CHAPTER III

PADDY PRODUCTION IN WORLD, INDIA AND TAMIL NADU

In this chapter the researcher made an attempt to study the growth and development of paddy production in world level, India level and Tamil Nadu level in detail.

3.1 World Level Paddy Production

Paddy is the second largest produced cereal in the world. At the beginning of the 1990s annual production was around 350 million tonnes and by the end of the century it had reached 410 million tonnes. World production totaled 395 million tonnes of milted rice in 2003, compared with 387 million tonnes 2002.

World Paddy production in 2004 was just less than 610 million tonnes. At least 114 countries grow paddy and more than 50 have an annual production of 100,000 tons or more. Asian farmers produce about 90% of the total, with two countries, China and India, growing more than half the total crop.

The 2010 paddy season has come to a close in most regions, except in a number of northern hemisphere Asian countries, where secondary crop harvests are in progress. The FAO world production forecast has undergone a near 2.0 tonnes downward revision since the previous issue of the RMM, following less optimistic prospects for crops in Asia, notably in India. Despite the reduction, FAO estimates 2010 global output to have reached a new high of 699.1 million tonnes (466.0 million tonnes, milled basis), a 2 percent upturn from the 2009 poor result. The achievement was primarily sustained by greater plantings, assessed in the order of 161.0 million hectares. Slightly higher yields of 4.3 tonnes per hectare were also achieved,

notwithstanding several climatic difficulties associated with the back-to-back el Niño and la Niña manifestations. From a regional perspective, much of the season 16.0 million tonnes expansion is attributable to output recoveries in Asia. North America, Africa, Oceania and Europe also closed the season with positive results, which more than compensated for declines in Latin America and the Caribbean.

At this time of the year, countries along and south of the Equator are already harvesting their 2011 main paddy crops, but sowing of the 2011 crops is only beginning in several major northern hemisphere producers. Although prospects for the upcoming season still remain tentative, recent climatic forecasts point to a high likelihood of La Niña conditions continuing on a weakening path over the coming months, with associated weather anomalies possibly dissipating by June 2011. As a result and based on expectations of a return to normal weather conditions, a first forecast of 2011 global production sees world output expanding to 719.8 million tonnes (479.9 million tonnes, milled basis), up 3 percent from the current 2010 estimate. Countries in Asia are foreseen to continue driving this growth, although production in Europe may also increase and recoveries in Latin America and the Caribbean.

TABLE 3.1

WORLD PADDY PRODUCTION

Country	1999-00	2000-01	2001-02	2002-03	2008-09	2009-10	2010-11
China	138,936	131,536	124,320	123,200	196.7	200.5	205.5
India	89,700	84,871	91,600	80,000	133.6	141.2	150.0
Indonesia	33,445	32,548	32,422	32,500	64.4	66.4	67.3
Bangladesh	23,056	25,086	25,500	26,000	48.0	50.3	51.0
Vietnam	20,926	20,473	20,670	20,500	38.9	39.9	40.7
Thailand	16,500	16,901	16,500	16,500	32.1	31.5	32.3
Burma	9,860	10,771	10,440	10,440	15.5	15.2	16.3
Philippines	7,772	8,135	8,450	8,300	15.5	16.8	17.1
Japan	8,350	8,636	8,242	8,200	10.6	10.6	10.5
Brazil	7,768	7,062	7,480	7,600	8.9	9.4	10.0
United states	6,502	5,941	6,764	6,457	7.5	7.3	7.9
Korea, south	5,263	5,291	5,515	5,300	6.6	5.8	6.0
Egypt	3,787	3,965	3,575	3,800	4.2	4.0	4.3
Pakistan	5,156	4,700	3,740	3,500	10.3	8.3	10.0
EU	1,751	1,567	1,620	1,792	3.4	3.5	4.0
Taiwan	1,349	1,342	1,245	1,197	1.9	2.1	2.3
Australia	787	1,259	930	965	1.3	1.5	2.0
Others	28,282	27,270	27,575	28,156	31.0	32.0	31.5
TOTAL	409.00	397.00	396.00	384,.00	682.0	699.1	718.9

Source: USDA, Foreign Agricultural Services (FAS)

From the above table it can be noted that there is an increasing trend in the paddy production all over the world. In the year 1999-2000 total world paddy production was 409.0 million tonnes it was increased to 718.9 million tonnes in the year 2010-11.

3.2World Level Paddy Export

Total world rice exports in 2003 have recently been projected at 25,564,000 metric tons, higher than the 24,949,000 tons estimated for 2002, according to the USDA. Thailand will maintain its top position, with 7.5 million tons estimated to be shipped in 2002 and 2003, unchanged from 2001. India and Vietnam will continue to trade places in 2003, as the former is expected to become the world's second biggest rice exporter with 4 million tons, followed by Vietnam with 3.5 million tons. Traditionally, Vietnam has exported more rice than India, but Vietnam is very likely to lose its position to India this year. India has huge stockpiles, which keep prices very competitive, whereas low production in Vietnam pushes prices up. In fourth place comes the US, which will export 2.95 million tons next year. US rice exports have been steadily growing since 1999, thanks to increasing crops and more competitive prices. China will be fifth, with 2.25 million tons projected for export.

