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Association of grain yield with quality characteristics and other yield components in rice

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ABSTRACT

Correlation studies of various important physico-chemical quality characteristics and yield components with grain yield plant^{-1} in 10 parents and 25 hybrids revealed that grain yield was positively and significantly associated with kernel breadth while kernel length and length / breadth ratio manifested negative and significant relationship with grain yield plant^{-1}. Kernel length is negatively and significantly associated with total spikelets panicle^{-1} and test weight while kernel breadth had positive and significant correlation with total spikelets panicle^{-1}, fertile grains panicle^{-1}, test weight and grain yield. Among yield components, total spikelets panicle^{-1}, fertile grains panicle^{-1} and test weight had positive and significant association while sterile grains panicle^{-1} and sterility percentage exhibited a negative correlation with grain yield plant^{-1}.

Key words: *Aromatic rice, correlations, quality traits, yield components*

Generally, the export quality traditional basmati varieties are tall in stature but poor yielders. In order to improve the yield potential without sacrificing special quality features, the knowledge on the nature of association of these important quality traits with grain yield and yield attributes is essential. This study is an attempt to assess the relationship of various physico-chemical quality characters with grain yield plant $^{-1}$ and other yield attributes.

The experimental material comprised of ten parents and their 25 hybrids. Two popular high yielding non-scented varieties (IR 64 and PR 109) and three aromatic rice genotypes (IR 62874-88-2 -1, PK 1379-9 -1-1 and Gaurav) were used as females and were crossed with five basmati testers *viz.*, HBC 85, Karnal Local, Basmati 410, Basmati 6129 and PGB as males to generate 25 crosses using line x tester mating design during wet season 1998. The F_1s along with their parents and one dwarf high yielding basmati variety Pusa Basmati 1 as yield check and one export quality check Taroari Basmati were evaluated in a randomized block design with two replications during wet season 1999 at Directorate of Rice Research (DRR) farm, Hyderabad. Each entry was sown in 3 rows of 3.6m length and 30 x 30 cm spacing. Normal agronomic practices prescribed for basmati cultivation were followed. Observations were recorded on ten randomly selected plants in each entry for various morpho-physiological characters as well as grain yield and yield attributes. All the selected plants were harvested and threshed separately. After six months of storage, the polished rice samples were analyzed for seven key quality traits *viz.*, kernel length (KL), kernel breadth (KB), length/breadth ratio (L/B ratio), kernel length after cooking (KLAC), elongation ratio (ER), amylose content (AC) and alkali spreading value (ASV) on individual plant basis at Quality Laboratory, DRR following standard methods (Murthy and Govindaswamy 1967, Juliano *et al.* 1965, Juliano 1971, Little e*t al* 1958). The mean values were utilized for calculating correlation coefficients for different yield and quality characters with grain yield plant $^{-1}$.

Kernel length had a positive and significant association with length/breadth ratio and kernel length after cooking while kernel breadth recorded a significant and negative relationship with kernel length and length/ breadth ratio (Table 1). Asha Christopher *et al*. (1999) also reported similar results in F_2 generation of rice. The interrelationship between kernel length after cooking and elongation ratio was positive and significant (Chauhan *et al.*, 1995). Among the physico –chemical quality traits, kernel breadth had a positive and

Table 1. Correlation coefficients of various quality traits and yield components with grain yield pant^{-1}

Character	KB	L/B	KLAC	ER	ASV	AC	PH	TN	PL	TSP	FGP	SGP	TW	SP	GYP
KL	-0.71**	0.55**	0.48**	-0.32	0.23	0.5	0.12	-0.19	-0.19	-0.50**	-0.36*	0.01	-0.56**	0.19	-0.55**
KB		-0.46**	-0.21	0.36*	0.01	-0.14	-0.03	-0.07	0.17	0.46**	0.46**	-0.16	0.62**	-0.33	0.50**
L/B			0.14	-0.30	0.23	0.15	-0.07	-0.25	-0.28	-0.32	-0.18	-0.05	-0.42*	0.07	-0.39*
KLAC				0.68**	-0.01	-0.01	0.49**	-0.10	-0.01	-0.16	-0.13	0.03	-0.26	0.04	-0.14
ER					-0.19	-0.07	0.44**	0.09	0.18	0.25	0.15	0.03	0.21	-0.10	0.32
ASV						-0.11	-0.27	0.19	0.37*	0.25	0.08	0.11	0.10	0.02	0.19
AC							0.15	-0.03	0.02	0.01	-0.03	0.04	-0.11	-0.03	-0.03
PH								-0.32	-0.07	0.13	0.14	-0.05	-0.36*	-0.20	-0.03
TN									0.64**	0.23	-0.41*	0.66**	0.50**	0.60**	0.28
PL										0.37*	-0.31	0.63**	0.36*	0.47**	0.18
TSP											0.54**	0.18	0.49**	-0.32	0.68**
FGP												-0.73**	0.21	-0.95**	0.73**
SGP													0.16	0.85**	-0.30
TW														-0.02	0.61**
SP															-0.54**

KL: Kernel length; KB: Kernel breadth; L/B : Length /breadth ratio; KLAC: Kernel length after cooking; ER: Elongation ratio; ASV: Alkali spreading value;AC: Amylose content ; PH: Plant height; TN: Tiller number; PL: Panicle length; FGP: Fertile grains panicle^{-1}; SGP: Sterile grains panicle^{-1}; TSP: Total spikelets panicle^{-1}; TW: Test weight; SP: Spikelet sterility; GYP: Grain yield plant^{-1}.
*Significant at 5% level ; ** Significant at 1% level

significant association with grain yield plant^{-1} (Chauhan and Chauhan 1994) suggesting that bolder grain type may have high grain weight and thus enhances grain yield. Kernel breadth exhibited significant positive correlation with total spikelets panicle^{-1} and test weight while kernel length had negative and significant association with total spikelets panicle^{-1} and test weight. length/breadth ratio also exhibited negative and significant association with test weight suggesting that slender kernels will have lesser test weight. With the remaining quality traits, grain yield plant^{-1} had nonsignificant relationship. Deosarkar *et al* (1989) also reported non-significant association of amylose content, alkali spreading value and kernel length after cooking with grain yield confirming the present results. Among yield components, fertile grains panicle^{-1}, total spikelets panicle^{-1} and test weight exhibited positive and significant correlations while sterile grains panicle^{-1} and sterility percentage manifested negative association with grain yield plant^{-1} (Reddy *et al* 1997, Marekar and Siddiqui 1996). Panicle length is positively and significantly associated with total spikelets panicle $^{-1}$, (Verma & Mani, 1997). Total spikelets panicle $^{-1}$ was positively and significantly correlated with fertile grains panicle $^{-1}$, test weight and grain yield. Fertile grains panicle $^{-1}$ was strongly correlated with grain yield while it's association with sterile grains panicle^{-1} and spikelet sterility were significantly negative (Sreedhar and Kulkarni, 1995). Total spikelets panicle^{-1}, fertile grains panicle $^{-1}$ and test weight had positive and significant correlation with grain yield , hence selection for these characters would bring simultaneous improvement to the grain yield plant $^{-1}$.

Selection for high kernel length, length / breadth ratio and elongation ratio would bring simultaneous improvement to the kernel length after cooking. In the preset study, kernel length and length/breadth ratio had negative correlation with total spikelets, test weight and grain yield plant$^{-1.}$ In the context of basmati improvement, it is suggested that weightage should be given for longer panicles with more spikelets coupled with less sterility while making selection in segregating lines and also in choosing the parents in the breeding programme.

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