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QUALITY ANALYSIS AND CHARACTER ASSOCIATION STUDIES OF RICE UNDER SRI BASED CULTIVATION PRACTICES

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ABSTRACT

The present investigation is carried out to study the correlation and path analysis in scented long duration variety of rice (*Oryza sativa* L.). Character association of the yield attributing traits revealed significantly positive association of grain yield exhibited significant positive correlation with root dry weight (0.657), number of tillers hill^{-1} (0.636), test weight (0.601), panicle length (0.594), panicle weight (0.537) and dry weight (0.535). Hence, selection for the traits can improve yield. Whereas in quality analysis the highest length breadth ratio (3.29) found in treatment having 20cm x 20cm spacing with two seedlings per hill. Based on the result of the study, the treatment with spacing 25 cm from row to row and 25 cm from plant to plant with two seedlings per hill, have good cooking and eating quality, hence selection for improvement based on these parameters will be a right step in the right direction for obtaining good quality grains.

INTRODUCTION

Correlation analysis establish the extent of association between yields and its components and also bring out relative importance of their direct and indirect effects, thus giving an obvious understanding of their association with grain yield. Rice grain quality is a major factor from consumer as well as marketing point of view. (Siddiqui, 2007). Rice (*Oryza sativa* L.) is one of the pivotal staple cereal crop feeding more than half of the world's population. It is the staple food for over one third of the world's people (Poehlman and Sleper 1995). More than 90% of the world's rice is produced and consumed in Asia. Rice provides 75% of the calories and 55% of the protein in the average daily diet of the people (Bhuiyan *et al.*, 2002). The rice productivity is less than 2 tons per hectare in most of the states (Dash, 2009). Most of the aromatic rice germplasms are available in our country are low yielding, photoperiod sensitive and grown during aman season in the rain fed low land ecosystem (Begum *et al.*, 1993). Among them, it seems at present that the most effective and economic way available is to develop some resource conservation techniques to increase yield in scented rice. The supply of fine and fine scented rice is very less in the world; therefore its market is comparatively higher than normal rice. Most of the fine scented traditional varieties are tall, low productive, low input responsive, long duration and susceptible towards the insect, pest and diseases. Due to this, farmers are unable to make their cultivation practices profitable. The chemical fertilizers are considered as essential part of modern farming and their use in different countries has increased considerably day-by-day. Their application directly or indirectly causes series of changes in physical, chemical and biological properties of soil. (Divya and Belagali, 2012). The problems not only confined over location bases but also affect vast area of rice growing countries (Kumar *et al.,* 2014). It is therefore important to achieve high yield with good quality from scented rice varieties through genetically modified varieties which includes good characters. Scented rice is the most exportable commodities which shares major position of the total agricultural export. India is the largest exporter of quality rice. The consumer mainly prefers good quality rice. The cooking quality is a complex character which is very much influenced by physicochemical characteristics of rice grain (Azeez, and Shafi, 1966). Ultimately, this kind of analysis could help to design selection strategies to improve grain yield. In the light of the above scenario, the present investigation is carried out with the objective of studying the character associations in scented rice for yield improvement.

MATERIALS AND METHODS

The experiment was conducted to study the effect of planting parameters on scented rice (cv. '*Dubraj*') at Research cum Instructional-Farm, Indira Gandhi Krishi Viswavidyalaya, Raipur during *kharif* 2012. The climate of this region is sub-humid with an average annual rainfall of about 1200-1400 mm and the crop received 1315.9 mm of the total rainfall during its crop growth. The soil of experiment field was '*Alfiisols*' which is locally known as '*Dorsa*'. The soil was neutral in reaction and medium in fertility having low N, medium P and high K. The data on physico- chemical properties of the experimental soil are presented in Table A.

The experiment was laid out in randomized block design (RBD) with three replication, fourteen treatments and one variety of rice *i.e. dubraj* and the treatments details are given in the Table B.