Burma (1.5 million tons) is expected to outdo Pakistan (0.8 million tons) in exporting rice. As a matter of fact, the latter had exported more rice than Burma until 2001, but will likely lose its place this year on account of poor production triggered by irrigation water shortages. Pakistan's 2002 exports are projected at 1.25 million tons, against 1.5 million tons from Burma.

TABLE 3.2

WORLD EXPORTS OF PADDY

Particulars	**2008-09**	**2009-10**	**2010-11**
Developing Countries	26.1	26.8	27.3
Developed Countries	3.5	4.6	4.5
World Export	29.6	31.4	31.8

Source: FAO Rice Market Monitor April 2011

From the above table it can be noted that World export was increased from 29.6 million tonnes in the year 2008-09 to 31.8 million tonnes in the year 2010-11.

3.3 World Import of Paddy

Indonesia is likely to remain the world's number one paddy importer in 2003 with approximately 3.25 million tonnes unchanged from the year's estimate. The country needs to import this much because its rice production is considerably limited by EI Nino-induced drought. Trailing behind are Iran and Nigeria with 1.5 million tonnes each next year, Iran's imports next year will top those in the past few years, when figures mostly exceeded one million tonnes each year, while import growth in Nigeria has been steady at over one million tonnes each year as well.

TABLE 3.3

WORLD IMPORTS OF PADDY

	2008-09	2009-10	2010-11
Developing Countries	24.8	26.9	27.0
Developed Countries	4.8	4.5	4.7
World Export	29.6	31.4	31.8

Source: FAO Rice Market Monitor April 2011

From the above table it was noticed that there was an increasing trend in world export of paddy. The overall export in the year 2008-09 was 29.6 million tonnes it was increased to 31.8 in the year 2010-11.

3.4 Paddy in Indian Scenario

Agriculture is the main source of income for families in India. Farms cover over half the land and almost three-quarters of that land is used to grow the two major grains: paddy and wheat. India is the second leading producer of paddy in the entire world, preceded only by china. India's annual paddy production is around 85-90 million tons. Annual consumption is around 85 million tons. In India, Paddy is cultivated in both seasons – winter and summer. West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Orissa, Assam, Karnataka and Haryana are the major producing states. More than 50% of total production comes from the first four states. Food Corporation of India purchases around 20 to 25% of the total paddy production in the country both under levy form the paddy mills and directly in the form of paddy from the farmers at Minimum Support Paddy announced by the Government.

More than 4000 varieties of paddy are grown in India. India is the world's largest exporter of Basmati paddy to Saudi Arabia and other Middle East Countries, Europe, and the United States. India has the potential to export one million tons of Basmati paddy. Major destinations for Indian non-basmati, white/parboiled paddy are Bangladesh, Indonesia, Philippines, Nigeria, South Africa, Ivory Coast, and other African countries.

3.4.1 Development of Hybrid Paddy in India

During the last few years, hybrid paddy technology in the tropics has entered the commercialization phase in India, Vietnam, the Philippines, Bangladesh and Indonesia. Research to develop hybrid paddy was initiated in India way back in 1970s but with no success. It was only in the year 1989, the research programme was accelerated and intensified and within a period of 5 years, half a dozen paddy hybrid paddy varieties were developed from public and private sectors in India. By the end of 2001, a total of 19 hybrid paddy varieties were released. However, farmer adoption of hybrid paddy has been much slower than expected because of several constraints. Improving grain and cooking quality characteristics of hybrids, incorporating resistance to some major pests and diseases, increasing average seed yields on a large scale to reduce seed costs are the research priorities. Policy interventions by the government for increased support, aggressive popularization of hybrids, and assured procurement of hybrid paddy at a minimum support paddy are needed. If these problems can be solved, hybrid paddy could be cultivated on 3-4 million hectares in India during the next decade to partially sustain food security. The government has intended to popularize hybrids on a priority basis during the tenth fiver-year plan period (2002-07).

3.4.2 Steps to Develop Hybrid Paddy

The following steps are followed to developed hybrid paddy cultivation in India.

- Use new seeds every season and follow recommended seeding.
- Prepare the land early and properly
- Transplant seedlings then replant empty hills
- Apply the right kind and amount of fertilizer at the right time
- Maintain the right amount of water
- Manage the pests
- Harvest on time

Recognizing the potential of hybrid paddy to enhance production and productivity, India launched a national program in 1989 for the development and large-scale adoption of hybrid paddy to sustain self-sufficiency in paddy production. A remarkable success was achieved within a short span of 5 years and half a dozen paddy hybrid paddy varieties were developed from public and private sectors. The first four hybrid paddy varieties were released in the country during 1994. Subsequently, two more hybrid paddy varieties were also released. By the end of 2001, a total of 19 hybrid paddy varieties were released. More than 23 hybrid paddy varieties have been released till now with average yield of 6.5 to 7.5 tonnes. It is estimated that about 0.75 million hectare is under cultivation of hybrid paddy in the country.

