Co 1 were found to be good combiners for pod borer resistance since they recorded statistically significant negative GCA effects. They could be utilised as donors in the hybridisation programme for infusing pod borer resistance.

Phenotypic mean performance, SCA effects and estimates of heterosis of hybrids for pod borer damage was presented in Table 2. Among 12 hybrids evaluated, only five hybrids *viz.*, Si 250 x Co 1, Es 22 x Co 1, Si 3315/11 x TMV 3, Si 3315/11 x TMV 4 and Si 3315/11 x Co 1 recorded statistically low incidence of pod borer. Significant negative SCA effects and favourable standard heterosis values were recorded only in three hybrids *viz* Si 3315/11 x TMV 3 and Si 3315/11 x TMV 4 and Si 3315/11 x Co 1. Among the three hybrids, the hybrid Si 3315/11 x Co 1 could be of immense value to plant breeders since it registered high *per se* performance, *SCA* effect besides heterosis and the hybrid derived from parents of good combiners. Since the inheritance is predominantly a non-additive type of gene action, the hybrid vigour for pod borer damage could be exploited through heterosis breeding. It is evidenced by the high magnitude of SCA variance when compared to GCA variance. But, the parents involved in other two hybrids *viz.* Si 3315/11 x TMV 3 and Si 3315/11 x TMV 4 were either with one good and one poor combiner. In the hybrids, the role of non additive gene action might be high. For harnessing the non-additive gene action, cyclic method of breeding involving selected recombinants and intercrossing would be desirable for obtaining pod borer resistant sesame varieties.

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INTER RELATIONSHIP AND PATH ANALYSIS OF CERTAIN COOKING QUALITY CHARACTERS IN HETEROGENOUS POPULATIONS OF RICE (*Oryza sativa L.*)

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ABSTRACT

The grain yield showed no correlation with most of the quality characters. Kernel length had a significant positive correlation with kernel L/B ratio in both corsses and both generations. LER and BER had relationship with EI in positive and negative direction respectively. Path analysis also indicated that LER and BER are prime grain quality characters for improvement of genotypes.

KEY WORDS : Rice, Quality Characters, BER, LER, EI, Correlation

Cooking quality is an important character that determines consumer preference. Consumer prefernce of rice is dependent on physical dimension of polished kernels, wholeness, transluscency etc. Moreover, high volume expansion and length-wise expansion of kernel during cooking are more desirable traits of good quality rice like Basmati rice. Hence an attempt was

Table 1. Correlation co-efficients among cooking quality characters of rice. Cross I IR 50 x Pusa Basmati

Characters	Generations	Kernel breadth	Kernel L/B ratio	KLAC	KBAC	LER	BER	EI	Single plant yield
Kernel length	F_2	-0.035	0.718**	0.811**	0.102	-0.533**	0.163*	-0.339**	-0.040
	F_3	0.326**	0.333**	0.739**	0.247**	-0.609**	0.022	-0.242**	-0.014
Kernel breadth	F_2		-714**	-0.208*	0.659**	-0.231**	-0.407**	-0.007	-0.108
	F_3		-0.777*	0.135*	0.740**	-0.310**	0.017	-0.132*	-0.026
Kernel L/B ratio	F_2			0.712**	-0.357**	-0.205*	0.430**	-0.238**	-0.049
	F_3			0.338**	-0.550**	-0.110	0.032	-0.063	-0.087
KLAC	F_2				0.073	0.059	0.339**	-0.040	-0.096
	F_3				-0.080	0.082	-0.255**	0.237**	-0.021
KBAC	F_2					-0.088	0.417**	-0.374**	-0.059
	F_3					-0.451**	0.683**	-0.724**	-0.022
LER	F_2						0.175*	0.538**	0.084
	F_3						-0.333**	0.638**	0.034
BER	F_2							-0.441**	-0.102
	F_3							-0.936**	-0.021
EI	F_2								-0.107
	F_3								0.061

* Significant at 5% level

** Significant at 1% level

made to unravel the relationship of quality characters involving Basmati and non Basmati crosses of F_2 and F_3 generations.

MATERIALS AND METHODS

A study was undertaken at Agricultural College and Research Institute, Madurai during October, 1993 to identify superior cross combinations to conceptualise breeding strategies for quality improvement in rice F_2 of two inter-varietal crosses of rice involving IR 50 and two Basmati varieties *viz.*, Pusa Basmati I and Kasthuri. In each cross combination, a total of 700 plants and 500 plants of F_2 and F_3 generations respectively was planted with a spacing of 20 x 15 cm at the rate of one seedling per hill. Normal cultual and manurial practices were followed. The grains harvested from a single plant were cleaned, processed and dried. These grains were utilised for recording quality characters *viz.*, kernel breadth, kernel L/B ratio, kernel length and breadth after cooking (KLAC and KBAC), linear elongation ratio (LER), breadthwise expansion ratio (BER) and elongation index (EI). The measurement of quality characters was taken as per the method suggested by Pillayar and Mohandass (1981) and Juliano and Perez (1984). Correlation and path coefficient analysis were computed following the standard statistical procedures.

