Genetic diversity of rice varieties in Tamil Nadu

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The genetic diversity of rice varieties released in Asia was investigated in 1979 by Hargrove, Coffman, and Cabanilla, IRRI. These authors expressed the view that the cytoplasmic similarity of modern rice varieties, although posing no immediate practical problem, is sufficiently relevant to demand a prompt broadening of the maternal genetic base of modern rices. They recommended the avoidance of the use of maternal derivatives of Cina as females in crosses, the naming of varieties of diverse maternal origin, and the identification and use of alternative sources of dwarfism.

The genetic diversity of rice varieties available in Tamil Nadu was investigated. The state has released 107 varieties; 68 are pure-line selections from traditional cultivars and 39 were developed by hybridization. Twenty-one other high-yielding varieties have been introduced into the state from outside since 1965 (Table 1). Thus 60 varieties developed by hybridization are available. Of that number 17 (28%) released before 1965 are tall varieties with local cultivars as their ultimate female progenitors.

In the varieties available after 1965 (71.7%), 21 have Cina, 8 have DGWG, and the other 14 have local cultivars as ultimate female progenitors (Table 2). All except IR5, NLR 9672, Ponni, White Ponni, and Bhavani carry the same semidwarfing gene from the semidwarf Chinese variety Dee-geo-woo-gen.

After their introduction TN1, IR8, and their derivatives were increasingly used in Tamil Nadu's crossing program. About 50% of the 43 varieties either released or introduced in Tamil Nadu after 1965 have the same maternal parent Cina, and thus have similar cytoplasmic components. The IRRI researchers suggested the use of new sources of semidwarfism such as Ponni Dwarf mutant, D66 (a mutant from Calrose), P3 Dwarf (a spontaneous mutant from Basmati Dehradun), and of alternate sources of maternal parents, which are readily available in the 68 pure lines already released by the State. ■

Table 1. Details on varieties either released or introduced in Tamil Nadu, India, through 1980.

	Varieties (no.)			
	Pure lines	Hybridization		Total
		Until 1965	After 1965	
Varieties developed in Tamil Nadu				
Paddy Experiment Station, Aduthurai	23	5	8	36
Paddy Experiment Station, Ambasamudrarn	11	2	2	15
Paddy Experiment Station, Tirur	6	I	2	9
Paddy Breeding Station, Coimbatore	24	8	10	42
Multi Crop Experiment Sub-station, Palur	2	–	–	2
Deep-Water Rice Research Station, Talainayar	2	–	–	2
Saline & Alkaline Experiment Station, Peravurani	–	1	–	1
Varieties introduced in Tamil Nadu	–	–	21	21
Total	68	17	43	128

Table 2. Ultimate female progenitors of varieties developed through hybridization in Tamil Nadu, India.

Ultimate female progenitor	Until 1965	After 1965	Total
Molagalagulu	1	–	1
ADT 2 (White Serumani)	1	–	1
ADT 3 (Kuruvai)	2	1	3
Norin 6	–	1	1
Norin 8	1	–	1
TKM 7 (Kullakar)	–	1	1
SR 26B (Kalamonk)	1	–	1
CO 3 (Vellaisamba)	1	–	1
CO 4 (Anaikomban)	2	–	2
CO 13 (Arupatham kodai)	1	–	1
PTB 15 (Kavunginpoothala)	–	2	2
Karneji	–	2	2
Manipur 36 (Japan Phon)	–	1	1
T 90 (Machakanta)	–	1	1
Basmati 370	–	2	2
GEB 24 (Kichili Samba)	7	2	9
DGWG (Dee-geo-woo-gen)	–	8	8
Cina	–	21	21
Not known	–	1	1
Total	17	43	60

Isolation of composite rice cultures

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Because of genotypic differences, cultivars with similar morphology and flowering duration vary in their adaptation and yield potential. When mixed, such types may be suitable for different agroclimatic conditions. A trial to isolate composites with better adaptability was conducted at Ambasamudram during the 1980 kar (Jun-Sep).

The 11 trial varieties were raised in individual nurseries and in 55 combinations. For the combinations, seeds of two varieties were mixed at 1:1. The 66 treatments were transplanted at a 20- × 10-cm spacing at 2 seedlings/hill in randomized blocks with 3 replications. Fertilizer was applied at 100-50-50kg of N-P_2O_5-K_2O/ha.

TM3447, TM2048, TM1927, and TM1898 showed variation in flowering and grain characters, and so were not good combiners. Among the combinations, nine showed uniformity for flowering, pigmentation, and grain characters.

