and soil salinity. It was further observed that the yields of rice can be improved by 15 per cent from the present level.

A study was conducted by C.Senthil Kumar and T.Alagumani, in the Lower Bhavani Project command area in Tamil Nadu with a view to assess the productivity, water use efficiency and resource use efficiency in paddy cultivation. The study highlighted the existence of variation in the productivity of paddy due to the availability of water. The resource use analysis showed that the marginal value productivity for manure, water and plant protection was found to be greater than the marginal input cost. This indicated there is a possibility of increasing the yield by increasing the use of these inputs in the command area.

---


P. Nasurudeen and N. Mahesh\textsuperscript{67} measured the efficiency of paddy farms in the Union Territory of Pondicherry. The results indicated that about 12.62 per cent of the farmers belonged to the most efficient category and 23.45 per cent to the least efficient group. The allocative efficiency measures also indicated that about 15.86 per cent of farmers belonged to the most efficient category and 21 per cent in the least efficient category. They said there was a possibility of increasing the output level by 36 per cent in the short run and reduce the costs by 24 per cent.

In estimating the technical, allocative and cost efficiencies of individual farms raising paddy or wheat in an area of Haryana state, Jal Singh, Philip Hone and K.K.Kundu \textsuperscript{68} measured the cost efficiency by comparing the actual cost incurred in producing the farm’s actual output with the cost of that which would have been incurred to produce the actual output and the technical efficiency was measured by comparing the output to the level of input used, and they opined that allocative efficiency as the difference between cost efficiency and technical efficiency. The study showed that the differences in efficiency level were due to the differences in the degree of the soil degradation and there was scope for bridging the gap between actual and potential production.

In analyzing the yield gap in paddy cultivation in Kerala state, Elasamma Job\textsuperscript{69} made known that the average farmers are operating at a lower level of


efficiency when compared to the progressive farmers. The mean efficiency of the average farmers was 64.68 per cent while the estimated efficiency on the part of the progressive farmers was 77.80 per cent.

L.R. Kumar et al., 70 explored the difference in technical efficiency levels in rice growing farms of the North West Himalayan Region and came to the conclusion that the overall technical efficiency in the case of improved rice growing farms was higher than that of farms growing local varieties, and increasing the share of rice cultivation under irrigated situation in the total farm area can bring about improvement in the overall technical efficiency.

Tom Coelli et al., 71 measured the efficiency of rice farmers in Bangladesh. According to them a majority of allocative efficiency could be attributed to overuse of labour and fertilisers, pointing towards a disguised unemployment problem. Large farmers were likely to be more inefficient and the farmers with better access to input markets and those who did less off-farm work were more efficient. Age, education, experience, soil fertility, extension and training were not largely influencing the efficiency levels

Sankara Ramalingam 72 studied the cost of production, yields and profits of Low Yielding Varieties (LYV) and High Yielding Varieties (HYV) of paddy

cultivated in a village in Tamil Nadu. He stated that with the lesser cost of production, the yields as well as profits were higher in the case of the HYV. But the LYV paddy cultivation required higher cost of production but the yields and profits were lower than those of the HYV.

In examining the impact of risk and risk aversion on the adoption of special-purpose lines of credit in Nepal, J.R. Anderson and K.B. Hamal, found that farmers’ levels of absolute risk aversion were highly dependent on their present wealth which, in turn, was obviously closely related to such things as area of arable land and average annual income. The prevalence of risk aversion among farmers may be the reason for their less likely participation in the adoption of new technology. Farmers with a relatively high degree of absolute risk aversion tended to perceive greater risk in new technology. The years of education was not significantly associated with the farmers’ perceptions of variance of yields and gross margins.

V. Puhazhendhi applied the Game Theory model to study the risk management in farm situations in paddy cultivation. The area selected for the study was in Tiruchirapalli district of Tamil Nadu. The conclusions arrived at were that there was a more unfavourable trade-off between risk and net income on small farms and that the risk was observed to be more on small farms, and that they should adopt more conservative strategies to increase their net income.

---


In probing into the variations of the Linear Programming Models for farm planning and their consequences in terms of results of optimum farm plans, P.L. Sankhayan and H.S.Cheema\textsuperscript{75} stressed that care should be exercised to avoid using wrong model formulations inconsistent with the arithmetic logic while using Linear Programming for obtaining farm plans.

