complementary genes responsible for scentedness. Richharia *et al.* (1965) reported that scentedness is a polygenic character.

Variation in ratios of scented to nonscented observed may be due to difficulty in scoring methods, because it completely depends on the individuals inhaling capacity. Clear indications are for major gene control for scentedness. These major genes can very easily be incorporated into improved breeding lines.

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STUDY ON COMBINING ABILITY IN HYBRID RICE (*Oryza sativa* L.)*

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ABSTRACT

Among the lines, ZS 97 A possessed high gca effects for number of productive tillers per plant, number of filled grains per panicle, 100 grain weight, grain yield and straw yield per plant. Among the testers, IR 50 possessed high gca effects for days to panicle emergence, number of productive tillers per plant, number of spikelets per panicle, number of filled grains per panicle, grain yield and straw yield per plant. Among the hybrids in general, ZS 97A/IR 50 expressed high order of expression for the characters viz, total spikelets per panicle, number of filled grains per panicle and grain yield per plant. This high order of expression might be due to the additive genetic effects present in both the parents.

Key Words : Rice, Combining ability

Recent achievement in rice breeding is the development of hybrid rice in China. Hybrid rice came into cultivation from 1976 and 1984. The area has been increased to 25 per cent of total cultivated area of 33 million hectares (Yuan and Virmani, 1986). Hybrid rice has 25 to 30 per cent increased yield over locally adapted varieties in China. The disadvantage of Chinese hybrids is that they do not perform well under Indian conditions on account of varied agro climatic conditions and hence

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Table 1. GENERAL COMBINING ABILITY EFFECTS OF LINES AND TESTERS FOR TWELVE CHARACTERS IN RICE

PARENTS	CHARACTERS											
	Plant height	Days to panicle emergence	No of productive tillers	Boot leaf length	Panicle length	No. of spikelets per panicle	No.of filled grains per panicle	No.of Chaff per panicle	Volume of 100 grains	100 grains weigh.	Grain yield per plant	Straw yield per plant
IR 8	-7.071**	9.333**	-2.007**	1.159**	1.762**	9.593**	9.554**	0.024	-0.039	0.118**	2.892**	1.012**
IR 36	-0.348**	0.889*	3.126**	-0.217	1.116**	5.682**	11.943**	-6.276**	-0.107	0.081**	4.314**	0.223**
IR 2	0.310	4.778**	1.970**	1.129**	0.443	-0.307	-3.479**	2.657**	-0.158	0.083**	0.772**	0.706**
IR 50	-1.282**	-11.333**	2.956**	-1.095**	0.248	10.993**	16.054**	-4.854**	-0.307	-1.824**	5.289**	1.812**
IR 54	-5.902**	4.556**	4.348**	-0.436	-0.669**	-10.063**	-3.902	-6.532	-0.095	-0.021	2.945	5.734
ADT 36	-6.991**	-10.333**	-0.541**	-0.150	-2.202**	-11.063**	-13.879**	2.802**	1.649**	7.589**	-3.301**	-4.022**
TKM 9	-1.496**	-10.000**	-0.563**	-0.403	1.482**	-6.163**	-14.891**	8.746**	-0.073	-0.050**	-5.769**	-4.211**
PONNI	14.401**	4.333**	-1.619**	1.465**	0.925	-0.029	1.620**	-1.109**	-0.173	0.088**	-0.661**	2.756**
BHAVANI	16.667**	5.222**	-2.841**	-1.066**	-2.386**	1.659	-4.968**	6.557**	-0.228	-0.010	-0.162**	3.889**
CO 33	-6.642**	-1.000**	-3.863**	-1.273**	-0.454**	-7.219**	-7.713**	0.591	-0.207	-0.166	-3.851**	-4.488**
CO 37	-2.008**	-2.111**	-0.285	-0.143	-0.628**	9.526**	11.532**	-1.900**	-0.139	-0.172	-2.936**	-1.566**
CO 43	0.363	5.667**	-0.685**	1.027**	0.395	-2.607**	-1.868**	-0.698	-0.129	0.046**	0.468**	-1.844**
ZS 97A	-1.101	-1.222**	1.057**	-0.511	0.108	0.093	4.020**	-3.787**	-0.073	0.042**	1.089**	0.529**
EJN 1A	1.508*	0.694	1.334**	-0.184	-0.112	2.020**	1.195*	0.838*	-0.204	-0.036**	0.678**	1.453**
YAZ 1A	-1.407*	0.528	-2.291**	0.695	3.889**	-2.113*	-5.216**	2.949**	-0.277	-5.963**	-1.766**	-1.983**

