



Technical Brief # 3 -2011
Historical Review on Rice Varieties of Tamil Nadu

CLIMARICE II: "Sustaining rice production in a changing climate"

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This Technical brief contains information on the historical varietal development of rice in Tamil Nadu, popular varieties, problems related to climate, climate responsive varieties, market demand and farmers response to improved varieties / hybrids against the traditional cultivars.

"...the possibility of increasing the rice area is almost exhausted in most Asian countries. With little expansion in area and slowing yield increases, growth in rice production has fallen below growth in demand as population has continued to increase." - IRRI

Rice is the main grain cultivated in Tamil Nadu and it is a nourishing food that people subsist on every day of their life. Rice is grown in 2.1 million hectares that accounts for about one-third of the gross cropped area in Tamil Nadu. Rice is grown under diversified ecosystems such as flooded, semi dry and rainfed. Research in rice is aimed at increasing the yield, yield stability and improving resistance against abiotic and biotic stresses. There exist a huge collection of rice germplasm carrying useful genes for the above traits and have been continuously exploited by the plant breeders towards developing improved rice varieties.

Status of rice cultivation in Tamil Nadu

Tamil Nadu is one of states in India which adopted the green revolution technologies rapidly in the 1960s and 1970s, especially for rice crop. Rice production grew at the rate of about 1.4 per cent per annum between 1970-71 and 1999-2000. For the same period, the rice production growth had been marginally ahead of population growth rate in the state. Most of rice production increase over the period has come from yield enhancements. The yield of rice increased at the rate of 2.23

per cent per annum during the period from 1965-66 to 1999-2000 (Ramasamy et al., 2003). Analysis of the data obtained from Directorate of Economics and Statics, Government of Tamil Nadu, on area, production and productivity of rice for a period of 40 years from 1970 - 71 to 2009 - 2010, indicated that there is a decline in area by 1.2 % and increase in yield by 2.45 % per year over Tamil Nadu.



Photo: (A.Lakshmanan) Paddy ADT 38 variety in flowering stage

History of development of Rice Varieties and Hybrids

Rice breeding programme in India started during 1911 in undivided Bengal and Subsequently in 1912, a crop specialist was appointed exclusively for rice in Madras Province. After the establishment of Indian Council of Agricultural Research (ICAR) in 1929, rice research projects were initiated in various states of the country and by 1950, 82 research stations in 14 states of the country were fully devoted for rice research projects. These research stations, mainly by the pure line method of selection, released 445 improved varieties. These varieties were of various kind such as earliness, deep water and flood resistant, lodging resistant, drought resistant, non-shredding of grains, dormancy of seed, control of wild rice, disease resistant and higher response to heavy manuring. During the pure line period of selection (1911-1949), the advantage of natural selection have been fully exploited and there have been varieties available for every rice

ecology. During the early period of breeding research programme, varieties were developed suitable for specific stress situation or for resistant to particular disease. When, after World War II, synthetic fertilizers became popular, efforts were made to identify varieties which respond to heavy fertilization.

Research programme was initiated during 1970 to develop hybrid rice variety in India. There was no success in this programme during the subsequent two decades. However, the research programme was accelerated and intensified from 1989 with a mission mode project. With this concerted research efforts, a remarkable success was achieved within a short span of 5 years and half a dozen rice hybrid rice varieties were developed from public and private sectors. The first four hybrid rice varieties were released in India during 1994. Subsequently, two more hybrid rice varieties were also released. By the end of 2001, a total of 19 hybrid rice varieties were released.

Famous Rice varieties of Tamil Nadu suitable for changing climate

Screening existing successful varieties for projected future climate scenarios would be a quickest and timely climate change adaptation strategy. Selected rice variety must be tolerant/ resistant to drought, cold injury, pests, lodging resistant, non-shattering with horizontal and multiple disease resistance. The list of candidate varieties and their special traits are tabulated (Table 1).

Table 1. Varieties suitable for extreme conditions

Variety	Year	Special feature
MDU 2	1984	Cold tolerant rice variety
PMK 1	1985	Drought tolerant, non-lodging, suitable for dry and semidry cultivation
MDU 4	1991	Cold tolerant, long slender
ASD 19	1995	Tolerant to early drought, moderately resistant to blast
MDU 5	1996	Drought tolerance suited for dry and semidry situations
TKM 11	1998	Drought resistant suitable for samba rainfed
CO 47	1999	Non lodging, blast resistant
TKM 12	2002	Resistant to drought

PMK (R) 3 (PM 9106)	2003	Drought tolerant, non lodging habit and non shattering Tolerant to leaf folder, stem borer, blast and sheath rot under field conditions, semidwarf
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Performance of hybrid rice under farmers perspective in Tamil Nadu

In the past according to farmers, non-availability of seeds, lower profitability, low market price, higher seed cost and lack of consumer demand were major reasons reported for yield drop. So the technological issues are development of superior-yielding hybrids with acceptable grain quality and adequate level of resistance to major insect pests and diseases; ensuring genetic purity of hybrid seed and reducing the cost of hybrid seed (Ramasamy *et al.*, 2003).