T.Haque et al.,\textsuperscript{76} measured the relative role of different factors in influencing intra-regional and inter-regional variations in productivity. The conclusions were that the profitability was on the decline in all regions and the rate of decline was higher in the more developed states. The infrastructure facilities like irrigation, input supplies, extensions and marketing facilities needed to be strengthened and the agricultural policies pursued by the Centre and States should be consistent with the national goals of optimal resource use and production.

V.Rajagopalan\textsuperscript{77} studied the changes over years in rice output in Tamil Nadu by measuring the changes through index series. He divided the periods into three subsets as Period I; 1956-57 to 1966-67, Period II; 1967-68 to 1971-1972 and Period III; 1972-73 to 1979-80. The results arrived at by the researcher were that labour hours, cost of labour, machine power, fertilizer cost had respectively


increased by 30, 178, 3, 289 per cent. But the rice yields had increased by 40 per cent. He suggested that the technology transfer must be cost and time effective for effectively improving opportunities for agricultural growth and thereby income and employment.

While examining the efficiency of farm technologies used in paddy cultivation Sadhu and Maharajan\textsuperscript{78} compared two areas, one from the Punjab and the other from Kashmir, and said that seed-fertilizer-water technology was the main factor in deciding the level of output.

Rajagopal\textsuperscript{79} in a study on the impact of the HYV (High-Yielding Varieties) paddy seeds on the agro-economic conditions of different farmers groups in the South-eastern part of Madhya Pradesh concludes that economic factors such as cost of production, income and output level had greater influence on the adoption of high-yielding varieties of paddy in the region.

According to Kanaga Anbuselvam\textsuperscript{80} farm business income declined as size of the holding increased and there existed a inverse relationship between farm size and productivity.


Kasthuri Bai Dhanasekaran\textsuperscript{81} examined the water distribution performance in Madurai District of Tamil Nadu and assessed the productivity of inputs. The findings were that abundant supply of water led to its overuse resulting in lower productivity, whereas in areas of scarce water supply water was used economically leading to higher productivity.

Sanat Kumar et al., \textsuperscript{82} stated that per hectare yield of rice was higher on the borrower farms as compared to the non-borrower farms in both marginal farms and small farms.

Renuka Pillai\textsuperscript{83} focused on the role of input utilizations in paddy cultivation and stated that productivity of inputs had played an important role in the growth performance of paddy in West Bengal and Orissa, and that one-third of the output growth in Indian rice was contributed by Total Factor Productivity (TFP). TFP growth measures the increase in output that is not accounted for by the increase in basic factor inputs such as land, labour and capital.

In another study on the changes in Total Factor Productivity (TFP) in Punjab agriculture since the 1980s Manjeet Kaur and M.K.Sekhon\textsuperscript{84} observed

\begin{itemize}
\item \textsuperscript{83} Renuka Pillai, \textit{An Analysis of Paddy Growth in West Bengal and Orissa}, \textit{Indian Journal of Agriculture Economics}, 2001, Vol.56, No.4, p 614.
\end{itemize}
decreasing trends in the compound growth rates in the 1990s as compared with the 1980s in so far as area, production and productivity of rice are concerned. Further, the output growth shown in Punjab agricultural growth during these periods was the outcome of technological change. Thus, the more agriculture became progressive, the more inefficient it became.

A comparative study of co-operative bank credit beneficiary and non-beneficiary groups of rice cultivators was undertaken in Cuddalore district of Tamil Nadu by D. Binu Kumar et al. The study showed that the production and returns in rice in the beneficiary groups of marginal and small farmers were higher than their counterparts in the non-beneficiary groups. The impact of short-term agricultural co-operative credit on rice production was encouraging and provision of short-term credit was an effective way to increase net returns of rice cultivation. In the case of non-beneficiaries, it was suggested that educating the farmers properly on the advantages of co-operative agricultural credit would go a long way in increasing the productivity and production of rice.

