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Germplasm improvement

Genetics

Analysis of yield and yield components in rice

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Mean and genetic variability are the important factors for selection. Heritability estimates and genetic advance are helpful in predicting the effects of selecting the best genotypes. We undertook this study to select good genotypes in very early rice cultivars and hybrids.

Four early-maturing (105-115 d) varieties ADT36, ASD16, CO 37, and IR50, and seven very early-maturing (less than 100 d) rice varieties and cultures, ASD8, Heera, Kalyani II, Sattari, AS18696, and AS89011, were crossed in line \times tester mating design. The 11 parents and their 28 F_1 hybrids were studied in an experiment laid out in a randomized block design, replicated three times, during 1993-94 late Pishanam season (Nov-Mar) at RRS. Observations were recorded on five randomly selected plants per replication. Mean (\bar{X}), standard deviation (SD), phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in the broad sense (h^2), and genetic advance as a percentage of mean (GA%) were calculated for 12 traits.

Significant differences were observed for all of the traits, indicating wide variability. PCV was, in general, higher than GCV, but the difference was very low, indicating less environmental influence on the expression of different traits. GCV ranged from 7.1 for kernel length to 28.0% for grain yield per plant (see table). Grains per panicle, grain yield per plant, and dry matter production exhibited high GCV and PCV, indicating a wide scope for improvement through selection.

A moderate amount of variability (10-20%) was observed for days to panicle emergence, plant height, panicles per

Genetic parameters for 12 traits in very early inbreds and hybrids of rice. RRS, Ambasamudram, Tamil Nadu, India. 1993-94.

Trait	Mean (\bar{X})	Standard deviation (SD)	Phenotypic coefficient of variation (PCV)	Genotypic coefficient of variation (GCV)	Heritability (broad sense) (h^2)	Genetic advance as % of mean (GA%)
Days to panicle emergence	66.7	0.85	10.4	10.4	98.8	21.2
Plant height	104.6	14.35	13.8	13.7	99.0	28.2
Panicles per plant	9.4	1.80	19.3	19.1	98.4	39.1
Panicle length	24.6	2.24	9.2	9.1	97.7	18.6
Grains per panicle	106.7	24.83	23.3	23.3	99.6	47.9
100-grain weight	2.22	0.21	9.4	9.4	99.6	19.4
Grain yield per plant	13.4	3.74	28.1	28.0	99.5	57.5
Dry matter production	32.46	8.08	24.9	24.9	99.9	51.3
Harvest index	0.42	0.06	16.1	15.8	95.9	31.9
Kernel length	6.17	0.44	7.2	7.1	97.1	14.4
Kernel breadth	2.39	0.22	9.4	9.1	94.7	18.3
Kernel shape	2.58	0.35	13.7	13.5	96.7	27.4

plant, harvest index, and kernel shape, while low GCV was observed for panicle length, 100-grain weight, kernel length, and kernel breadth. All of the traits had very high heritability but only days to panicle emergence, plant height, grain yield per plant, dry matter production, harvest index, and kernel shape showed high h^2 coupled with a high GA%.

indicating a predominance of additive gene effects in controlling these traits.

Grains per panicle, grain yield per plant, dry matter production, and days to panicle emergence had high estimates of GCV, h^2 , and GA%. Direct phenotypic selection based on these traits would be effective for varietal improvement in very early rice cultivars. ■

General combining ability for kernel traits in rice

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We studied the general combining ability of five lines of high-yielding cosmopolitan varieties and three testers of Basmati varieties for kernel traits in a line \times tester mating design. The experiment was laid out in a randomized block design with three replications in 1991-92 wet season at TNRRI. Each treatment (parents and their resulting 15 F_1 hybrids) was raised in two 3-m rows with 30- \times 20-cm spacing. We randomly measured 10 plants per replication from each treatment.

Among the lines, Improved White Ponni and IR50 were good general combiners for kernel breadth, kernel length-breadth ratio, kernel length after

cooking, kernel breadth after cooking, and elongation index (see table). High general combining ability was recorded in Improved White Ponni for grain yield and linear elongation ratio, and in IR50 for kernel length. ADT37 had desirable general combining ability for breadthwise expansion ratio and elongation index, and ADT39 for grain yield and kernel breadth. Considering the testers, Pusa Basmati 1 was a good general combiner for six kernel traits, and ADT 41 for kernel length, kernel length-breadth ratio, and grain yield.

High general combining ability effects are related to additive genetic effects that represent the fixable genetic component of variation. Improved White Ponni was determined to be the best parent, followed by Pusa Basmati 1, and IR50, which possess desirable general combining ability for the majority of kernel characteristics studied. ■