RESULTS AND DISCUSSION

Correlation coefficients for F_2 and F_3 generations of two rice crosses are given in Tables 1 and 2. All the quality characters had non-significant assocation with grain yield which indicated the limited contribution of these characters to grain yield. Tomar and Prasad (1992) and Vanwenchao *et al.* (1992) found negative correlation of grain length with yield. Similarly Rangasamy (1991) also did not observe significant corrlation between grain L/B ratio and grain yield.

Inter correlation among quality characters :

In F_3 generation of both crosses significant positive association was observed between kernel length and kernel breadth. But in F_2 generation, negative correlation was observed in both generations. This change in the direction from F_2 and F_3 might be due to higher level of

Table 2. Correlation co-efficients among cooking quality characters of rice. cross 2 IR 50 x kasthuri

Characters	Generations	Kernel breadth	Kernel L/B ratio	KLAC	KBAC	LER	BER	EI	Single plant yield
Kernel length	F_2	-0.071	0.701**	0.881**	-0.152	-0.699**	-0.092	-0.374**	0.081
	F_3	0.156*	0.356**	-0.057	0.206**	-0.373**	0.065	-0.335**	-0.205
Kernel breadth	F_2		-0.752**	-0.169*	0.830**	-0.120	-0.268**	-0.164*	-0.143
	F_3		-0.443*	-0.142	0.831**	-0.386**	-0.430**	-0.006	-0.087
Kernel L/B ratio	F_2			0.706**	-0.656**	-0.348**	0.183*	-0.392**	-0.077
	F_3			0.041	-0.305**	-0.561**	0.298**	-0.628**	-0.052
KLAC	F_2				0.202*	-0.281**	-0.012	-0.149	0.137
	F_3				-0.269**	0.044	-0.158*	0.139*	-0.124
KBAC	F_2					0.007	0.311**	-0.249**	-0.156
	F_3					-0.389**	0.141*	-0.404**	-0.099
LER	F_2						0.193*	0.517**	-0.064
	F_3						0.062	0.723**	-0.077
BER	F_2							-0.731**	0.084
	F_3							-0.643**	0.009
EI	F_2								-0.097
	F_3								0.046

* Significant at 5% level

** Significant at 1% level

Table 3. Phenotypic pathways between EI and quality characters. Cross 1 IR 50 x Pusa Basmati

Characters	Generations	Kernel breadth	Kernel breadth	Kernel L/B ratio	KLAC	KBAC	LER	BER	EI
Kernel length	F_2	-4.621	-0.022	1.714	2.162	0.087	0.588	-0.247	-0.339**
	F_3	0.329	-0.010	-0.007	-0.185	0.001	-0.351	0.018	-0.242**
Kernel breadth	F_2	0.160	0.656	-1.705	-0.554	0.565	0.255	0.617	-0.007
	F_3	0.107	-0.032	0.016	-0.034	0.003	0.179	-0.014	-0.132*
Kernel L/B ratio	F_2	-3.319	-0.468	2.387	1.896	-0.306	0.226	-0.654	-0.238**
	F_3	0.110	0.025	-0.021	-0.085	-0.002	-0.063	-0.026	-0.063
KLAC	F_2	-3.750	-0.136	1.699	2.665	0.062	-0.065	-0.514	-0.040
	F_3	0.243	-0.004	-0.007	-0.251	-0.001	0.048	0.208	0.237**
KBAC	F_2	-0.469	0.432	-0.852	0.194	0.857	0.097	-0.632	0.374**
	F_3	0.081	-0.023	0.011	0.020	0.005	-0.260	-0.558	-0.724**
LER	F_2	2.464	-0.152	-0.488	0.157	-0.075	1.103	-0.265	0.538**
	F_3	-0.200	0.010	0.002	-0.021	-0.002	0.577	0.272	0.638**
BER	F_2	-0.753	-0.267	1.029	0.903	0.357	-0.193	-1.517	-0.441**
	F_3	0.007	-0.001	-0.001	0.064	0.003	-0.192	-0.818	-0.936**

Residual effect F2 = 0.596, F3 = 0.053

* Significant at 5% level

** Significant at 1% level

Table 4. Phenotypic pathways between EI and quality characters - Cross 2 IR 50 x Kasthuri