Nurunnaher et al., investigated the impact of institutional credit on farm production, investment and the income of the member and non-member farmers of selected co-operative societies in Bangladesh. They found that member farmers by availing loans from societies used more purchased inputs than non-members for

---

producing rice crops. Thus, according to them, institutional credit played no less a role in the use of purchased inputs.\textsuperscript{86}

U.L. Jyothirmai \textit{et al.}, used the Marginal Value of Production (MVP)/Opportunity Cost (OC) ratio to determine the allocative efficiency of resource use. They stated that where this ratio is more than one and the regression coefficient found significant the resources are said to be underused, whereas, the negative coefficient with significance indicates the overuse of resources. They demonstrated that the efficiency of resource use is low in paddy farms, and identified the lack of awareness and education of farmers, weather aberrations and non-availability of inputs in time as the causes for inefficiency in using the resources.\textsuperscript{87}

In another study carried out by Karuppanalagu\textsuperscript{88} on technological change and production of paddy it was concluded that in the case of the modern variety, yield per acre, returns and net income were higher, while expenditure on irrigation and human labour were lower when compared to the traditional variety.


\textsuperscript{88} Karuppanalagu, \textit{A Study of Technological Change and, Agricultural Production with Special Reference to Paddy Cultivation in Madurai District of Tamil Nadu}, Unpublished Ph.D., Thesis, Madurai Kamaraj University, Madurai, 2004.
J.L. Sharma after analyzing the economic efficiency of farm size in Punjab observed that gross margins per hectare basis increased with the increase in the size of the farm.\textsuperscript{89}

M. Mahadevappa\textsuperscript{90} stated that the increasing area under soil stress has brought down the average productivity, and the rice farming itself is beset with problems in such soil. He emphasized the need for increasing productivity through improved agronomic practices and integrated pest management techniques.

K. Banu Rekha \textit{et al.}, in an investigation for weed control in rice crop said that weeds effectively competed with the transplanted rice and reduced the crop yield to an extent of 40-55 per cent.\textsuperscript{91}

T.S.N. Vagdevi \textit{et al.}, studied the resource productivity and resource use efficiency in vegetables cultivation in Krishna district of Andhra Pradesh and said that production function analysis showed the predominant operation of diminishing factor returns and diminishing returns to scale, and the marginal value products to opportunity cost ratios also showed the inefficient use of resources of different magnitudes.\textsuperscript{92}

\begin{flushright}
\textsuperscript{89} J.L. Sharma, \textit{An analysis of Operational Farm Size vis-a-vis Economic Efficiency, Agricultural Situation in India,} 2004, Vol.LXI, No.4, pp.189-190.
\end{flushright}
1.9.3 Studies relating to Marketing

Studies relating to marketed surplus, markets, marketing, marketing functions, market functionaries, market infrastructures, prices, price spread and rice exports are highlighted in this section.

A.D. Naik et al., in their study on marketing of onions found that the cost of marketing incurred by the farmers varied across the size of farmers as well as channels of distribution preferred by the farmers.

Barbara Harris found that the marketed surplus is related positively to price, income, farm size, paddy production and negatively to distance and family size. The other findings were;

i) Cultivators with small families contributed more to the marketed surplus than those with large families.

ii) Proximity to market also acted as a positive determinant of marketed surplus.

iii) Price was an important conditioner of the level of surplus extracted from cultivators. Even the large farmers were forced to part with much of their marketed surplus during the period of low prices because of lack of storage and drying facilities.

---


Pandey et al.,\textsuperscript{95} stated that immediate cash requirement and absence or lack of storage facilities forced the farmers to sell their agricultural produce after harvest. The relationship between distance and marketing cost had a positive association as far as marketed surplus was considered, but considering the net price received their relationship showed a negative association.

K.Bardhan\textsuperscript{96} in studying the marketed surplus of food grains observed the existence of a negative relationship between marketed surplus and price, whereas that between output supply and price was positive.

R.Suderasan and M.Thanasekaran\textsuperscript{97} in a study on production and marketing of grapes in Madurai District, Tamil Nadu, identified lack of adequate finance to meet establishment cost, increasing cost of inputs, crop loss due to diseases and pests as the problems in production, while in marketing the produce, absence of organized markets, high incidental costs, market fees and lack of finance were the problems faced by farmers.

M.S.Jairath\textsuperscript{98} in identifying the issues hampering the movement of agricultural commodities mentioned that the existence of numerous and varied


market rates and market fee, the commissions of commission agents and entry tax/octroi inflated the cost of produce, subsequently the final products became very expensive; thus the gap between consumer’s price and the producer’s price was widened.

G.S Ram and B.Swarup\textsuperscript{99} measured the marketing efficiency of regulated and non-regulated fodder markets and came to the conclusion that there was no significant variation between the two markets in the matter of market efficiency. But marketing costs, marketing margins and transportation costs were high because of the largeness of fodder.

