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Association and Path analysis betweenYield and its Contributing traits in F_2 Generation of Aromatic Rice

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ABSTRACT

A field experiment was conducted during kharif, 2010 at Rice section, ARI, Rajendranagar, involving 7 F_2 populations to study the correlations, direct and indirect effects of yield components in aromatic rice. The correlation analysis indicated that grain yield was significantly associated with days to 50% flowering, plant height, panicle length, 1000-grain weight, kernel length and kernel breadth. Critical analysis of the results by path analysis revealed that the characters, kernel breadth followed by 1000-grain weight, panicle length and number of productive tillers are directly influencing the grain yield. A critical study on correlation and path analysis in each cross in F_2 generationr evealed that selection on important yield components viz., number of productive tillers per plant, panicle length and 1000-grain weight and the quality trait, kernel length was suggested to bring out further improvement in aromatic rice.

Key words : Aromatic Rice, Correlation, F_2 Generation, Path analysis.

Rice (*Oryza sativa* L.) is the major food crop in India occupying nearly 44 million hectares with an annual production of 96 million tonnes and productivity of 2181 kg ha^{-1}. While, in Andhra Pradesh it is grown in an area of 40 lakh hectares with production of 122 lakh tonnes and productivity of 3050 kg ha^{-1}.

As scented rice has got a premium price in international market, it is a major source of earning foreign exchange to the country. In the light of recent food crisis, expecting a shortage of food grains, the Government of India banned the export of non-basmati rice, but on the other hand, permitted the export of basmati rice. Basmati rice is mostly exported to Gulf, European countries and the United Kingdom.

In Andhra Pradesh, aromatic short grain varieties like Godavari Isukalu and Chittimutyalu are commonly grown in the districts like Nizamabad, Karimnagar and Warangal. In the recent times, farmers started growing long slender aromatic (Basmati type) varieties also in the districts where cool temperatures prevail during flowering and grain formation stages, because this type of rices command a high premium price in the market compared to non-basmati rice. In the light of this, ANGRAU also started research in breeding of Basmati varieties and released first high yielding Basmati variety in 2002 by name 'Sumati' which is very popular now. Similarly, RNR-2465, a medium duration, aromatic, short grained culture released as 'Sugandha Samba' because of its high yield potential of 6.47 t ha^{-1}. It is becoming very popular because of its good quality and aroma. This indicated there is a great scope for research in aromatic rice in Andhra Pradesh also.

Therefore to improve the production of this important food crop a study of association of yield and its components are very much essential particularly in segregating population of rice. Any component of yield does not act independently; sometimes it reacts parallel to other component, sometimes control each other, acts in contradiction compensating for either an increase or decrease in other component. In this context, the present work has been undertaken to study the inter-relationship between yield and its components in the F_2 generation with a view to identify characters and their combinations which might be helpful to identify the selection criteria for higher yield in rice.

MATERIAL AND METHODS

The present experiment was carried out during *kharif*, 2010 at Rice Section (ACRIP)

Agricultural Research Institute, Rajendranagar, Hyderabad. The experimental material consisted of 7 F_2 populations. All the selected F_2s were sown in a well prepared nursery bed. F_2s were transplanted in nine rows by adopting a spacing of 20 cm between rows and 15 cm between plants in a randomized block design replicating thrice. 150 competitive plants in F_2s in each replication were selected randomly and the data on 10 characters i.e. days to 50 per cent flowering, plant height(cm), panicle length (cm), number of productive tillers per plant, 1000-grain weight(g), number of grains per panicle, grain yield per plant (g), kernel length (mm), kernel breadth (mm) and L / B ratio were collected.

Correlation coefficients were calculated at genotypic and phenotypic level using the formulae suggested by Falconer (1964).

The direct and indirect effects both at genotypic and phenotypic level were estimated by taking grain yield as dependent variable, using path coefficient analysis suggested by Wright (1921) and Dewey and Lu (1959).

RESULT AND DISCUSSION

The genotypic and phenotypic correlation coefficients among yield and its component characters are presented in Table 1. In general, the values of genotypic correlations were higher than that of phenotypic correlations.

