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COMPONENTS OF GENETIC VARIATION AMONG A SET OF TWELVE PARENTS IN RAINFED RICE

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Genetic analysis of components of variation for yield and yield components in rainfed rice revealed the importance of both additive and non-additive type of gene action in the inheritance of characters. The parents IR. 13564, IR 45 and IR 8072 were found to be good general combiners for making simultaneous improvement in plant yield coupled with grains per panicle, 1000 seed weight, days to flowering and plant height in the desired direction.

It is a long felt need for the development of early maturing, non-lodging, drought resistant and high yielding varieties of rainfed paddy with white rice for Tamil Nadu. The present study has been taken up to evaluate the breeding potential of twelve selected drought tolerant rice varieties in a diallel study.

MATERIALS AND METHODS

The materials consisted of twelve parents of diverse genotypes and geographic regions viz , Kuruvaikalangiam and Kattanur. local cultivars of rainfed rice from Tamil Nadu, India : B. 733 (Indonesia); IR. 45, IR. 4722, IR. 6228, IR. 8072 IR. 8103, IR. 8608, IR. 13564, KMP. 34 and and kaika (Breeding lines from IRRI) 132 hybrids obtained in a full diallel cross of parents. The parents and their F_1S were grown in a randomised block design with two replications during the summer season 1982 in the Multicrop Experiment Station, Paramakudi. Each plot consisted of a single row of ten plants with a spacing of 60 x 30 cm. Observations were recorded on five random plants on days for first flowering (X_1), Plant height (X_2), Productive tillers per plant (X_3) Grains per panicle (X_4) grain yield per plant (X_5) and 1000 seed weight (X_6). Analysis of combining ability was carried out according to Method I, Model-I of Griffing (1956).

RESULTLS AND DISCUSSION

The variation among parents, hybrids as well as general and specific combining ability was highly significant for all the six characters. The component parents Vs hybrids and also reciprocal effect with the exception of grains per panicle was also significant for all characters (Table 1). The higher magnitude of general combining ability variance indicated the greater importance of additive gene action. Similar results have been reported in both upland and lowland rice (Singh and Nanda, 1976; Rao *et al.*, 1978 and Amirthadevarathinam, 1982, 1983).

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The analysis of components of genetic variation is presented in table 2 The significant value of regression as well as the t^2 values indicated epistasis for days for first flowering, plant height and plant yield. However, productive tillers, grains per panicle and 1000 seed weight recorded a very low value for regression differing neither from zero nor from Unity in addition to non-significant t^2 values. The significant specific combining ability as well as the dominance components (H_1 and H_2) observed for these three characters indicated the involvement of dominance associated with non-allelic interaction.

The dominance noticed for the economic characters could be exploited in production of hybrid rice. Nonetheless, in view of epistasis found associated with dominance, it would be appropriate to go in for the development of superior segregants from among the useful hybrid combinations. Such an endeavour would need information on the effective number of factors such as dominance relations, frequency of favourable alleles, etc. governing the traits in order to predict the breeding behaviour of the segregating progeny and to design the selection procedures.

There was a preponderance of recessive alleles for grains per panicle' plant yield, plant height, days for first flowering and productive tillers and dominance of alleles for 1000 seed weight as evident from the covariance of additive and dominance effects (F-parameters). Nearly symmetrical distribution of positive and negative alleles with only a slight excess of dominance was obtained for days for first flowering and plant yield indicating greater role of additive type of gene action for these two important characters. This is in accordance with Sivasubramaniam snd Madhava Menon, 1973. On the other hand, an unequal distribution of genes was observed for rest of the characters regardless of their direction of action. Under such a genetic situation of ambi-directional dominance and unequal gene frequencies, the per se performance of the parents would be of little avail in selecting the most productive cross combination.

An analysis of the combining ability showed IR .45 and IR. 13564 to be the most useful parents for making simultaneous improvement in plant yield, grains per penicle ,1000 seed weight, days for first flowering and plant height (Table 3). Therefore, the cross IR.45 x IR.13564 would be an ideal choice for the development of early maturing and high yielding varieties very much desired for rainfed rice cultivation. On an examination of the specific combining ability effects, this particulars cross combination of (IR. 45/IR 13564) showed additive effects for all characters excepting days for first flowering and 1000 seed weight. In addition, IR 8072 was a good general combiner and this parent would also be a potential source of further selection and improvment of yield besides earliness and short stature. The combined influence of epistasis with major additive effects would increase the scope of selection and fixation of transgressive segregants for almost all characters. In view of the selections for favourable recessive alleles, family selection based on progeny performance would be effective with the potentiality of recessive alleles remaining hidden in heterozygous conditions