Transplanting of one, two-three and three-four seedlings hill^{-1}, using seed rate of 10 kg ha^{-1}, 20 kg ha^{-1}, 35 kg ha^{-1} and 40 kg ha^{-1} at the spacing of 25 cm x 25 cm, 25 cm x 20 cm, 25 cm x 15 cm, 25 cm x10 cm, 20 cm x 20 cm, 20 cm x 10 cm in the field respectively. The 12 days old seedlings were transplanted from T_1 to T_{13} while 23 days old seedlings were transplanted in the treatment T_{14} because these two treatments are based on traditional method of rice cultivation while other treatments are based on SRI method of rice cultivation. Crop was transplanted on 03.07. 2012 and harvested on 02.12. 2012. Recommended dose of nutrient was 60 kg N + 40 kg P_2O_5 + 30 kg K_2O ha^{-1}. The fertilizers were applied @ 60: 40:30 kg / ha. Entire quantity of phosphorus and Farm yard manure was applied before transplanting. Nitrogen, phosphorus and potassium applied through urea, single super phosphate and muriate of potash respectively. Nitrogen was applied in 3 splits (basal, tillering and panicle initiation stage (@ 50:25:25%). The quality characters were estimated by standard procedures like hulling and milling, head rice recovery percentage according to Bajpai and Singh (2010), kernel length and breadth were measured by dial micro meter and length/breadth ratio was calculated, alkali spreading value following the method of Little *et al.* (1985), water uptake and volume expansion by Beachell and Stanel (1963), cooked kernel length was recorded using a graph paper and elongation ratio by the method adopted by Azeez and Shafi (1966). Observations were recorded and the data was subjected to statistical analysis. Statistical analyses for the above characters were done following Singh and Chaudhary (1995) for correlation coefficient and Dewey and Lu (1959) for path analysis.

RESULTS AND DISCUSSION

Correlation refers to degree and direction of association between two or more than two variables. It measures the mutual relationship between various plant characters and determines the component characters on which selection can be based for genetic improvement of dependent characters. Galton (1889) was first to suggest the use of correlation index to describe the association for the effectiveness of indirect selection process. Associations among different yield attributing characters with grain yield were calculated in all possible combinations at phenotypic (P) level are presented in Table 1.1. The results of the correlations study are explained as character wise: Grain yield exhibited significant positive correlation with root dry weight (0.657), number of tillers hill^{-1} (0.636), test weight (0.601), panicle length (0.594), panicle weight (0.537) and dry weight (0.535). Plant height had recorded highly positive significant correlation with panicle weight (0.684) and it showed significant positive correlation with effective tillers (0.633), water uptake (0.607), dry weight (0.588) and number of tillers hill^{-1} (0.549). The results are in accordance with the findings of Babu *et al.* (2012). Dry weight had recorded highly significant positive genotypic correlation with effective tillers (0.847), kernel length (0.748), straw yield (0.739), kernal length after cooking (0.735), water uptake

Table 1.1: Character association matrix among growth, yield components, quality characters and grain yield of rice