Individual varieties and combinations differed significantly in grain yield but the component varieties vs combinations did not. AS693 yielded highest (7.1 t/ha), followed by AS691 (6.9 t/ha), AS764/2 (6.8 t/ha), and TKM9 (6.8 t/ ha). The best varieties, however, were not always the best combiners. The combination AS687 + AS688 yielded highest (7.8 t/ ha) and was comparable to 17 other combinations (range, 7.5-6.8 t/ha). Among them, six combinations involving AS687, AS688, AS691, and AS693 showed uniformity in flowering duration and grain characters as well as high yield potential (see table).

Grain yield of varieties and combinations, Tamil Nadu, India.

Entry	Yield (t/ha) of varieties	Yield (t/ha) of combinations AS688	AS691	AS693	AS762/1	AS764/2	TKM9
AS687	5.9	7.8	7.2	7.3	7.1	7.0	6.8
AS688	6.3		7.0	6.9	7.3	6.0	7.2
AS691	6.9			6.8	6.5	7.5	7.0
AS693	7.1				6.4	6.6	6.3
AS762/1	6.5					6.7	6.6
AS764/2	6.8						6.3
TKM9	6.8						

C. D. (*P* = 0.05): varieties, 0.5 t/ha: combinations 1.1 t/ha; varieties vs combinations, ns.

The following two groups of varieties combined favorably among themselves; the best combinations for yield were from the first group.

Group I : AS687, AS688, AS691, AS693

Group II: AS762/1, AS764/2, TKM9

The two groups can be further examined for composites of two or more varieties that are promising for high yield and wide adaptability. ■

GENETIC EVALUATION AND UTILIZATION

Disease resistance

Estimation of yield losses of tolerant and susceptible rice varieties to blast disease in Maharashtra State, India

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Table 1. Yield of paddy for 2 varieties and in protected and unprotected conditions for 4 years of experimentation, and pooled results, India.

Variety, treatment	Yield (t/ha) 1972	1973	1974	1975	Pooled av
Variety					
EK70.	3.8	2.6	2.5	1.7	2.6
K184	4.4	2.2	4.1	2.1	3.2
S.E.^{m}	1.03	0.546	1.961	0.724	4.289
C.D. 5%	3.05	1.61	5.78	2.13	ns
Treatment					
Protected	4.2	2.4	3.4	2.1	2.6
Unprotected	3.9	2.4	3.2	1.7	2.4
S.E.^{m}	1.03	0.546	1.961	0.724	SEd=0.393
C.D. 5%	ns	ns	ns	2.13	t = 4.634

Table 2. Yield losses caused by blast in rices not protected against the disease, India.

Year	EK70 Protected	EK70 Unprotected	EK70 Loss	K184 Protected	K184 Unprotected	K184 Loss
1972	4.1	3.6	0.5	4.4	4.3	0.1
1973	2.7	2.5	0.2	2.1	2.2	–0.1
1974	2.5	2.4	0.1	4.3	3.9	0.4
1975	1.9	1.4	0.5	2.2	1.9	0.3
Av	2.8	2.5	0.3	3.3	3.0	0.2

(Yield in t/ha)

An experiment on rice varieties Early Kolpi 70 and Karjat 184 was conducted at the Agricultural Research Station, Lonavla, to estimate yield losses caused by rice blast. Although the yield losses caused by blast (*Pyricularia oryzae*) have been reported at 73%, the information is not precise.

The 4-year experiment was begun in kharif 1972. It was planted in a randomized block design with eight replications, four treatments, and two varieties with and without plant protection. The plants were sprayed with benomyl (1:1000) 5 times at 2-week intervals for the entire period of the crop beginning 20 days after planting. The plot size was 7.68 m^2.

Neck infection developed in 31.20%-76.90% of the EK70 plants over the 4 years of the experiment and only 2.53% 24.33% in K184 plants. The difference in disease infection between the 2 varieties was significant in all 4 years. The pooled analysis revealed the same trend, and indicated that EK70 was more susceptible to blast (52.21% infection) than K184 (14.04% infection).

Benomyl (1:1000) in protected plots significantly reduced the neck infection percentage for 3 years of the experiment. It was not effective in 1972. The pooled analysis of the data confirmed the yearly trend, and the neck infection was 8.8% less in protected plots than in unprotected plots. This difference was significant at the 1% level.

Even though in each year (except 1972) the protected plots had significantly less neck infection, yields were not affected during 1972, 1973, and 1974. During these years, the differences in the yield were not statistically significant (Table 1). But in 1975, protection significantly increased the yield by 0.375 t/ha. In the pooled analysis, the protection treatment was significant. It gave an overall yield increase of 0.181 t/ha. Pooled analysis of data indicated no significant differences in the yield patterns of the two varieties.

Table 2 gives the pooled average yield of each variety in protected and unprotected conditions. The average loss due to blast was 0.3 t/ha for EK70 and 0.2 t/ha for K184. ■