IJTA © Serials Publications

National Academy of Agricultural Science (NAAS) Rating : 3. 03

Performance of Rice under Different Parameters

Damini Thawait*, Sanjay K. Dwivedi, Amit Kumar Patel and Samaptika Kar*****

***ABSTRACT**: The experiment was carried out at Raipur during season of 2012, the present investigation is carried out to study the quality traits and character association in scented variety of rice* (Oryza sativa *L.). The treatment 25 cm x 25 cm is spacing + 2 to 3 seedlings hill^{-1} (T_2), produced higher production efficiency and productivity rating index over the other treatments with good quality characters.*

***Keyword:** Rice, number of seedlings, planting geometry, grain quality, protein content, grain dimension, grain production efficiencies.*

INTRODUCTION

Rice is the most important and staple food crop for feeding of more than two third populations in the world. Rice is only cereal that is eaten as whole grain and human selection down the ages has given preference to quality to cater to the needs of diverse rice based preparations. Rice is intimately involved in the culture as well as the food ways and economy of many societies. It is considered as the gift of god, and it is treated with reverence, and its cultivation is tied to elaborate rituals. Rice a member of the family Poaceae originated from South-East Asia. In world rice has occupied an area of 158.9 million hectares, with a total production of 685.0 million tonnes in 2010 (Anonymous, 2011). In Asian countries, rice is the main major staple crop covering about ninety per cent of rice grown in the world, thus rice is immensely important to food security of Asia, the two countries, China and India, growing more than half of the total crop. Rice provides about two-third of the calorie intake for more than two billion people in Asia, and a third of the calorie intake of nearly one billion people in Africa and Latin America (Shastry *et al*., 2000). Rice is the most important staple in Asia where it provides 35-80 per cent of total calorie uptake (IRRI, 1997). Rice *(Oryza sativa* L) is considered as the 'Global Grain' in 89 nations and it is an important food for more than half of the global population. In India, rice is grown under three major ecosystems: rainfed upland (16%), irrigated land (45%) and rainfed lowland (39%), with a productivity of 0.87, 2.24, and 1.55 t ha^{-1}, respectively.

The slogan 'Rice is life' is most appropriate for India**.** It contributes 20 to 25 per cent of agriculture GDP. India is second largest producer of rice after China; rice production in India has shown a steady upward trend during the period 2005–06 to 2008–09 reaching a record level of 99.18 million tons in 2008–09. Production declined to 89.09 million tons in 2009–10 due to a severe drought gripping most parts of the country but rebounded to 96 million tons in 2010–11 and further to a record 103.4 million tons in 2011–12. (Anonymous, 2012). Rice, being the main source of livelihood for more than 120–130 million rural household. It is the backbone of the Indian Agriculture. The rice plays a very vital role in the national food security. Even then rice self-sufficiency in India is precarious. Information on association of characters, direct and indirect effects contributed by each character towards yield will be an added advantage in aiding the selection process. India is the largest exporter of quality rice next to the Thailand. Specialty rice is a term used to distinguish cultivars of rice that have unique properties like flavor, color,

* Om Vidya Mandir, Juna Bilaspur, Bilaspur (C. G.) 495001, *(corresponding E-mail: daminithawait@gmail.com*

** Scientist, Department of Agronomy, IGKV, Raipur-492012 (C. G.) India

*** c/o Debendra Kumar, Macchhuti, P. O. Selepur, Dist. Cuttak, Pin-754202

nutrition and chemical composition [Yang, 2010]. The physicochemical characteristics include grain length (L), grain breadth (B), L/B ratio, protein content etc. Grain quality is a very wide area encompassing diverse characters that are directly or indirectly related to exhibit one quality type (Siddiqui, 2007). Different cultivars showed significant variations in morphological, physicochemical and cooking properties (Yadav, 2007). The cooking quality of rice was determined on the basis of morphological and physicochemical properties. Cooked rice is composite food consist of different biopolymers, including starch and proteins along with moisture as plasticizer (Ahmed *et al.*, 2007).