TABLE 3.4

HYBRID PADDY VARIETIES IN INDIA

CR 314-10	CRM 2007-1	HRI-126
IET 15848	IET 16775	IET16783
IET 17021	JKRH-2000	MPH 5401
PAC 801	PAC 832	PRH-122
RR 347-2	Sahyadri-4	UPRI 99-1
VL Dhan 86		

Source: FAO

World wide, India stands first in paddy area and second in paddy production, after China. It contributes 21.5 percent of global paddy production. Within the country, paddy occupies one-quarter of the total cropped area, contributes about 40 to 43 percent of total food grain production and continues to play a vital role in the national food and livelihood security system. However, India did not become a major paddy exporting country for a long time. Its share in world paddy trade, mainly in the form of small-volume exports of highly prized basmati paddy, was insignificant (5 percent). It was not until the mid-1980s that the quantum of export started to grow, from 110 000 tonnes in 1978/79 to 890 613 tonnes in 1994-95 and to a record 5.5 million tonnes in 1995/96, second only to Thailand (at 5.9 million tonnes). Among the exporting countries, Thailand, Vietnam, India and Pakistan are the major countries exporting paddy in sizeable quantity.

Paddy is one of the important cereal food crops of India. Paddy contributes about 43% of total food grain production and 46% of total cereal production in the country. It continues to play vital role in the national exports. The percentage share of

paddy in total national export was 4.5% during 1998-99. The percentage share of agriculture export in total national export was 18.25, whereas the percentage of paddy export in total agriculture export was 24.62 during 1998-99. Thus, paddy export contributes nearly 25% of total agriculture export from the country.

3.4.3 Paddy Production and Economic Development

India is one of the world's largest producers of white paddy, accounting for 20% of all world paddy production. Paddy is India's pre-eminent crop, and is the staple food of the people of the eastern and southern parts of the country. Production increased from 53.6 million tons in FY 1980 to 74.6 million tons in FY 1990, a 39 percent increase over the decade. By FY 1992, paddy production had reached 111 million tons, second in the world only to China with its 182 million tons. Since 1950 the increase has been more than 350 percent. Most of this increase was the result of an increase in yields; the number of hectares increased only 40 percent during this period. Yields increased from 1,336 kilograms per hectare in FY 1980 to 1,751 kilograms per hectare in FY 1990. The per-hectare yield increased more than 262 percent between 1950 and 1992.

The country's paddy production declined to 89.13 million tonnes in 2009-10 crop years (July-June) from record 99.18 million tonnes in the previous year due to severe drought that affected almost half of the country. India could achieve a record paddy production of 100 million tonnes in 2010-11 crop years on the back of better monsoon this year. Andhra Pradesh is the top most paddy-producing state in the country.

Paddy is one of the chief grains of India. Moreover, this country has the biggest area under paddy cultivation, as it is one of the principal food crops. Paddy is

the major food grain in India. It is in fact the dominant crop of the country. India is one of the leading producers of this crop. Paddy is the basic food crop and being a tropical plant, it flourishers comfortably in hot and humid climate. Paddy is mainly grown in rain fed areas that receive heavy annual rainfall. That is why it is fundamentally a kharif crop in India. It demands temperature of around 25 degree Celsius and above and rainfall of more than 100 cm. Paddy is also grown though irrigation in those areas that receives comparatively less rainfall. Paddy is the staple food of eastern and southern parts of India. In 2009-10, total paddy production in India amounted to 89.13 million tonnes, which was much less than production of previous year, 99.18 million tonnes.

Paddy can be cultivated by different methods based on the type of region. But in India, the traditional methods are still in use for harvesting paddy. The fields are initially ploughed and then fertilizer is applied which typically consists of cow dung and then the field is smoothed. The seeds are transplanted by hand and then through proper irrigation, the seeds are cultivated. Paddy grows on a variety of soils like silts, loams and gravels. It can also tolerate alkaline as well as acid soils. However, clayey loam is well suited to the raising of this crop. Actually the clayey soil can be easily converted into mud in which paddy seedlings can be transplanted easily. Proper care has to be taken as this crop thrives if the soil remains wet and is under water during its growing years. Paddy fields should be level and should have low mud walls for retaining water. In the plain areas, excess rain water is allowed to inundate the paddy fields and flow slowly. Paddy raised in the well watered lowland areas is known as lowland or wet paddy. In the hilly areas, slopes are cut into terraces for the cultivation of paddy. Thus, the paddy grown in the hilly areas is known as dry or upland paddy.