ZS 97A = Zhen Shan 97A
EJN 1A = Er-Jiu - Nan 1A
YAZ 1A = Yar - Ai - Zhao - 1A

* Significant at 5% level
** Significant at 10% level

Table 2. Specific combining ability effects of hybrids for twelve Characters

HYBRIDS	CHARACTERS											
	Plant height	Days to panicle emergence	No. of productive tillers	Boot leaf length	Panicle length	No. of spikelets per panicle	No.of filled grains per panicle	No.of Chaff per panicle	Volume of 100 grains	100 grains weigh	Grain yield per plant	Straw yield per plant
ZS 97A/ IR 8	-5.659**	1.667*	3.732**	1.231**	4.658**	0.919	-3.376**	8.154**	0.118	0.163**	-1.389**	-1.330**
ZS 97A/ IR 36	3.318**	0.778	6.932**	0.024	0.207	0.296	5.535**	-5.180*	0.151	-0.018	2.828**	3.493**
ZS 97A/ IR 42	-2.467**	0.889	-4.712**	-0.702	-1.560**	-1.048	1.491**	-2.846**	0.095	0.035	-0.914**	-1.541**
ZS 97A/ IR 50	5.902**	-0.667	5.899**	-1.561**	-0.652	11.219**	17.357**	-6.169**	0.051	0.071**	6.895**	3.437**
ZS 97A/ IR 54	-0.971	2.111**	-3.423**	1.147	0.806*	9.241**	7.713**	2.009**	6.481**	0.018	1.050**	-1.252**
ZS 97A/ ADT 36	0.648	1.667	0.366	-0.606	0.676	-4.659**	-7.143**	2.343**	-1.705*	0.082**	-2.472**	-0.396*
ZS 97A/ TKM9	0.633	-1.000	1.621**	1.080**	-1.685	2.326**	5.602**	-8.002**	0.351	0.164**	0.574**	0.659**
ZS 97A/ PONNI	2.719**	2.000**	-6.057**	0.265	0.564	1.274	6.857**	-4.613**	0.251	-0.058**	2.988**	0.126
ZS 97A/ BHAVANI	2.613**	-0.556	2.301**	-0.377	-0.538	-10.982**	-19.687**	8.620**	0.073	-0.059**	-2.578**	-1.774**
ZS 97A/ CO 33	-1.488**	-1.333*	0.721**	-1.334**	-0.213	7.563**	5.857**	1.454**	0.118	-0.144**	2.096**	2.504**
ZS 97A/ CO 37	-3.805**	0.111	-4.890**	0.190	-2.159	-6.415**	-1.087	-5.580**	0.318	-0.121**	-0.696**	-3.819**
ZS 97A/ CO 43	-1.443**	-5.667**	2.110**	0.643	-0.102	-5.082**	-14.920**	9.809**	0.173	-0.133**	-2.396**	-0.107
EJN 1A/ IR 8	1.396*	-3.583**	-1.312**	-0.536	-2.119**	8.091**	8.949**	-0.871	0.248	-0.249**	-0.281**	-1.753**
EJN 1A/ IR 36	0.042	-2.139**	-5.379**	-0.568	-0.767*	-10.365**	-12.340**	1.962**	0.015	0.122**	2.295**	-1.998**
EJN 1A/ IR 42	0.382	-0.361	4.877**	-0.589	-0.077	0.824	-1.418*	2.729**	0.326	-0.043**	-0.880**	-1.581**
EJN 1A/ IR 50	4.777**	4.417**	-4.045**	1.374**	-0.299	-9.409**	-8.618**	-0.694	0.343	0.105**	-2.883**	-2.887**
EJN 1A/ IR 54	1.433**	1.472*	-1.268**	-0.524	0.962**	9.246	10.871**	-1.282*	0.337	0.042	1.560**	1.858**