The correlation analysis indicated that grain yield was significantly positively associated with days to 50% flowering, plant height, panicle length, 1000-grain weight, kernel length and kernel breadth. Similar kind of association was revealed by Kuldeep*et al*. (2004), Patil and Sarawgi (2005) and Sankar *et al*. (2006) for days to 50 percent flowering and panicle length; Debchoudhary and Das (1998), Nayak*et al.* (2001) and MadhaviLatha (2002) for plant height; Satish Chandra *et al.*(2009) for 1000-grain weight; Sadhukhan and Chattopadhyay(2000) for kernel length and Supriyochakraborthy and Hazarika(1994) and De *et al.*(2005) for kernel breadth.

The grain yield per plant had non-significant positive association with number of productive tillers per plant and number of grains per panicles.

Correlation gives only the relation between two variables whereas, path coefficient analysis helps us know the direct and indirect effect through other components on grain yield. Hence, the direct and indirect effects of different yield components on yield were estimated using genotypic and phenotypic correlation coefficients and are presented in Table 2.

The association of different component characters among themselves and with yield is quite important for devising an efficient selection criterion for yield. The total correlation between yield and component characters may be some times misleading, as it might be an over-estimate or under-estimate because of its association with other characters. Hence, indirect selection by correlated response may not be some times fruitful. When many characters are affecting a given character, splitting the total correlation into direct and indirect effects of cause as devised by Wright (1921) would give more meaningful interpretation to the cause of association between the dependent variable like yield and independent variables like yield components. This kind of information will be helpful in formulating the selection criteria.

In the present study, the characters *viz.,* panicle length, 1000-grain weight, number of productive tillers and kernel breadth at both levels exhibited positive direct effects on grain yield. These findings were in agreement with the reports made by Sankar *et al*. (2006) and Satish Chandra *et al*. (2009) for number of productive tillers per plant; Suman (2003) and Khedidar *et al*. (2004) for panicle length; Yogameenakshi et *al*. (2004) for 1000-grain weight and De *et al*. (2005) for kernel breadth.

Panicle length exhibited positive indirect effects through plant height, number of grains per panicle, days to 50 percent flowering, 1000 grain weight, number of productive tillers per plant, kernel length, kernel breadth and L/B ratio on grain yield which is in conformity with the results reported by Madhavilatha (2002) and Satish Chandra et al. (2009).

Number of grains/panicle showed positive indirect effect through plant height, productive tillers/plant, 1000- grain weight, kernel length and kernel breadth at both the levels and number of productive tillers, panicle length and L/B ratio at phenotypic level on grain yield as reported by Madhavilatha *et al*. (2002) and Satish Chandra *et al.* (2009).

Table 1. Estimation of phenotypic and genotypic correlation coefficients between yield and its components.

Character		Days to50% flowering	Plant height (cm)	Panicle length (cm)	Number of grains per panicle	1000-grain weight (g)	Number of productive tillers per plant	Kernel length (mm)	Kernel breadth (mm)	L/B ratio	Grain yield per plant (g)
Days to50% flowering	G	**1.000**	0.074	0.687**	0.153	0.214	0.201	0.355	0.090	0.790**	0.522*
	P	**1.0000**	0.073	0.437*	0.116	0.169	0.158	0.316	0.080	0.67**	0.477*
Plant height (cm)	G		**1.000**	0.744**	-0.390	0.617**	0.812**	0.754**	0.559**	0.373	0.530*
	P		**1.000**	0.452*	-0.342	0.552**	0.626**	0.654**	0.509*	0.256	0.436*
Panicle length(cm)	G			**1.000**	0.014	0.561**	0.991**	0.758**	0.283	0.711**	0.860**
	P			**1.000**	0.060	0.500*	0.507*	0.602**	0.290	0.633**	0.635**
Number of grains per panicle	G				**1.000**	-0.485	0.007	-0.333	-0.567	0.154	-0.258
	P				**1.000**	-0.428	0.048	-0.321	-0.515*	0.024	-0.117
1000-grain weight (g)	G					**1.000**	0.344	0.977**	0.981**	0.298	0.884**
	P					**1.000**	0.242	0.932**	0.866**	0.226	0.734**
Number of productive tillers per plant	G						**1.000**	0.595**	0.244	0.708**	0.417
	P						**1.000**	0.395	0.042	0.368	0.376
Kernel length(mm)	G							**1.000**	0.898**	0.448*	0.893**
	P							**1.000**	0.834**	0.380	0.795**
Kernel breadth	G								**1.000**	-0.033	0.611**
	P								**1.000**	0.032	0.586**
L/B ratio	G									**1.000**	0.770**
	P									**1.000**	0.513*