Interestingly, per hectare yield of upland paddy is comparatively less than of the wet paddy.

The regions cultivating this crop in India is distinguished as the western coastal strip, the eastern coastal strip, covering all the primary deltas, Assam plains and surrounding low hills, foothills and Terai region-along the Himalaya Mountains and states like West Bengal, Bihar eastern Uttar Pradesh, eastern Madhya Pradesh, northern Andhra Pradesh and Orissa. India, being a land of eternal growing season, and the deltas of Kaveri River, Krishna River, Godavari River and Mahanadi River with a thick set-up of canal irrigation, permits farmers to raise two, and in some pockets, even three crops a year. Irrigation has made even three crops a year possible. Irrigation has made it feasible even for Punjab and Haryana, known for their baked climate, to grow paddy. They even export their excess to other states. Punjab and Haryana grow prized paddy for export purposes. The hilly terraced fields from Kashmir to Assam are idyllically suited for paddy farming, with age-old hill irrigational conveniences. High yielding kinds, enhanced planting methods, promised irrigation water supply and mounting use of fertilizers have together led to beneficial and quick results. It is the rain fed area that cuts down average yields per hectare.

In some of the states like West Bengal, Assam, Orissa and Bihar, two crops of paddy are raised in a year. Winter season in the north western India are extremely cold for paddy. Paddy is considered as the master crop of coastal India and in some regions of the eastern India where during the summer monsoon rainy season both high temperature and heavy rainfall provide ideal conditions for the cultivation of paddy. Almost all parts of India are suitable for raising paddy during the summer season provided that the water is available. Thus, paddy is also raised even in those parts of

western Uttar Pradesh, Punjab and Haryana where low level areas are waterlogged during the summer monsoon rainy season.

Winter paddy crop is a long duration crop and summer paddy crop is a short duration crop. At some places in the eastern and southern parts of India, paddy crop of short duration is followed by the paddy crop of long duration. Winter paddy crop is raised preferably in low lying areas that remain flooded mainly during the rainy season. Autumn paddy is raised in Uttar Pradesh, Maharashtra, Rajasthan, Madhya Pradesh, Punjab and Himachal Pradesh, summer; autumn and winter paddy crops are raised in West Bengal, Andhra Pradesh, Assam and Orissa. Summer paddy crop is raised on a small scale and on a small area. However, winter paddy crop is actually the leading paddy crop accounting for a major portion of the total Hectare under paddy in all seasons in the country. Moreover in the last few years, several steps in order to augment yield per hectare were taken up very seriously at all levels.

India is a large country. The wide variety of terrain leads to a wide variety of climate conditions. These range from permanent snowfields to tropical coast lands, from areas of virtual desert in the north-west to fertile, intensively cultivated paddy fields in the north-east. Generally, we consider India to lie between 8* and 35* N latitude, with a tropical and sub-tropical climate. The subcontinent has eight climatic zones all of which only have the monsoon rains in common. But even the monsoon comes to different parts of the country at different times.

3.4.4 Three Seasons for Paddy Cultivation in India

There are three seasons for growing paddy in India. These three seasons are named according to the season of harvest of the crop.

Autumn is that part of the season in the year when the rain is gone and the winter is on its way. Generally, the autumn or Pre-Kharif season lasts from March-May to June-October. The rise that is grown in Autumn is called Autumn paddy or Pre-Kharif paddy. About 7% crop is grown in this season. The varieties grown during this season are mostly varieties of short duration ranging from 90 to 110 days.

Autumn Paddy or Pre-kharif paddy is sown during May to August. However, the time of sowing slightly differs from state to state according to weather condition and rainfall pattern. Harvesting of paddy is done in September-October.

Autumn paddy crop is known by different names in different parts of India. For example: it is known as ‘Aus’ in West Bengal, ‘Ahu’ in Assam, ‘Beaki’ in Orissa, ‘Bhadai’ in Bihar, ‘Virippu’ in Kerala and ‘Kuruvai/Kar/Sornavari’ in Tamil Nadu.

The Rabi season in India starts from November- February to March-June. The paddy that is grown during this period is called Rabi paddy or summer Paddy.

Summer paddy is known by different names in different parts of our country. For example: it is also known as known as ‘Baro’ in Assam and West Bengal, ‘Dulua’ in Orissa. ‘Dalwa’ in Andhra Pradesh, ‘Punja’ in Kerala and ‘Navarai’ in Tamilnadu and ‘Garma’ in Bihar.

The sowing time of summer paddy is November to February and harvesting time is March to June. The area under summer paddy is only 9% and early maturing varieties are mostly grown in this season.

After the harvest of Kharif, paddy, the land will be either left fallow or cultivated with a suitable crop in the following rabbi season.