Parmod Kumar and R.K.Sharma\textsuperscript{100} studied the efficiency of four paddy markets in Haryana by dividing the study period into the post-liberalization period and the pre-liberalization period and by using the market integration as the indicator of market efficiency. They observed that the wholesale paddy prices indicated that markets were integrated in the long run although the price transmission was found to be lacking in the short run; price adjustment among the markets was taking around 2-3 weeks time period but the adjustment process was found to be quicker in the post-liberalization period as compared to the pre-liberalization period and the distance covered to market the produce was the most important and significant variable with a positive effect on the net price received by farmers. He opined that the need for storage in agricultural marketing increases.


\textsuperscript{100} Parmod Kumar and R.K. Sharma, Spatial Price Integration and Pricing Efficiency At the Farm Level, Indian Journal of Agricultural Economics, 2003, Vol.58, No.2, pp.203-218.
In analyzing the price formation mechanism in the world rice market, C.S.C Sekar.\textsuperscript{101} stated that the supply was highly inelastic although the coefficient was insignificant. His findings were

i) Yield function showed the overwhelming importance of irrigation.

ii) In the demand function world rice price and exchange rate had a significant effect on domestic rice price.

iii) In the export supply function exports of rice responded to price signals in the world.

iv) The export demand function showed that the income of rice importing countries from India was a major determinant of demand for Indian rice exports.

Christopher Edmonds\textsuperscript{102} in examining the role of infrastructure development and technical change in rice production stated that accessibility to markets appeared to play a key role in determining land use and rice cropping intensity. Greater distances between farms and markets were associated with a reduced probability of intensive rice cultivation. The time and direct cost of transporting inputs and outputs between rural homesteads, farm plots, and markets influenced the land use and production decisions.


In examining the existing availability and utilisation of facilities like cleaning, grading, drying, packaging and weighing in regulated paddy and wheat markets in the state of Uttranchal, Raj Kishor et al.,\textsuperscript{103} found that the utilisation of cleaning facilities was low at the traders’ level, but among the farmers the use of traditional cleaning devices was low due to the adoption of combines and power threshers. The grading facility available only in two market yards was not used. Only variety based grading of paddy and wheat was performed at the farmers’ and traders’ level. For the drying of paddy and wheat grains the process of sun drying was popular. The high operational cost was the reason for the low utilisation of modern mechanical dryers by the rice millers. Further, the packaging of the produce was not popular among the farmers. The researchers were of the opinion that the existing labour intensive weighing method should be replaced with the installation of electronic / computerized weighbridges.

Parmod Kumar\textsuperscript{104} by using multiple regression analysis studied the relationship between the determinants of marketed surplus for different crops in two districts of Haryana state. He said that in the case of paddy, the output per hectare as well as the marketed surplus per hectare rose with the rise in farm size for all size-groups and slightly declined with large farms. Output, operated area and area under tenancy boosted the marketed surplus, whereas family size and unirrigated area presented a negative relationship with marketed surplus.


\textsuperscript{104} Parmod Kumar, \textit{Marketed Surplus of Different Crops Across Farm Size: A Study in Haryana, Indian Journal of Agricultural Economics,} 1999, Vol.54, No.4, pp.500-521.
In an attempt to highlight how far the paddy markets and rice markets were integrated in selected areas of Maharastra, the researcher A.A.Rane\textsuperscript{105} stated that the correlation coefficients between the paddy prices that prevailed in the selected markets were quite high. The paddy and rice markets were well integrated and the degree of integration could be increased by linking the markets by rail, road and by other means of communication.

The existing labyrinth of controls and government interventions in rice markets was counterproductive and responsible for the fragmentation of rice markets. Such fragmentation hurts the efficiency of agricultural operations and isolates some markets. There was an urgent need to reform the rules governing the interstate commerce in food grains by overhauling state government tax policy and regulations, and to reform price policy at the levels of producer, wholesaler and consumer. In addition it was crucial to privatize whole sale grain to improve the efficiency of market signals. These were the observations of Ragavendra Jha, K.V. Bhanu Murthy and Anurag Sharma.\textsuperscript{106}

In examining the marketable surplus and price spread of paddy in Orissa Ravikesh Srivastava and Ranjen Sahoo\textsuperscript{107} came to the conclusion that the coefficient of correlation between marketable surplus and the area under crop and


production of paddy, and also the marketing efficiency varied across different channels.