Character	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0.588*	0.549*	0.434	0.343	0.218	0.336	0.633*	0.473	0.304	0.684**	0.400	0.466	0.465	0.359	0.376	0.521	0.514	0.607*	0.334
2		0.667**	0.579*	0.377	0.281	0.562*	0.847**	0.669**	0.582*	0.483	0.44	0.739**	0.535*	0.346	0.585*	0.748**	0.735**	0.674**	0.357
3			0.594*	0.347	0.142	0.371	0.738**	0.678**	0.462	0.445	0.460	0.529	0.636*	0.446	0.600*	0.678**	0.664**	0.633*	0.378
4				0.329	0.183	0.411	0.778**	0.461	0.294	0.289	0.411	0.476	0.435	0.571**	0.536	0.774**	0.774**	0.473	0.320
5					0.004	0.477	0.266	0.282	0.534*	0.393	0.544*	0.365	0.657*	0.101	0.296	0.284	0.325	0.464	0.258
6						0.389	0.286	0.183	0.281	0.248	0.250	0.390	0.178	0.286	0.223	0.219	0.240	0.399	0.313
7							0.495	0.477	0.425	0.371	0.573*	0.604*	0.410	0.381	0.525	0.387	0.446	0.561*	0.313
8								0.680**	0.447	0.434	0.481	0.729**	0.473	0.568*	0.698**	0.872**	0.846**	0.635*	0.381
9									0.431	0.457	0.443	0.666**	0.499	0.381	0.565*	0.644*	0.654*	0.706**	0.533*
10										0.467	0.419	0.593*	0.594*	-0.021	0.393	0.533*	0.564*	0.520	0.146
11											0.410	0.528	0.537*	0.295	0.391	0.337	0.372	0.529	0.419
12												0.554*	0.601*	0.298	0.415	0.478	0.512	0.486	0.534*
13													0.403	0.379	0.678**	0.658*	0.648*	0.724**	0.378
14														0.080	0.304	0.531	0.554*	0.561*	0.285
15															0.349	0.351	0.387	0.301	0.35
16																0.612*	0.631*	0.608*	0.282
17																	0.981**	0.679*	0.346
18																		0.660*	0.385
19																			0.401

* At 5% level, ** at 1 % level; 1. Plant height; 2. Dry weight ; 3. Tillers hill^{-1} ;4. Root volume ;5. Root dry weight;6. SPAD value; 7. Light interception;8. Effective tillers hill^{-1};9. Filled grains panicle^{-1};10. Panicle length; 11. Panicle weight ;12. Test weight ; 13. Straw yield; 14. Gain yield; 15. Grain length ;16. Brown rice length; 17. Kernel length ;18. KLAC;19. Water uptake

Table 1.2: Quality analysis study of rice

Treatments	Grain type	Brown rice length mm	Breadth (mm)	L:B	VER	ER	Grain yield (t/ha)	Husk colour
T_1:25x25cm^2+S_1	MS	6.05	1.85	3.26	3.46	1.37	3.69	Straw
T_2: 25x25cm^2+S_{2-3}	MS	6.10	1.87	3.28	3.42	1.41	3.82	Straw
T_3:25x25cm^2+S_{4-5}	MS	5.99	1.85	3.24	3.51	1.25	3.44	Straw
T_4:25x20cm^2+S_1	MS	6.04	1.84	3.27	3.58	1.24	3.60	Straw
T_5:25x20cm^2+S_{2-3}	MS	5.99	1.84	3.24	3.53	1.31	3.68	Straw
T_6: 25x20cm^2+S_{4-5}	MS	5.96	1.81	3.29	3.49	1.28	3.31	Straw
T_7:25x15cm^2+S_1	MS	5.94	1.81	3.27	3.53	1.28	3.64	Straw
T_8:25x15cm^2+S_{2-3}	MS	5.98	1.82	3.27	3.49	1.27	3.39	Straw
T_9:25x15cm^2+S_{4-5}	MS	5.98	1.82	3.27	3.56	1.36	3.35	Straw
T_{10}:25x10cm^2+S_1	MS	5.93	1.81	3.27	3.47	1.46	3.43	Straw
T_{11}:25x10cm^2+S_{2-3}	MS	5.92	1.80	3.28	3.45	1.42	3.29	Straw
T_{12}:25x10cm^2+S_{4-5}	MS	5.89	1.80	3.27	3.61	1.35	3.26	Straw
$T_{13:}$20x20cm^2+S_2(2S)	MS	5.89	1.79	3.29	3.42	1.40	3.56	Straw
$T_{14:}$ 20x10cm^2+S_{2-3}	MS	5.82	1.77	3.28	3.69	1.27	3.08	Straw
SEm ±	MS	0.04	0.01	0.03	0.20	0.03	1.28	
CD (p=0.05)		0.12	0.04	NS	NS	0.09	3.74	