The time gap between the harvest of the Kharif paddy and the cultivation of the rabbi crop depends upon the suitability of the prevailing weather, availability of water, etc.

Sowing of Rabi paddy has gained momentum in the Southern Peninsula in recent times. As per reports in 2004, about 35 lakh hectare are has been covered against 32 lakh hectares sown last year in the corresponding period. Reported area sown under Rabi paddy in West Bengal is about 13.5 lakh hectares which is ahead by about 2 lakh hectares as compared to last year's coverage. The normal area under Rabi paddy is about 42 lakh hectares in 2004. West Bengal and Andhra Pradesh account for two thirds of the area and it is mostly irrigated.

TABLE 3.5

STATEWISE PRODUCTION OF RABI PADDY IN INDIA

Production of Rabi Paddy in '000 tonnes				
State	1974-75	1984-85	1994-95	2004-05
Andhra Pradesh	1,81707	2,051.5	3,288.0	3,443.6
Assam	4702	55.1	55.1	653.8
Bihar	87.2	74.9	204.4	30.0
Karnataka	304.5	434.6	832.0	1031.0
Kerala	196.2	167.0	147.8	144.6
Maharashtra	22.3	43.3	67.6	60.0
Orissa	199.0	322.2	522.2	912.0
Tamil Nadu	63.6	52.0	809.0	1,446.7
Uttar Pradesh	3.4	3.8	10.2	14.0
West Bengal	856.4	1,270.0	3,013.0	4,660.0

Source: Directorate of Paddy Development, Patna.

TABLE 3.6

YEAR WISE PRODUCTION OF RABI PADDY IN INDIA

Year	Production ('000 tonnes)	Year	Production ('000 tonnes)
1988-89	3,653.1	2001-02	7,813.2
1989-90	3,995.0	2002-03	7,112.4
1990-91	2,651.3	2003-04	7,694.8
1991-92	3,723.4	2004-05	7,974.3
1992-93	4.436.7	2005-06	8,309.8
1993-94	3,844.0	2006-07	7,624.9
1994-95	3,541.9	2007-08	9,574.5
1995-96	4,003.3	2008-09	9,211.3
1996-97	3,951.4	2009-10	9,096.5
1997-98	5,045.1	2010-11	10,414.1
1998-99	4,554.9	2011-12	10,014.6
1999-00	4,432.8	2012-13	13,358.9
2000-01	6,995.9	2013-14	12,769.9

Source: Directorate of Paddy Development, Patna.

India ranks second in the production and consumption of paddy in the global market. The most of the production comes from Kharif crops. The rainfed kharif crops are to a great extent depends on South West Monsoon.

Kharif or Winter is the main paddy growing season in the country. It is known as Winter Paddy or Kharif Paddy as per the harvesting time.

The winter crop sowing takes place between June and October and harvesting is between November and April.

This indicates the high dependence of the paddy crop on the south-west monsoon which is occurs over the subcontinent from June through September.

About 84% of the country's paddy crop is grown in this season and generally, medium to long duration varieties are grown in this season.

The normal area under kharif paddy is about 403 lakh hectares till 2002.

Winter paddy is known by various names in India. For example: it is known as 'Aman' in West Bengal, 'Sali' in Assam, 'Sarrad' in Orissa, 'Agahani' in Bihar and Uttar Pradesh, 'Sarava' in Andhra Pradesh, 'Mundakan' in Kerala and 'Samba/Thalai' in Tamil Nadu.

Kharif paddy production typically accounts for 87 to 88 percent of India's total production. The 2003 monsoon favored most of the Kharif paddy areas.

The Kharif paddy crop is sown around the beginning of the southwest Monsoon and harvested in the autumn months.

TABLE 3.7

STATE WISE PRODUCTION OF KHARIF PADDY IN INDIA

Production of Kharif Paddy in '000 tonnes				
State	1974-75	1984-85	1994-95	2004-05
Andhra Pradesh	3,882.6	4,857.6	5,988.7	7,046.0
Assam	1,936.5	2,382.9	3,096.3	3,206.9
Bihar	4,452.2	5,301.6	6,093.5	7,441.6
Gujarat	177.8	838.1	942.1	984.9
Haryana	393.0	1,363.0	2,227.0	2,594.0
Himachal Pradesh	96.8	117.2	112.2	120.9
Jammu and Kashmir	456.0	569.0	574.7	2,335.5
Karnataka	1,681.0	1,940.3	391.1	2,604.0
Kerala	1,137.7	1,088.9	827.3	6,463.0
Madhya Pradesh	2,421.4	3,761.2	626.2	6,376.5
Maharashtra	1,376.6	2,131.9	2,329.5	2,475.9
Manipur	274.7	332.5	478.3	365.0
Orissa	2,967	3,850	5,831	4,275
Punjab	1,179.0	5,052.0	7,703.0	8,716.0
Rajasthan	100.2	212.8	173.2	252.6
Tamil Nadu	3,511.1	5,309.6	6,753.8	5,778.6
Uttar Pradesh	3,520.0	7,153.1	10,354.8	12,898.0
West Bengal	5,687.0	6,822.6	9,222.9	9,291.0