Characters	Generations	Kernel breadth	Kernel breadth	Kernel L/B ratio	KLAC	KBAC	LER	BER	EI
Kernel length	F_2	0.662	0.006	-0.327	-0.196	0.033	-0.619	0.066	-0.374**
	F_3	-0.009	0.013	0.007	0.001	-0.015	-0.289	-0.042	-0.335**
Kernel breadth	F_2	-0.047	-0.082	0.350	0.037	-0.179	-0.107	0.191	-0.164*
	F_3	-0.001	0.081	-0.009	0.001	-0.059	-0.300	0.281	-0.006
Kernel L/B ratio	F_2	0.464	0.062	-0.466	-0.157	0.141	-0.308	-0.131	-0.392**
	F_3	-0.003	-0.036	0.020	-0.001	0.022	-0.435	-0.195	-0.628**
KLAC	F_2	0.584	0.014	-0.329	-0.222	0.044	-0.248	0.009	-0.149
	F_3	0.001	-0.012	0.001	-0.007	0.019	0.034	0.103	0.139*
KBAC	F_2	-0.100	-0.069	-0.305	0.045	-0.216	0.006	-0.222	-0.249**
	F_3	-0.002	0.067	-0.006	0.002	-0.071	-0.302	-0.092	-0.404**
LER	F_2	-0.463	0.010	0.162	0.062	-0.002	0.885	-0.138	0.517**
	F_3	0.003	-0.031	-0.011	-0.001	0.028	0.775	-0.041	0.723**
BER	F_2	-0.061	0.022	-0.085	0.003	-0.067	0.171	-0.713	-0.731**
	F_3	-0.001	-0.035	0.006	0.001	-0.010	0.048	-0.653	-0.643**

Residual effect F2 = 0.116, F3 = 0.042

* Significant at 5% level ** Significant at 1% level

recombination. Similar trend was observed between KLAC and KI (both the crosses) between kernel length and KLAC (cross 2) and between kernel breath and KIAC (cross 1).

Kernel length exhibited a significant positive correlation with kernel L/B ratio in both crosses under both generations. Similar findings were reported by Chauhan *et al.* (1987). Kernel length and kernel breadth had significant positive association with KLAC and KBAC respectively. Kernel length had positive and significant relationship with kernel L/B ratio but KB had negative assocaiton with kernel L/B ratio. Sood and Siddiq (1980) also reported similar association. Kernel L/B ratio had positive association with KLAC and negative association with kernel elongation. LER and BER had association with EI in positive and negative direction respectively in both generations which were of added advantage to improve quality. Hence, both crosses can be selected for improving the quality traits, since kenel L/B ratio is important for getting good price. LER and BER add value on the fineness of cooked rice.

It may be concluded that most of the grain quality traits are not associated with yield and hence it is difficult to combine grain quality with yield. Reddy *et al.* (1991) reported that grain was negatively associated with grain fineness. Hence, quality traits alone were considered for path analysis and they are given in Table 3 and 4. Elongation index, one of the key grain quality traits, was used as a dependent variable to analyse the pathways between EI and other seven grain quality traits. LER showed high direct positive effect (except F_2 of cross 1) and BER recorded high direct negative effect. This was earlier reporter by Vivekanandan (1993). As LER and BER had contributed consistent direct effect on EI, these two traits are adjudged as the best for the improvement of grain quality.

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SEEDLING THROWING METHOD-A NEW CONCEPT FOR LOWLAND RICE PRODUCTION TECHNOLOGY

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ABSTRACT

Feild experiments were conducted in *Kharif* and *Rabi* 1995-96 on a clay loam soil (Typic Haplustalf)at Tamil Nadu Agricultural University,Coimbatore, to test the effect of seedling age(20,25,30,35 and 40 day),nitrogen (N) dose (120,150,180,and 187.5 kg ha^{-1}) and split application (3,4 and 5) on seedling throwing method of rice planting. The grain yield of rice varied with different seedlings ages. In *Rabi*, the performance of 20 day old seedlings was not encouraging as there was 15.9 per cent yield reduction compared to older seedlings of 30 to 40 day. The two levels of (150 and 187.5kg/ha) tried did not markedly influence the grain yield in *Rabi* season. However,a substantial influence in grain yield with applied N was noticed during the season. In both the seasons skipping the basal application of N and increasing the split application increased the grain yield. Application of N in four splits increased the yield by 5.3 per cent during *Rabi* compared to three splits application. In *Kharif* season five splits increased the yield to the tune of 3.6 per cent (243kg/ha^{-1}) as against four splits.

KEY BOARDS: Seedling age,N Levels,N split application

Rice being a semi-aquatic plant,transplanting method of establishment is the most favourable one. It is believed to give more staple grain yield than direct seedling methods (Biswas et al., 1991). Line Planting is seldom practised by the farmers of Tamil Nadu, obvviously due to socio-economic considerations. The need for a satisfactory alternative to the transplanting of rice, in the context of the scarcity and increasing cost of labour and the desire to reduce the drudgery of the women, has been very much felt and attempts were made in this direction. In South East Asian Countries,a method of rice crop establishment simply by throwing the rice seedlings into the puddled field has been developed to achieve better management and yield in rice cultivation (Matsushima,1979). In Kerala, Varughese et al.(1993) also studied the seedling throwing method of rice planting in the context of scarcity of human labour and higher cost and drudgery involved in transplanting.

Seedling age at transplanting plays a crucial role to achieve uniform crop stand in realising the potential yield. Though a linear decline in yield was obtained with older seedlings of transplanted crop, Matsushima (1979) recommended aged seedlings for seedling throwing method of rice planting. Crop yield is influenced,often decisively by the extent to which the plant requirement for N can be met. The nutilisation by rice in India reveals that the recovery of applied N ranged from 19.1