MATERIAL AND METHOD

The experiment was carried out at Research Cum Instructional Farm, I.G.K.V., Raipur (C.G.) during *Kharif* 2012. The soil of experiment field was '*Inceptisols*' (sandy loam) which is locally known as '*Matasi*'. The soil was neutral in reaction and medium in fertility having low N, medium P, high K 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 weekly average maximum and minimum temperature varied in between 25.8^{0}C – 31.9^{0}C and 12.75^{0}C – 25.8^{0}C, respectively. The experiment was laid out in randomized block design (RBD) with three replication, fourteen treatments and one variety *dubraj* and the treatments *viz.* 25 cm x 25 cm + S_1 (T_1), 25 cm x 25 cm + S_{2-3} (T_2), 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), 25 cm x 20 cm + S_{4-5} (T_6), 25 cm x 15 cm + S_1 (T_7), 25 cm x15 cm + S_{2-3}(T_8), 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}), 20 cm x 20 cm + S_2 (T_{13}), 20 cm x 10 cm + S_{2-3} (T_{14}). 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 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}. Cultural operations were done as and when necessary. Crop was transplanted on (July) 23. 07. 2012 and harvested on (December) 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 as per the treatments. Entire quantity of phosphorus and FYM 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, kernel length and breadth were measured by dial micro meter and length/breadth ratio was calculated, cooked kernel length was recorded using a graph paper adopted by Azeez and Shafi (1966). The plants of outer row and the extreme ends of the middle rows were excluded to avoid border effect. 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 or character association studies. The Productivity rating index (PRI) is calculated by the actual yield data. It was calculated by using the following formula:

$$PRI = \frac{Yield\,obtained\,from\,experimental\,plot\,(q\,ha^{-1})}{Standard\,yield\,(q\,ha^{-1})}$$

For scented rice, Standard yield was taken 33.13 q ha-1 as reported by Bhandarkar and Sharma (2013).

Whereas the Production efficiency (PE) is calculated by using formula given by Tomar and Tiwari (1990) as follows:

$$PE\,(kg\,ha^{-1}\,day^{-1}) = \frac{Seed\,yield\,(kg\,ha^{-1})}{Duration\,of\,crop\,(days)}$$

RESULT AND DISCUSSION

Quality Analysis Studies of Scented Rice

The data of PE and PRI presented in Table 1.1, indicated that the production efficiency (PE) and productivity rating index (PRI) influenced significantly due to different treatments and the values were recorded higher under the treatment 25 cm x 25 cm + S_{2-3} (T_2), which was found to be at par with 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), 25cm x 15cm + S_1 (T_7) and 20 cm x 20 cm + S_2 (T_{13}), In case of productivity rating index, 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), 25 cm x 20 cm + S_{2-3} (T_5), 25 cm x 15 cm + S1 (T_7) and 20 cm x 20 cm + S_2 (2S) (T_{13}) found to be at par with the same treatment 25 cm x 25 cm + S_{2-3} (T_2). The lowest PE and PRI were recorded under the treatment 20 cm x 10 cm + S_{4-5} (T_{14}) *i.e.* farmers practice. It might be due to planting of higher seedling densities in narrow spacing which interrupts the proper growth and development of plants. In case of protein content under the treatment 25 cm x 25 cm + S1 (T_1) and 25 cm x 25 cm + S_{2-3} (T_2)