Table 1 : Analysis of variance for Combining Ability in Rainfed rice

Source	d.f	Days for first flowering X_1	Plant height X_2	Productive tillers/ m^2 X_3	Grains per panicle X_4	Plant yield X_5	1000 seed weight X_6
Replication	1	1.7	4.9	18.3	55.1	176 6	52.6**
Parents	11	118.4**	1145 5**	83 0**	2324.8**	1154.5**	240.0**
Hybrids	131	114 9**	555.2**	111.0**	3535.7**	646.6**	10.3**
Parents Vs Hybrids	1	801.2**	781.5**	344.9**	6661.2**	48.6*	948.7**
G. c. a	11	218.5**	1044.5**	73.6**	2004.1**	556.5**	25.9**
S. c. a	66	53.0	138.3**	49 8**	1489.2**	267.2**	8.0**
R. E	66	32.6*	248.9**	51.0**	175 3*	285.9**	6.0**
Error	143	6.7	31.5	34.7	692 2	102.2	1.6

*P = 0 05 **P = 0.01

Table 2 : Components of genetic variation and their ratios for six characters in rainfed rice

Component	Characters					
	X_1	X_2	X_3	X_4	X_5	X_6
D	55.8	557.1**	25.2**	812.2*	625.9**	11.1**
H_1	12857.5**	1039.4**	196.8**	84081.5**	—54019.7**	0.5
H_2	13490.9**	10316 0**	755.5**	732783.1**	55509.0**	7.0**
F	—621 1**	—8892.1**	—543.2**	—648209.4**	—109087.5**	0 4
E	3.3	15 6	17.3	344.2	51.3	0.9
H^2	153.9	120.3	20.0	1309.4	—11.2	1.9
H/D	15.2	1 2	2.8	10.1	10.1	0.2
H_2/4H1	0.3	2.5	1.0	2.2	—0.3	—3.8
t^2	44.3	8.2	0.2	0.04	3.4	1.4
b	0.06	0.5	0 2	– 0.1	1.1	0.01
(Wr + Vr)/ Parents	0.3	0.3	–0.7	0.4	1.0	– 0.03
KD/Kr	0.4	– 0.7	–0.6	—0.95	0.8	1.2

*P = 0.05 **P = 0.01

Table 3 : General combining ability effects and mean values of parents in rainfed rice

Parent	Characters					
	X_1	X_2	X_3	X_4	X_5	X_6
IR. 8608	−2.11	−1.10	0.49	−10.47**	1.09	−0.75**
	82.80	97.30	29.00	171.80	38.30	25.01
IR. 4722	−0.87**	−0.60	−3.81**	−1.06	0.87	0.05
	83.30	92.00	18.00	169.50	51.00	23.12
Kattanur	−3.04**	13.80**	−1.06	0.87	−2.01	1.22**
	95.00	150.50	30.30	212.80	69.00	26.27
IR. 13564	5.15**	7.52**	0.33	20.26	8.05	0.55**
	100.50	143.00	18.50	182.50	121.50	24.05
B. 733 C	−0.76**	−2.01**	0.23	5.66	−0.89	−1.31**
	81.00	106.00	29.00	163.80	53.00	21.24
IR. 8103	2.55**	2.27**	0.22	4.14	−3.29**	−0.42**
	92.30	106.30	12.50	206.30	35.00	23.24
IR. 6228	1.60**	−1.54**	1.06	−6.30	−3.51**	0.52**
	98.00	124.80	28.50	187.30	42.30	20.92
Kuruvaikalangiam	1.02**	3.11**	−0.55	1.15	1.06	2.44**
	89.00	107.80	30.30	169.00	49.80	31.18
IR 8072	−4.09**	−9.59**	2.61**	−4.44	7.88**	−0.76**
	78.80	74.80	28.80	121.80	58.80	23.17
Kaika	4.33**	1.31	−0.51	−2.64	−3.86**	0.44**
	99.00	100.80	18.30	177.30	45.50	24.98
IR. 45	−3.56**	−10.31**	2.56**	−14.45**	5.48**	−0.22
	81.80	71.00	29.60	151.50	39.80	22.29
KMP. 34	−0.21	−2.85**	−1.58	8.06**	−4.86**	−1.49**
	91.30	96.30	31.50	258.80	31.30	16.[illegible]8
Var gi.	0.12	0.61	0.66	13.23	1.95	0.03
Ca. gi	0.68	1.52	1.57	7.13	2.74	0.34

Upper figures are g. c. a. effects and lower figures are mean values.

*P = 0.05 **P = 0.01

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