A survey conducted among the rice growing farmers of Tamil Nadu by Ramasamy *et al.* (2003) indicated that the average yield of hybrid rice was 5.27 tons/ha while that of inbred rice was 5.33 tons / ha. Thus the study results indicate that there was no significant yield gain from hybrid in Tamil Nadu in the farmers' fields. It was reported based on data from on-farm testing of rice hybrids under scientists' direct supervision during 1993-94 that hybrid rice had yield gain of about 95 per cent over the best inbred rice varieties in Tamil Nadu [Janaiah 2000]. In China, hybrid rice has shown yield advantage of 15 to 20 per cent over those of conventional inbred varieties in the farmers' fields [Lin and Pingali 1994; Luat *et al* 1993; Lin 1994].

The farmer's perception on problems threatening rice production has undergone a major shift. Unpredictable weather and market fluctuations, climate change induced pest dynamics, labor shortage, water crisis and sky rocketing fertilizer costs were ranked as the major challenge for rice production. To address these issues multi-disciplinary approach is essential. And from crop improvement research point of view thrust should be give to temperature tolerance, drought hardiness and horizontal as well as multiple pest and disease resistance.

Research Initiatives on varietal screening for high temperature tolerance through ClimaRice

Agriculture is also a significant contributor to climate change and emission of nitrogenous oxide from rice field is one of the potent components causing global warming. Rice cultivation particularly in Cauvery basin is more affected by climate change and seasonal climate variability and its contribution is severe in yield reduction, crop failure and economic losses. The development of more sustainable, resilient agricultural systems could be achieved by identifying heat tolerant rice genotypes and development of new rice varieties for mitigating the yield losses under high temperature condition.

The research focuses on identification of suitable rice genetic resources and development of heat tolerant rice varieties with high-quality grain and was carried out at Soil and Water Management Institute, Thanjavur which is one of the ClimaRice Dissemination centre during Summer, 2010. A total of 14 rice varieties (ADT 48, ADT 37, ADT 36, ADT(R) 45, ADT 42, ADT 43, ADT 38, Co 49, Co 50, Co, 48, ADT® 46, Co 43, BPT 5204 and CR 1009) were evaluated under two different cultivation systems (Flooded and System of Rice Intensification). Performance of the varieties tested are presented in Table 2.

Table 2. performance of rice varieties on productive tillers, Number of grains and yield - Summer, 2010

Variety	No. of PT/hill		No. of grains/hill		Yield (kg/ha)	
	F	S	F	S	F	SRI
ADT 48	1 1	2 3	814	2668	2464	807 7
ADT 37	6	1 4	744	2352	2396	757 3
ADT 36	6	1 6	708	2752	2036	791 4
ADT 45	1 1	1 5	1342	2490	3231	599 5
ADT 42	1 2	1 7	1296	1972	2407	366 3
ADT43	9	1 7	1314	3094	2440	574 7

ADT 38	1 1	2 2	1364	3256	3941	940 8
Co 49	8	1 3	1008	1794	3106	552 9
Co 50	9	1 5	1278	2370	3728	691 3
Co 48	8	1 6	944	2976	1844	581 4
ADT46	7	1 6	896	3040	2021	686 0
Co 43	8	1 4	1136	2464	3595	779 8
BPT 5204	1 3	2 0	1976	4240	3670	787 6
CR 1009	8	1 5	1312	3300	4242	706 7

PT : productive Tillers; F: Flooded system; S : System of Rice Intensification

The rice varieties viz., ADT 38, ADT 48, ADT 36, BPT 5204, and Co 43 under SRI resisted higher temperature during summer and performed better than other varieties. These varieties produced more number of productive tillers, higher grain numbers and in turn produced higher grain yield. During summer (march - May), the atmospheric temperatures were more by 2 to 3 degree C. The chalky characteristic in rice grain is more prevalent in other varieties with high temperatures that caused yield losses.

Conclusion

Each and every variety of rice is the result of the vision and hard work of women and men of generations past who toiled to select rice varieties which adapted to different climates, soil types, topography and agronomic practices. As climate change has made frequent floods and prolonged droughts the order of the day in India, the modern high yielding rice varieties and hybrids suffer most, leading to a partial or total loss of crops. Conversely, many research shows that traditional rice varieties (such as non-lodging, saline-tolerant, drought-tolerant and flood-tolerant varieties), which are hardier in nature, have been insulated against such unfavorable weather and are able to produce good yields. Promoting traditional crop varieties once again and maintaining biodiversity will definitely offset the hurdles posed by climate change.

References

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ClimaRice II Project (2009-2011)

ClimaRice II is an integrated project that aims to test and validate climate change adaptation techniques related to rice production, in close co-operation with farmers and local agencies in two study areas in the Cauvery River Basin, Tamil Nadu, and Krishna River Basin, Andhra Pradesh, in India.

The overall goal is to contribute to the regional and national adaptation strategies to sustain rice production and ensure food security amidst changing climate. The partners are:

- Bioforsk - Norwegian Institute for Agricultural and Environmental Research (Project Co-ordinator)
- Tamil Nadu Agricultural University, Coimbatore, India
- International Pacific Research Institute, Hawaii, USA
- International Water Management Institute, Hyderabad, India

The project is funded by the Norwegian Ministry of Foreign Affairs/The Norwegian Embassy, New Delhi.
Read more: www.climarice.com