Source: Directorate of Paddy Development,

TABLE 3.8

YEAR WISE PRODUCTION OF KHARIF PADDY IN INDIA

Year	Production (‘000 tonnes)	Year	Production (‘000 tonnes)
1979-80	35,925.8	1992-93	49,049.3
1980-81	44,744.8	1993-94	63,376.3
1981-82	39,265.5	1994-95	65,877.8
1982-83	48,947.0	1995-96	66,317.1
1983-84	49,336.7	1996-97	66,367.8
1984-85	38,486.3	1997-98	65,242.8
1985-86	50,089.5	1998-99	70,723.8
1986-87	49,244.7	1999-00	72,602.7
1987-88	43,164.4	2000-01	67,878.8
1988-89	55,052.2	2001-02	71,322.6
1989-90	53,781.7	2002-03	72,519.9
1990-91	59,392.2	2003-04	72,665.9
1991-92	53,560.9	2004-05	76,705.7

Source: Directorate of Paddy Development,

Paddy is grown in many regions across India. India alone has about 45 million hectares of area, and it produces on an average 93 million metric tons of paddy since 2001 onwards. Paddy cultivation has been carried into all regions having the necessary warmth and abundant moisture favourable to its growth, mainly subtropical rather than hot or cold.

In India, paddy is grown in different types of soils. Experts point out that in India; paddy is grown in such varied soil conditions that it is difficult to point out the soil on which it cannot be grown. However, soils having

3.5 Different climatic factors affecting Paddy Cultivation in India

There are many varieties of paddy which are cultivated with differential response to climate factors, such as

3.5.1 Rainfall

Rainfall is the most important weather element for successful cultivation of paddy. The distribution of rainfall in different regions of the country is greatly influenced by the physical features of the terrain, the situation of the mountains and plateau.

3.5.2Temperature

Temperature is another climatic factor which has a favourable and in some cases unfavourable influence on the development, growth and yield of paddy. Paddy being a tropical and sub-tropical plant, requires a fairly high temperature, ranging from 20* to 40* c. The optimum temperature of 30*c during day time and 20*c during right time seems to be more favourable for the development and growth of paddy crop.

3.5.3 Day Light or Sunshine

Sunlight is very essential for the development and growth of the plants. In fact, sunlight is the source of energy for plant life. The yield of paddy is influenced by the solar radiation particularly during the last 35 to 45 days of its ripening period. The effect of solar radiation is more profound where water, temperature and nitrogenous nutrients are not limiting factors. Bright sunshine with low temperature during ripening period of the crop helps in the development of carbohydrates in the grains.

In India, paddy is grown under widely varying conditions of altitude and climate. The climate of India is difficult to lay due to the country's large geographic

size and varied topography. Many regions have their own micro climates (e.g. in mountain tops), and the mean climatic conditions in Kashmir (Extreme north) are very different from those in the extreme south. India's climate is strongly influenced by the Himalaya and the Thar Desert. The Himalaya ensure, by acting as a barrier to the cold north winds from Central Asia, that northern India is warm or mildly cool during winter and hot during summer. So, India as a whole is considered to be a tropical country. Therefore, the paddy growing seasons vary in different parts of the country, depending upon temperature, rainfall, soil types, water availability and other climatic conditions. In eastern and southern regions of the country, the mean temperature is found favourable for paddy cultivation throughout the year. Hence, two or three crops of paddy are grown in a year in eastern and southern states. In northern and western parts of the country, where rainfall is high and winter temperature is fairly low, only one crop of paddy is grown during the month from May to November.

3.6. Different types of Soils for paddy cultivation

3.6.1 Sub-mountain soils

These soils are formed from the alluvium deposited in the valley floor by the Jhelum and the Indus rivers. They are salty loam to clay loam and are neutral to alkaline.

3.6.2 Hill Soils

These soils are shallow with fragments of rock occurring according to the elevations and have been categorized as red loam, brown forest soil, meadow soil podsolic soil.

3.6.3 Tarai Soils:

These soils are always saturated because of sufficient rainfall and high ground water table. These soils have been formed from transported materials by different rivers originating from the Himalayas. The Tarai soils are very productive and responding well to fertilizer application.

3.6.4 Calcareous Alluvial Soils:

The alluvial soils are rich in potash and calcium but are deficient in organic matter, nitrogen and phosphorus. Alluvial soils cover about 24% of the total land and occur in the great indo-genetic Plains, in the valleys of Narmada and Tapti in Madhya Pradesh and the Cauvery in Tamil Nadu.

3.6.5 Riverine Alluvium Soil:

Seen along the banks of rivers. Shows wide variation in Physico-chemical properties depending on the nature of alluvium and the characteristic of the catchment area through which the river flows. Organic Matter, N and K are moderate.