Gunamalai and Subramanim\textsuperscript{108} while analyzing the marketing cost, marketing margin and price spread in chewing tobacco markets identified three different channels in marketing it. They came to the conclusion that in all these channels tobacco producers realised less than 50 per cent of the consumer’s price. The construction of godowns in rural areas and making them available for farmers to store the harvested tobacco at reasonable rates, and imparting training to the growers in cutting, processing, grading etc., were their recommendations for realising better prices by growers.

In a study on the selected regulated markets in the state of Tripura, Kiran Sankar Chakraborty\textsuperscript{109} found that paddy-rice farmers selling through regulated markets got comparatively a better margin in the consumer’s price than the vegetable and fruit farmers. The producer’s share in the consumer’s rupee was around 80 per cent for paddy-rice farmers, which was made possible due to a strong marketing setup.

In investigating whether the real prices of different crops have declined after liberalisation, Kalamkumar and Narayanamoorthy\textsuperscript{110} used farm harvest prices and reported that the average gross income and average profit of paddy had


respectively increased from Rs.4,587 and Rs.2,032 in the pre-liberalisation period to Rs.5,960 and Rs.3,056 in the post-liberalisation period.

While highlighting the effects of factors determining exports from India, Kehar Singh and Inder Sen\textsuperscript{111} indicated that milled paddy/rice has bright prospects for exports and they suggested evolving a long-term strategy rather than looking for short-term opportunities to harvest the benefits of liberalisation and globalization of world economy.

Davinder Kumar Madaan\textsuperscript{112} observed that Indian agriculture faced serious challenges and huge opportunities under the WTO and Indian agriculture was hit hard during the post-WTO period, and that its competitiveness was also lost due to the increase in the Minimum Support Prices (MSPs). The suggestion for improving state of agriculture was increasing the productivity by enhancing the investments in irrigation, power, roads and agricultural research.

K. Narayana and Thirupathi Reddy\textsuperscript{113} examined the factors and issues related to the rice industry in India and emphasised the need for modernising it so as to strengthen the rice economy as the export prospects for rice were bright.


An analysis of the rice markets in 14 major rice producing states of India covering the period from 1980-81 to 1994-94 was carried out by Asha Maheswari. The following were the findings:

i) The proportion of rice arrivals to production stagnated around 30 per cent of production and it had a negative and significant trend in a majority of the states.

ii) The market arrivals in the selected markets had a growth rate of 3.62 per cent.

iii) The average proportion of the production accounted for by the regulated markets was only 5.87 per cent.

iv) In Tamil Nadu with significant growth in production and regulation of almost all the wholesale assembly centres, the bulk of the output flows outside the formal regulated market system.

In summing up the analysis it was stated that though regulated markets provided for larger quantities in some states, they could not be expected to overtake or subsume the indigenous sector in all other states. The non-regulatory or informal sector need not be curbed on account of considerations of administrative convenience.

---

An attempt was made to study the existing market infrastructure in Karnataka state by P. Thippaiah and R.S. Deshpande\textsuperscript{115} The study showed that the available infrastructure was not adequate to marketing agricultural produce. Even though the growth in the marketing facilities had increased the infrastructure catered to a small proportion of agricultural producers. The output prices were increasing at a faster rate than the input prices but such increase was more due to the increase in the aggregate price level. However, this increase was not commensurate with the rate of inflation in the economy.

There was an inherent instability in the Indian rice markets and wholesalers had the tendency to hoard more than the non-optimality inventory levels. The instability was owing to harvest prices or market prices and to the existence of a dual market. The relationship between retail price and the changes in stock was dependent on whether the wholesaler primarily supplied to the local retailer or to the hierarchy of retailers. These were the observations made by Raghbendra Jha and Hari K Nagarajan.\textsuperscript{116}

D.Ramesh et al.,\textsuperscript{117} suggested standardization, technology inputs, packaging and processing, and imaginative marketing to boost rice exports.


S.L. Sananse et al., in studying the international scenario of basmati rice observed that India exported 6.67 lakh metric tonnes of basmati rice and earned Rs. 1,843 crore foreign exchange in 2001-02. The same year non-basmati rice export was 15.41 metric tonnes and the foreign exchange earned thereby was Rs.1331 crores. Basmati and non-basmati rice items respectively contributed 13.33 per cent and 30.90 per cent of total the volume of cereals exports, and 39.89 per cent and 28.81 per cent of the total cereal export earnings in that year.