P -represents phenotypic correlation coefficient; G- represents genotypic correlation coefficient
*5% level of significance. **1% level of significance

Table 2. Estimation of genotypic and phenotypic direct and indirect effects between yield and yield attributing characters

Character		Days to50% flowering	Plant height (cm)	Panicle length (cm)	Number of grains per panicle	1000-grain weight (g)	Number of productive tillers per plant	Kernel length (mm)	Kernel breadth (mm)	L/B ratio
Days to50% flowering	G	**-0.408**	-0.030	-0.280	-0.062	-0.087	-0.082	-0.145	-0.036	-0.323
	P	**0.172**	0.012	0.075	0.022	0.029	0.027	0.054	0.013	0.116
Plant height(cm)	G	-0.058	**-0.783**	-0.582	0.305	-0.483	-0.854	-0.590	-0.437	-0.292
	P	-0.012	**-0.179**	-0.081	0.061	-0.099	-0.112	-0.117	-0.091	-0.046
Panicle length(cm)	G	0.379	0.410	**0.551**	0.007	0.309	0.546	0.418	0.156	0.619
	P	0.048	0.050	**0.111**	0.006	0.055	0.056	0.066	0.032	0.070
Number of grains per panicle	G	-0.007	0.020	-0.0007	**-0.051**	0.024	-0.0004	0.017	0.039	-0.007
	P	-0.0001	0.003	0.000	**-0.0008**	0.0003	0.000	0.0002	0.0004	0.000
1000-grain weight(g)	G	0.123	0.354	0.322	-0.279	**0.574**	0.197	0.561	0.563	0.171
	P	0.048	0.158	0.143	-0.123	**0.287**	0.069	0.267	0.248	0.065
Number of productive tillers per plant	G	0.053	0.288	0.261	0.001	0.090	**0.264**	0.157	0.064	0.186
	P	0.023	0.090	0.073	0.007	0.035	**0.144**	0.057	0.006	0.053
Kernel length(mm)	G	-0.269	-0.571	-0.574	0.252	-0.739	-0.450	**-0.757**	-0.680	-0.339
	P	0.117	0.242	0.223	-0.119	0.346	0.146	**0.371**	0.309	0.141
Kernel breadth(mm)	G	0.088	0.547	0.277	-0.555	0.960	-0.239	0.879	**0.978**	-0.032
	P	0.005	0.032	0.018	-0.032	0.055	0.002	0.053	**0.063**	0.002
L/B ratio	G	0.623	0.294	0.885	0.122	0.235	0.558	0.353	-0.026	**0.788**
	P	0.075	0.028	0.070	0.002	0.025	0.041	0.042	0.003	**0.111**
Correlation with grain yield per plant (r)	G	0.522	0.530	0.860	-0.258	0.884	0.417	0.893	0.611	0.770
	P	0.477	0.436	0.635	-0.177	0.734	0.376	0.795	0..586	0.513

Phenotypic residual effect = 0.519 Genotypic residual effect = 0.412

P- represents phenotypic correlation coefficient; G- represents genotypic correlation coefficient.

Bold values- direct effects Normal values- indirect effects

Productive tillers/plant exhibited positive indirect effect through days to 50 % flowering, plant height, panicle length, number of grains per panicle, 1000 -grain weight, kernel length and L/B ratio on grain yield, which is in conformity with the results reported by Madhavi Latha *et al*. (2002), De *et al*. (2005) and SatishChandra *et al*. (2009).

Critical analysis of the results by path analysis revealed that the characters, kernel breadth followed by 1000-grain weight, panicle length and number of productive tillers are directly influencing the grain yield.A study on correlation and path analysis in each cross in F_2 generation revealed that selection on important yield components viz., number of productive tillers per plant, panicle length and 1000-grain weight and the quality trait, kernel length was suggested to bring out further improvement in aromatic rice.

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