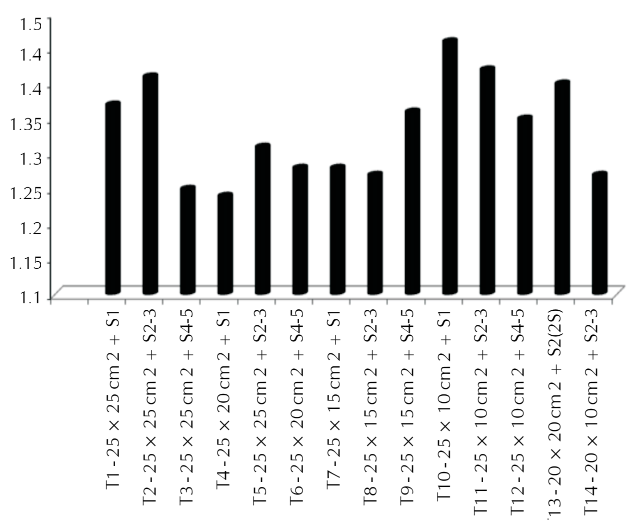

Figure 1: Effect of SRI based cultivation practices on elongation ratio of rice

(0.674) and filled grains panicle^{-1} (0.669). It showed significant positive correlation with brown rice length (0.585), panicle length (0.582), root volume (0.579), light interception (0.562) and grain yield (0.535). Number of tillers hill^{-1} showed highly significant positive phenotypic correlation with effective tillers (0.738), filled grains panicle^{-1} (0.678), kernel length (0.678) and kernal length after cooking (0.664). It showed significant positive correlation with grain yield (0.636), water uptake (0.633) and root volume (0.594). Root volume exhibited highly significant positive correlation with effective tillers (0.778), kernel length (0.774), kernel length after cooking (0.774), and grain yield (0.571). Root dry weight had recorded significant positive correlation with grain yield (0.657), test weight (0.544), panicle length (0.534). Light interception exhibited significant positive correlation with straw yield (0.604), test weight (0.537) and water uptake (0.561). Effective tillers showed highly significant positive phenotypic correlation with kernel length (0.872), kernel length after cooking (0.846), straw yield (0.729), brown rice length (0.585) and filled grains per panicle (0.680). Effective tillers showed significant positive correlation with grain yield (0.568) and water uptake (0.635). The results were in unison with Reddy *et al.* (1995), Roy *et al.* (1995) and Reddy *et al.* (1997). Filled grain panicle^{-1} had recorded highly significant positive correlation with water uptake (0.706), straw yield (0.729) and it showed significant positive correlation with kernel length after cooking (0.654), kernel length (0.644), brown rice length (0.565) and protein content (0.533). Similar findings were reported by Sood and Siddiq, (1986), Bhattacharya and Sowbhagya (1971). These results for number of filled grains per panicle were in accordance with Lalitha and Sreedhar (1996), Ganesan *et al.* (1997), Janardhanam *et al.* (2001), Yogameenakshi *et al.* (2004). Panicle length showed significant positive phenotypic correlation with grain yield (0.594), straw yield (0.593), kernel length after cooking (0.564) and kernel length (0.533). Straw yield exhibited highly significant positive correlation with water uptake (0.724), brown rice length (0.678) and significant positive correlation with kernel length after cooking (0.648). Grain yield had recorded significant positive correlation with water uptake (0.706), kernel length after cooking (0.554). Kernel length showed highly significant correlation with kernel length after cooking (0.981) and significant correlation with water uptake (0.679). The results were in unison with Krishnaveni and S. Rani (2006). Brown rice length showed significant positive phenotypic correlation with kernel length (0.612), kernel length after cooking (0.631) water uptake (0.608), protein content which is in line with the· findings of Juliano and Pascual (1980). Kernel length exhibited highly significant positive correlation with kernel length after cooking 0.981 and it showed significant positive correlation water uptake 0.679. This corroborates with the findings of Singh *et al.* (1995). Kernel length after cooking showed significant positive phenotypic correlation with water uptake - 0.660. The above findings were in agreement with the findings of Chauhan *et al.* (2005).