3.6.6. Laterite soils:

These soils are red but they differ from red soils. Such soils are found in heavy rainfall and high temperature areas. These soils are acidic, pH ranging from 4.0 to 5.0.

3.6.7 Saline and Alkaline soils:

The soils are highly alkaline and have below hard pan which obstruct the downward movement.

3.6.8 Red Yellow loamy soil:

These soils are encountered over extensive non-alluvial tracts of peninsular India. They develop in areas in which rainfall leaches soluble minerals out of the ground and results in a loss of chemically basic constituents.

3.6.9Red Soil:

The red colour in soil usually indicates a high amount of iron, in the form of iron oxide, which coats the particles of the soil. These soils are acidic. These soils are rich in potassium and poor in phosphorus.

3.6.10 Black Soils:

Black soils are spread mostly across the Deccan Lava Plateau the Malwa Plateau, and interior Gujarat, where there is both moderate rainfall and underlying basaltic rock. These soils contain sufficient lime and pH ranges from 7.0 to 8.5. These soils are also deficient in phosphorus and low in organic matter and nitrogen, Black soil can be classified as : Medium black soil, Shallow black soil and Deep Black soil.

3.6.11 Mixed Red and Black soils:

Sometimes black soils are also found in isolated pockets along with the red soils.

3.6.12 Deltaic Alluvium Soil:

The coastal belt is rich with highly fertile deltaic soil, giving it the reputation of being the paddy granary of the country. The alluvial soils of the deltas are very deep and well drained. These soils are very fertile.

3.7 Paddy Production in Tamil Nadu

The food production required to be enhanced to provide food and nutritional security to the growing population. In order to retain the farmers especially the younger generation to take up agriculture as a profession, the income from the farm holdings required to be increased considerably. In Tamil Nadu, 90% of the farmers belong to small and marginal category and their operational holdings account 56% of the total areas. So the small and marginal farmers play a key role in overall

development in Agriculture and the adoption of scientific technologies by these farmers needs focused attention.

The Gross Cropped Area in Tamil Nadu is around 58.43 lakh hectares of which the Gross Irrigated Area is 33.09 lakh hectares which is 57% and the balance 43% of the area are under rainfed cultivation. Major efforts are required to increase the productivity of rainfed crops by overcoming the various challenges such as; erratic monsoon rains, soil with low nutrient and organic contents / poor water holding capacity, soil and water erosion, etc.

The labour scarcity especially during the peak cropping season is also causing difficulty to the farmers to take-up timely field operations. In respect of agricultural crops, the crop cultivation is taken up in two to three seasons annually. Hence to achieve sustainable development and break-through in agricultural production, continuous concentration on technical advancement, input supply, credit and market supports are required. The Government is implementing various programmes to address the issues and constraints faced by the farmers to achieve the targeted growth in agriculture. The Government also primarily shoulders the major task of disseminating advanced technologies to 78.59 lakhs farm holdings through the departmental functionaries.

Tamil Nadu one of the leading rice growing states in India, has been cultivating rice from time immemorial as this State is endowed with all favourable climatic conditions suitable for rice growing. For enhancing rice production and productivity rice research was initiated in (composite) Madras State as early as 1902 at Samalkota of East Godavari district. Subsequently, it was extended to another 12

places of the composite State to develop new high yielding rice varieties and technologies to solve problems in rice cultivation of their respective regions.

These 13 Rice Research stations released many high yielding rice varieties. In the beginning, release of high yielding varieties was mostly through selection from the ecotypes or local cultivars or by introduction. Hybridization was started in 1917 to improve the yield as well as to incorporate tolerance/resistance to biotic and biotic stresses. The Paddy Breeding Station of Coimbatore which was established in 1913 has released CO 1 to CO 7 varieties up to 1929. The pure line CO 4 is highly resistant to blast and has been utilized as donor for the evolution of blast resistant strains. GEB 24 (Government Economic Botanist 24) quality rice evolved through selection from konamani, a slender grained variety was released in 1921.

A total of 50 varieties and 3 rice hybrids were released from Paddy Breeding Station, Coimbatore. After re-organisation of this state during 1956, with its present geographical limits, research has been further strengthened to produce more rice to meet the demand of ever-growing population in the State. The status of rice production and improvement in Tamil Nadu is discussed in this paper.

Total rice production in Tamil Nadu during the year 2007-08 is 5039954 tonnes. Production of rice has reduced to 5040 tonnes during 07-08 from 6611 tonnes in 06-07. Villupuram district is at the top with production of 480329 tonnes followed by Thanjavur district 479643tonnes. (Source: Department of Economics and Statistics, Chennai-600 006).