Sandeep Kumar et al., stated that during year 2000-01 India’s agricultural sector’s export earnings stood at 6004 million US$ representing 13.5% of the total exports. But it declined to 3489 US$ and 11.9% in 2002-03. For the same years the share of rice exports in the total agricultural exports was 10.70 and 13.60 per cent.

The trend values for India’s agricultural exports have been estimated at a marginal growth rate of 0.054 % during 1980-81 and 2002-03. During 1989-90 agricultural exports increased to 34.86 %, to 37.69 % in 1993-94 and to 54.14 % in 1995-96. Agricultural exports as a percentage of the total exports have declined to 13.21 % by 2002-03. The Compound Growth Rate of rice exports during 1991-92 and 2003-04 was estimated at 7.60. These observations were made by Ramanjaneyulu.

---


1.9.4 Concepts used the Study

1.9.4.1 Small Farmers

Sample farmers whose extent of paddy cultivation land is less than or equal to three acres of land in the study area in the study period.

1.9.4.2 Medium Farmers

Sample farmers whose extent of paddy cultivation land is more than three but less than or equal to seven acres of land in the study area in the study period.

1.9.4.3 Large Farmers

Sample farmers whose extent of paddy cultivation land is more than seven acres of land in the study area in the study period.

1.9.4.4 Farm Labour

According to the 1961 census those who work for wages in the farm crops and have no right on land and have no risk or liability for sowing of crops and they receive payment in the shape of wages and not as profit. The payment is either in cash or kind or both.\textsuperscript{121}

1.9.4.5 Family Labour

The labour put in by the farmer’s family is family labour. Family members who devote their time for farming operations are known as family labourers.\textsuperscript{122}


\textsuperscript{122} Ibid., p.70.
1.9.4.6 Permanent Labour

They are hired generally for a fixed period, generally one year, and are paid in cash or kind or in both. Facilities like residence, clothing or farm produce at concessional rate may also be provided.\textsuperscript{123}

1.9.4.7 Cropping Pattern

P.V.John states that “the term cropping pattern indicates the product mix or the crop mix that a cultivator gets from his lands.” \textsuperscript{124}

1.9.4.8 Infrastructure

Infrastructure, according to Nilabja Ghose\textsuperscript{125}, is a factor of production that works by raising the efficiencies of inputs. The measurable effects of infrastructure on the productive activity are taken as growth of output or factor productivity and declining cost.

1.9.4.9 Village Traders

They are traders functioning in villages who purchase paddy in small quantities from farmers, assemble their purchases and sell them as big lots either to wholesalers or to commission agents.

1.9.4.10 Paddy Wholesalers

Wholesalers are merchant middlemen engaged in wholesaling activities. They buy and resell merchandise to retailers and other merchants and to industrial

\textsuperscript{123} Ibid., p.70.
\textsuperscript{124} Ibid., p.29.
\textsuperscript{125} Nilabja Ghose, \textit{op.cit.}, p.153.
institutions, and commercial users, but do not sell in significant amount to ultimate consumers.\textsuperscript{126}

Wholesalers in the present study denote traders purchasing paddy either from the village traders or from large farmers and selling it to the commission agents or to rice millers.

\subsection*{1.9.4.11 Commission Agents}

Commission Agents usually exercise physical control over and negotiate the sale of goods. They act on behalf of the principals.\textsuperscript{127}

‘Commission Agents’ in the study are those traders who purchase paddy from wholesalers or large farmers and sell it to rice millers.

\subsection*{1.9.4.12 Rice Millers}

Those who undertake the process of converting paddy into rice in the rice-mills owned or leased by them. They purchase bulk quantity of paddy from farmers, wholesalers or commission agents, convert it into rice and sell it to rice-wholesalers or rice-retailers.

\section*{1.10 OBJECTIVES OF THE STUDY}

1. To compare and analyse the area, production and productivity of paddy in select countries, Tamil Nadu and the study area (Theni district).

\textsuperscript{126} C.B. Memoria and R.L. Joshi, \textit{op.cit.}, p.445.

\textsuperscript{127} C.B. Memoria and R.L. Joshi, \textit{op.cit.}, p.454.
2. To estimate and compare the cost structure and yield of paddy for different sizes of cultivators and to examine the cost to benefits ratio in paddy cultivation and the problems in production.