Grain size and shape, hardness, presence or absence of abdominal white, moisture content, harvest precision, storage conditions, processing and type of mills employed have direct bearing on head rice recovery (Bhattacharya, 1989). The grain type is medium slender with straw husk colour. The data reveal that different treatments produced significant variation for length and breadth, whereas, L: B ratio of brown rice did not differ significantly. Highest length and breadth of brown rice was recorded under the treatment 25 cm x 25 cm+ S_{2-3} (T_2) which was found to be at par with then treatment 25 cm x 25 cm + S_1 (T_1), 25 cm x 25 cm + S_{4-5}(T_3), 25 cm x 20 cm + S_1 (T_4) 25 cm x 20 cm + S_{2-3} (T_5) for breadth of brown rice. In case of length of brown rice, treatments 25 cm x 25 cm + S_1 (T_1), 25 cm x 25 cm + S_{4-5}(T_3), 25 cm x 20 cm + S_1 (T_4) and 25 cm x 20 cm + S_{2-3}(T_5), 25cm x 15cm + S_{2-3}(T_8) and 25cm x 15cm + S_{4-5}(T_9) were also found to be at par with the same treatment 25 cm x 25cm+S_{2-3} (T_2). The highest L: B ratio of brown was observed under treatment 25 cm x 20 cm + S_{4-5} (T_6) and 20 cm x 20 cm +S_2 (2S) (T_{13}). The lowest length and breadth of brown rice was observed under the treatment 20 cm x 10 cm + S_{4-5}(T_{14}) *i.e.* farmers practice. It was reported that lower VER is preferred by the consumers than higher VER, on the other hand, higher elongation ratio (ER) (Fig A) of the cooked rice is preferred than lower ER (Shahidullah *et al.*, 2009). The kernel elongation ratio was recorded highest under the treatments 25 cm x 25 cm + S_2 (T_2) which was found to be at par with the treatments 25 cm x 25 cm + S_1 (T_1), 25 cm x 20 cm + S_{2-3} (T_5), 25 cm x 15 cm + S_{4-5} (T_9), 25 cm x 10 cm + S_1 (T_{10}), 25 cm x 10 cm + S_{2-3} (T_{11}), 25 cm x 10 cm + S_{4-5} (T_{12}) and 20 cm x 20 cm + S_2 (2S) (T_{13}). Similar findings are reported by Shahidullah *et al.*, 2009. Similar results were found by Makarim *et al.* (2002) that the young seedlings produced significantly higher grain yield than 21 days old seedlings planted at 3 to 4 hill^{-1}. The grain and straw yield significantly influenced due to different treatments. The treatment 25 cm x 25 cm + S_{2-3} (T_2) produced significantly highest grain yield and straw yield, which was found to be at par with the treatment 25 cm x 25 cm + S_1 (T_1), 25 cm x 20 cm + S_1 (T_4), 25 cm x 20 cm + S_{2-3} (T_5), 25 cm x 15 cm + S_1 (T_7) and 20 cm x 20 cm + S_2 (2S) (T_{13}) in case of grain yield. Whereas in case of straw yield it was found to be at par with the treatment 25 cm x 25 cm + S_1 (T_1). It might be due to difference in spacing and seedling density and due to optimum spacing and seedling density plant get opportunity to use soil resources and more space for growth and development. Transplanting of younger seedlings in optimum density at wider spacing facilitate the root growth leading to higher absorption of water and nutrients. It helps to enhance quality characteristics of plant and ultimately resulting in good quality grains.

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