3.7.1. District and Season wise Production of Paddy in Tamil Nadu

The yield rate of Rice, on the contrary, has reduced to 2817kg/ha in 07-08 from 3423kg/ha in 06-07 (Source: Season and crop report 2007-08, Department of

Economics and Statistics, Chennai- 600 006). The productivity of rice has reduced to 2817 kg/ ha from 3423 kg/ ha in 06-07. Productivity in season wise and district wise during the year 2005-06 indicated that the total productivity was 2541 kg/ha (Source; Season and crop report 2005-06, Department of Economics and Statistics, Chennai - 600 006). The yield rate was recorded on three seasons

1. kar/kuruvai/Sornavar
2. Samab/Thaladi/pishanam
3. Navarai/kodai.

Among the three season, during the year 2005-06 the average yield rate was high in kar/kurauvai/sornavari (3298kg/ha) followed by navarai /kodai (2978kg/ha) and amba/thaladi/pishanam (2325 kg/ha). Highest yield rate of 4563kg/ha was recorded in Erode district during kar/kuruvai/sornavari season followed by Theni district (4525 kg/ha), Thoothukudi district (4101kg/ha) and Kanyakumari district (4077 kg/ha). In samba/thaladi/Pishanam season, highest yield rate was recorded in Thoothukudi district (4068 kg/ha) followed by Theni district (3980 kg/ha) and Erode District (3933 kg/ha). In navarai/kodai season 2005-06, highest yield rate was recorded in Thoothukudi district (4324 kg/ha) followed Erode District (4154 kg/ha) and Virudhunagr district (3824 kg/ha) (Source; Season and crop report 2005-06, Department of Economics and Statistics, Chennai -600 006).

Tamil Nadu is the southern-most state in India. The total rice area in 2005-06 was 2.05 m ha. Season-wise areas were 15.7 per cent in kuruvai (Jun.- Oct.), 74.7 per cent in samba (Aug.- Jan.) and 9.6 per cent in navarai (Dec.- Apr.). Rice is grown in all 30 districts of the state except Chennai and the top five districts with a higher rice area were Villupuram (8.2%), Nagapattinam (7.7%), Thiruvarur (7.6%), Thanjavur

(7.55%) and Thiruvannamalai (6.99%). The total paddy production was 7.83 million tonnes (5.2 million tonnes of rice, which was 84.3% of the total food-grain production in the state) in 2005-06, but had increased to 9.92 million tonnes in 2006-07.

Tamil Nadu ranks twelfth in total rice production in the country. Paddy productivity in Tamil Nadu has always been the second highest in the country, next only to Punjab. During 1998-99 and 1999-2000, the state average productivity was higher than Punjab. Over the last decade, average productivity ranged from 3462 kg ha-1 to 5369 kg ha-1 (Figure 1). However, productivity enhancement was required to fill ever-increasing demand. Water scarcity was a major problem, its availability being dictated by the monsoon.

There was an urgent need to reduce water consumption for rice cultivation while enhancing productivity. The System of Rice Intensification (SRI) fit the bill neatly and thus became an important focus for agricultural research and extension. SRI was made known to the Tamil Nadu Agricultural University (TNAU) through an informal email communication from Plant Research International (PRI), Wageningen, in early 2000.

The innovative concepts led to an explorative evaluation immediately. The results clearly showed the applicability of wider spacing and non-flood irrigation. At this juncture, PRI initiated a collaborative research project 'Waterless Rice' of which TNAU was part. SRI principles were introduced in the experiments of this project. The result of the first experiment itself threw light on the impact of weeder operation and water saving. There was a significant increase in yield (630 kg ha-1) due to the use of the weeder, which generated a lot of interest. There was no yield difference due to less irrigation.

3.7.2 Paddy cultivation in Cauvery Basin Area

More than 60% of the total population in the basin lives in rural areas and their major occupation is agriculture. The land under cultivation in the basin is 48%. Around 24% of the cultivable area has some means of irrigation or other. The crops grown in the area vary from region to region, however major crops are paddy, sugarcane, ragi and jowar. Apart from these, some other crops such as coffee, pepper, banana, betel vine, gingili, onion, cotton, black gram are also grown.

The map of Area under Paddy Production shows distribution of paddy throughout the basin. Major paddy producing areas are eastern coastal or deltaic regions of Tamil Nadu i.e. Thanjavur and Nagapattinam. Cuddalore and Pudukottai in Tamil Nadu and Mandya in Karnataka are also the areas where paddy cultivation is done at a large scale. While central part of the basin has lesser areas covered by paddy, but it can be observed that all the districts contribute to the paddy production in the area.

` The Agricultural Department has taken steps to introduce a method of cultivation to boost up the paddy yield in the Kolli hill tracts of Karur district.

The paddy crop is cultivated in an area of 1500 hectares every year with farmers take up their paddy cultivation in their traditional way without giving much importance to the improved technologies.

MAP SHOWING AREA UNDER PADDY CULTIVATION IN CAUVERY BASIN AREA