HYBRIDS	Plant height	panicle emergence	productive tillers	Boot leaf length	Panicle length	spikelets per panicle	filled grains per panicle	No.of Chaff per panicle	Volume of 100 grains	100 grains weigh	Grain yield per plant	Straw yield per plant
EJN 1A/ TKM9	1.311**	-0.917	1.523**	-0.670	-1.981**	1.113	-6.040**	7.107**	-0.052	-0.170**	-3.654**	-2.098**
EJN 1A/ PONNI	2.777**	-0.583	3.432**	-0.051	-1.943**	-7.754**	-1.984**	-6.338**	0.182	0.030	3.929**	-1.736**
EJN 1A/ BHAVANI	1.211**	0.528	-0.879**	-0.107	0.142	6.891**	8.138**	-1.205	0.137	-0.045	3.929**	-1.736**
EJN 1A/ CO 33	-0.563	1.083	-2.690**	0.890**	0.519	-1.365	1.016	-2.505**	0.048	0.217**	-2.490**	-3.820**
EJN 1A/ CO 37	2.913**	0.528	7.366**	0.640	1.987**	-0.376	-2.029**	1.529**	-0.019	0.082**	0.453**	6.391**
EJN 1A/ CO 43	-3.869**	3.417**	-1.634**	-1.640**	-0.546	5.551**	8.138**	-2.649**	0.104	-0.016	-0.781**	-0.098
YAZ 1A/ IR 8	4.264**	1.917**	-2.420**	-0.695	-2.538**	-9.009**	1.572**	-7.282**	-0.366	0.086**	1.670**	3.083**
YAZ 1A/ IR 36	3.360**	1.361*	-1.554**	-0.592	0.561	10.069**	7.009**	3.218**	-0.166	-0.104**	-5.123**	1.495**
YAZ 1A/ IR 42	2.849**	-0.528	-0.165	1.292**	1.637**	0.225	-0.073**	-0.118	-0.421	7.296**	1.794**	3.122**
YAZ 1A/ IR 50	-1.125	-3.750	-1.854**	0.183	0.952**	-1.809*	-8.740**	6.862**	-0.399	-0.176**	-4.012**	-0.851**
YAZ 1A/ IR 54	-8.462**	-0.639	4.691**	-0.623	-1.767	-18.487**	-18.584**	-0.727	-0.344	-0.060**	-2.610**	-0.606**
YAZ 1A/ ADT 36	4.983**	0.750	-3.420**	0.655	-0.847	7.113**	11.827**	-4.560**	3.379**	-0.815**	1.885**	-2.551**
YAZ 1A/ TKM9	1.944**	1.917**	-0.098	-0.410	-0.295	1.213	0.438	0.895	-0.299	5.963**	3.280**	1.438
YAZ 1A/ PONNI	-5.495**	1.417**	2.624**	0.214	1.378**	6.480**	4.873**	10.951	-0.432	0.028	0.853**	-1.128
YAZ 1A/ BHAVANI	0.028	3.180**	0.270	0.386	4.091**	11.549**	-7.416**	-7.416**	-0.210	0.104**	-1.351**	0.038
YAZ 1A/ CO 33	2.051**	0.250	1.969**	0.444	-0.306	-6.198**	-6.873**	1.051	-0.166	-0.074**	0.394*	1.316**
YAZ 1A/ CO 37	6.718**	-0.639	-2.476**	-0.830**	0.172	6.791**	3.116**	4.051**	0.299	0.039	0.243	-2.573**
YAZ 1A/ CO 43	5.113**	2.250**	-0.476	0.520	0.668	-0.476	6.782**	-7.160**	-0.277	0.150	3.178	0.205

ZS 97A = Zhen Shan 97A
EJN 1A = Er-Jiu - Nan 1A
YAZ 1A [illegible]

* Significant at 5% level
* Significant at 10% level

there is a need to know about the behaviour of the cytosteriles and their restorers and their potentiality to combine with other yield attributing traits to produce best combinations. The present investigation was taken up to study the general combining ability of the parents and specific combining ability of the hybrids for yield and its components.

MATERIALS AND METHODS

A study was undertaken to findout combining ability with three male sterile lines and twelve popular varieties of rice. The experiment was conducted at Rice Research Station, Tirur, Chengalpattu District, Tamil Nadu State during 1985-86. Seeds of the three Chinese male sterile lines *viz*, Zhen shan 97A, Er-jiu-Nan 1 A and Yar-Ai-Zho IA and Twelve popular rice varieties of Tamil Nadu *viz.*, IR 8, IR 36, IR 42, IR 50, IR 54, ADT 36, Ponni, Bhavani, Co 33, Co 37 and Co 43 were received from Paddy Breeding Station, School of Genetics, Tamil Nadu Agricultural University, Coimbatore and used as the parent materials.