3. To study the resource-use efficiency in paddy cultivation.

4. To find the existing marketing channels and evaluate and analyse the efficiency of different channels and to identify the problems in the marketing of paddy.

5. To offer suggestions based on the findings with a view to improve the production and marketing of paddy.

1.11 METHODOLOGY

1.11.1 Collection of Data

The study was conducted on the basis of primary and secondary data. The primary data were collected from the sample respondents by supplying Interview Schedules. First a field survey was conducted with the help of a draft interview schedule in the selected taluks. Respondents were chosen in order to gather information on cultivation operations, general practices of cultivation, and the problems associated with production and marketing. When the researcher had become aware of all farming operations the draft interview schedule was modified and pre-tested. It was finalised on the recommendations of educated and experienced cultivators and persons belonging to Farmers’ Associations. While collecting primary data the purpose of acquiring the information was clarified. Many of the small farmers did not maintain proper records for the cost, yield and revenue. But by recalling the farming operations they were able to supply the
necessary details. But a majority of the medium and large farmers maintained proper records. However, respondents’ information was checked and cross-checked. The cost of production, yield and revenue for the first crop and the second crop and for the different sizes of farmers were computed separately.

The secondary data on area under cultivation, production and productivity of paddy in major rice producing countries including India and of Tamil Nadu were for eleven years and those relate to the study area Theni district were for a nine-year period from 1997, the year of formation of the district. These data were collected from the records kept in government offices functioning in different towns. Relevant websites were also browsed to collect information. Text books on Macro Economics and Micro Economics, various issues of journals like the Indian Journal of Agricultural Economics, the Economic Affairs, the American Journal of Agricultural Economics, the Asian Development Review, the Indian Economic Journal, Agricultural Situation in India, the Agricultural Marketing, the Indian Journal of Agricultural Marketing, the Karnataka Journal of Agricultural Science, the Andhra Agricultural Journal, the Indian Journal of Marketing, the Bihar Journal of Agricultural Marketing, the Economic and Political Weekly, the Southern Economist and the Kissan World were consulted to collect the secondary data and to review the previous studies on paddy cultivation and to highlight the concepts used in the study. Periodicals like India Today and the Reader’s Digest, and the newspapers reports were also referred. Further, Ph.D. theses submitted in different universities have also been referred. Websites like www.theni.tn.nic.in, www.theni.tn.nic.in/agricultures, www.tnau.ac.in, www.agricoop.nic.in, www.dacnet.nic.in and the UN’s Food and Agriculture Organisation’s (Rome)
website www.fao.org.web sites were also browsed to collect the data required in carrying out the study.

1.11.2 Sampling Design

Theni, Bodi, Uthamapalayam, Periyakulam and Andipatti are the taluks of Theni district. Of them, Theni, Bodi and Uthamaplayam taluks have double cropped paddy lands under water supplied by River Periyar irrigation scheme. These three taluks together form the Cumbum Valley and the intensity of farming operations was also high in these taluks. The Sample respondents were conveniently chosen from these three taluks. The utmost care was given to ensure that the number of respondents almost equally represented the small, medium and large size farmers. A total number of two hundred and fifty sample respondents were selected. The following table shows the taluk-wise the split up of paddy cultivated area and the size of samples selected from each taluk.

Table 1.3
Area-wise Distribution of Sample Respondents

<table>
<thead>
<tr>
<th>Taluk</th>
<th>Number of Cultivators*</th>
<th>Percentage to Total Cultivators</th>
<th>Number of Sample respondents selected</th>
<th>Percentage to total samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uthamapaylam</td>
<td>12052</td>
<td>48.44</td>
<td>120</td>
<td>48.00</td>
</tr>
<tr>
<td>Theni</td>
<td>5877</td>
<td>23.62</td>
<td>66</td>
<td>26.40</td>
</tr>
<tr>
<td>Bodinayakkanur</td>
<td>6949</td>
<td>27.94</td>
<td>64</td>
<td>25.60</td>
</tr>
<tr>
<td>Total</td>
<td>24878</td>
<td>100.00</td>
<td>250</td>
<td>100.00</td>
</tr>
</tbody>
</table>