During rabi 1985, the three male steriles (lines) and twelve varieties (testers) were raised. Crosses were effected by using wet cloth method for emasculation between lines and testers to get 36 cross combinations.

The F1s, male sterile lines and pollen parents were raised during Kharif, 1986. The seedlings were transplanted in the main field with a spacing of 20 x 20 cm in a randomised black design, replicated thrice with 20 hills per replication. Observations were recorded in randomly selected ten plants in each replication. Data were computed to work out general and specific combining ability (*gca* and) as suggested by Kempthorne (1957).

RESULTS AND DISCUSSION

Estimates of general combining ability (*gca*) and specific combining ability (*sca*) are presented in Tables 1 and 2 respectively.

General combining ability

Among the lines, Er-jiu-Nan IA recorded the highest values for plant height, days to panicle emergence, number of productive tillers and total spikelets per panicle. The line ZS 97A exhibited desirable performances for volume of 100 grains, 100 grain weight and grain yield per plant. Yar-Ai-Zhao IA showed the lower value for days to panicle emergence when compared to other two lines indicating its potentiality for evolving short duration variety. These lines could be successfully utilised in the varietal improvement programme for the above mentioned traits.

Among the testers, IR 50 recorded the highest values for number of spikelets per panicle, number of filled grains, grain yield per plant and days to panicle emergence. IR 8 showed highest values of *per se* performances for total spikelets per panicle, volume of 100 grains and 100 grain weight. Ponni and Bhavani recorded the highest values for panicle length and straw yield per plant respectively. These testers might be useful as female parents to evolve superior hybrids.

Specific combining ability

In the present study, the hybrid combination ZS 97A/IR 50 exhibited high order of expression for total spikelets per panicle, number of filled grains per panicle and grain yield per plant. In this cross combination, both the parents possessed high order of expression for the yield components. In the cross, ZS 97A/IR 36, both the parents and hybrids exhibited good expression for the number of productive tillers per plant whereas in the

cross, ZS 97A/IR 8, only IR 8 recorded high degree of expression for panicle length. Gilbert (1958) recorded that generally parents with high order of mean *per se* performance of characters resulted in hybrids with mean performance. The result of the present study indicated that the parents mentioned above were with high order of *per se* performance.

The *gca* effect is considered as the intrinsic genetic value of the parent for a trait which is due to additive genetic effect and it is fixable (Simmonds, 1969). Singh and Harisingh (1983) and Jagtap (1986) opined that the *per se* performances of the parents were not always associated with high *gca* effects. In the present study eventhough all the characters studied except the volume of 100 grains exhibited non-additive gene action, most of the parents showed high order of expression for both *per se* performance and *gca* effect.

From the study it is revealed that ZS 97A possessed high *gca* effect for number of productive tillers per plant, number of filled grains per panicle, 100 grain weight, grain yield per plant and straw yield per plant. Among the pollinators, IR 50 possessed high *gca* effect for number of days to panicle emergence, number of productive tillers per plant, number of spikelets per panicle, number of filled grains per panicle, grain yield and straw yield per plant. Hence, these two parents may be exploited further for crop improvement programme.

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A SUPERFINE RICE VARIETY PAIYUR 1 FOR SALEM DHARMAPURI REGION

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ABSTRACT

In Salem - Dharmapuri region of Tamil Nadu, the traditional rice variety GEB 24 is predominantly grown for its fine rice quality. The yield potential of this strain is, however, very low. Several genotypes obtained from national and international sources were evaluated to identify high yielding strains with quality grains. The culture DPI 591, a multiple cross derivative was found to be high yielder with good cooking qualities. It registered a grain yield of 5827 kg/ha with an increase of 16.2 and 54.6 per cent over Bhavani and GEB 24, respectively. This has been released as Paiyur 1.

Key Words : Fine rice, High Yield, Rice Variety.

Rice, the stable food crop of Tamil Nadu, is grown in an area of 32.5 lakh hectares of which nearl 4.5 per cent of the area is in North-Western parts of the Sta comprising Salem and Dharmapu districts. Fine grained rice varieties a