* Records of Statistical Department, District Collectorate, Theni.
For collecting primary data on marketing, 60 sample traders were conveniently selected. The sample paddy traders consisted of village traders, wholesalers and commission agents and rice millers.
1.11.3 Period of Study

The field survey was undertaken in the months of April, May and June, 2006. Primary data were collected in the same year from October to December. The cost of cultivation, yield and other primary information were for the agricultural year 2005-2006. The data relating to the first crop (I Season/Kodai/Kuruvai) were for the crop raised between June and October 2005 and those relating to the second crop (II Season/Kalam/Thaladi) were for the crop raised between October/November 2005 and February/March 2006. The secondary data were collected for a ten-year from 1996 to 2005. But the secondary data relating to the study area were for an eight-year-period between 1998 and 2005.

1.11.4 Tools of Analysis

Percentages were used to highlight the socio-economic characteristics of the sample respondents. The growth rate in production, area and productivity or yield of paddy were calculated by applying the compound growth rate applying the exponential function. The Regression equation was used to estimate the trends in area, production and yield of paddy. The variations in the production and productivity have been worked out by the statistical tool co-efficient of variation involving mean and standard deviation.

The determinants of paddy productivity have been analysed with the help of the Cobb-Douglas type Production Function. The efficiency of the sample respondents in utilising the inputs was evaluated by marginal value productivity of
each of the inputs involved in the production of paddy. The inputs used in the production were equated with the actual acquisition cost.

The sample respondents’ reason for cultivating paddy, the methods followed for increasing the yield, the problems encountered by them in production, labourers, and in marketing of paddy were evaluated with Garrett’s Ranking Technique. The respondents were asked to rank the reasons/methods/problems as per the priority. The percentile position of each rank was calculated by applying the following formula.

\[
\text{Per cent Position} = \frac{100 (R_{ij} - 0.50)}{N_j}
\]

Where, \( R_{ij} = \) Rank given for the \( i^{th} \) factor by \( j^{th} \) individual
\( N_j = \) Number of problems ranked by \( j^{th} \) individual

The scores for per cent position of each rank were identified by referring the scores table given by Garrett; then for each rank and for each reason, the number of respondents given that rank for that reason/problem was multiplied with the corresponding scores and the products were added to get sum of the products. The sum of the products was divided by the total number of respondents so as to arrive at mean scores.

The Concurrent Margin Method was adopted to compute the price-spread. The marketing efficiency of the various channels involved in the movement of paddy was measured by Shepherd’s formula.
1.12 LIMITATIONS OF THE STUDY

The study covers only the double cropped area in the Cumbum Valley of Theni district. There may be certain weaknesses in the basic data obtained from the sample respondents because of their recall bias. Besides, the study is confined to Theni district which has its own agro-climatic conditions. The conclusions arrived at in the study have to be examined with care keeping the limitations of the study in view.

1.13 CHAPTERS SCHEME

The present study is coordinated with seven chapters.

The first chapter “Introduction and Design of the Study” covers the introduction to the topic, the origin of paddy, its cultivation practices, the statement of the problem, and the importance, scope and limitations of the study. Further, the methodology, collection of data, analytical tools used, review of literature on studies and on the concepts used in the study, and the chapters scheme also find a place in this chapter.

The second chapter, “Paddy An Overview”, highlights the production and productivity of paddy in major paddy growing countries, in Tamil Nadu and in the study area, Theni district. Rice exports from India are also focused in this chapter.

The third chapter titled “Profile of the Study Area and the Sample Growers” outlines the profile of the Cumbum Valley (Theni district) which is the study area, and the socio-economic conditions of the sample respondents from whom the primary data presented in the study have been collected.
“Cost-Benefit Analysis” is the fourth chapter in the study. This chapter shows the cost of production, yield and revenue for different sizes of sample growers across two seasons and also the problems faced by the sample respondents in the production paddy.

The fifth chapter is “Resource Use Efficiency and Returns to Scale”. This chapter highlights how efficiently the resources have been utilised by the sample respondents, and the paddy yield for the given inputs used in paddy cultivation.

The sixth chapter titled “Marketing of Paddy” is the penultimate chapter which deals with the marketing, the channels of distribution, the producers’ share in the consumers’ rupee, the marketing cost and the marketing efficiency of different channels, and the problems in marketing of paddy.

The seventh chapter “Findings and Suggestions” is the last chapter. It presents the findings of the study and the suggestions offered by the researcher on the basis of the findings.