Table 1.1
Quality Analysis Studies of Rice

Treatment	*PE (kg ha^{-1} day^{-1})*	*PRI(%)*	*Protein content(%)*	*Grain L/B Ratio*	*Brown rice L/B Ratio*	*Kernal L/B Ratio*
T_1 :25x25cm^2+S_1	25.46	1.11	6.79	3.88	3.26	3.08
T_2: 25x25cm^2+S_{2-3}	26.34	1.15	6.79	3.85	3.28	3.07
T_3 :25x25cm^2+S_{4-5}	23.69	1.04	6.53	3.80	3.24	3.07
T_4 :25x20cm^2+S_1	24.81	1.09	6.54	3.73	3.27	3.05
T_5 :25x20cm^2+S_{2-3}	25.40	1.11	6.42	3.78	3.24	3.08
T_6: 25x20cm^2+S_{4-5}	22.83	1.00	6.54	3.83	3.29	3.07
T_7 :25x15cm^2+S_1	25.11	1.10	6.47	3.84	3.27	3.08
T_8 :25x15cm^2+S_{2-3}	23.37	1.02	6.47	2.86	3.27	3.08
T_9 :25x15cm^2+S_{4-5}	23.11	1.01	6.61	3.81	3.27	3.10
T_{10}:25x10cm^2+S_1	23.62	1.03	6.44	3.94	3.27	3.05
T_{11}:25x10cm^2+S_{2-3}	22.69	0.99	6.51	3.80	3.28	3.13
T_{12}:25x10cm^2+S_{4-5}	22.47	0.98	6.51	3.87	3.27	3.06
$T_{13:}$20x20cm^2+S_2(2S)	24.54	1.07	6.56	3.91	3.29	3.08
$T_{14:}$ 20x10cm^2+S_{2-3}	21.24	0.93	6.36	3.82	3.28	3.11
SEm $\pm$	0.88	0.03	0.08	0.25	0.03	0.01
CD(P=0.05)	2.58	0.11	0.23	NS	NS	0.04

showed significantly highest protein content which was found to be at par with treatments 20 cm x 20 cm + S_2 (2S) (T_{13}). Grain size and shape are the first criteria for rice quality that breeders consider in developing new varieties for release and commercial production (Adair *et al.,* 1966). However the highest value of kernel L:B ratio was recorded under treatment 20 cm x 10 cm + S_{2-3} (T_{14}) which was found to be at par with treatments 25 cm x 25 cm +S_1 (T_1), 25 cm x 25 cm+ S_{2-3} (T_2), 25 cm x 25 cm + S_{4-5} (T_3), 25 cm x 20 cm + S_{2-3} (T_5), 25 cm x 20 cm + S_{4-5} (T_6), 25 cm x 15 cm + S1(T_7), 25 cm x 15 cm + S_{2-3} (T_8), 25 cm x 15 cm + S_{4-5} (T_9), 25 cm x 10 cm + S_1 (T_{11}) and 20 cm x 20 cm+ S_2 (2S) (T_{13}). Similar findings were also reported by Bajpai and Singh (2010). The quality of seeds is the important contributor to the cost. It might be due to Transplanting of younger seedlings in optimum density at wider spacing facilitate the root growth leading to higher absorption of water and nutrients and ultimately resulting in higher yield, these result are in accordance with Singh *et al.* (2012).

SUMMARY

The treatment 25 cm x 25 cm spacing + 2 to 3 seedlings hill^{-1} (T_2), produced higher production efficiency and productivity rating index over the other treatments with good quality characters, which revealed that the younger seedlings (10-12 days old), wider spacing (25 cm x 25 cm) and optimum seedling density (2 seedlings hill^{-1}) is beneficial for rice cultivation. However correlation values showed that some of the characters could not produce significant correlation with single plant yield which might be either due to very high negative direct effects. The significance of coefficient of correlation and its expression as coefficient of determination between the yield components was very high with positive sign, with root dry weight, number of tillers hill^{-1}, test weight, panicle length, panicle weight and dry weight. Whereas effective tillers had the highest direct effect towards grain yield followed by tillers hill^{-1}, relative dry weight, panicle weight, test weight, water uptake and kernel length after cooking. Hence, selection for these traits could bring improvement in yield and yield components.

REFERENCE

Adair C. R., Brachell H. M., Jodon N. E., Johnston T. H., Thysell J. R., Green V. E., Webb B. D. and Atkins J. G., (1966), Rice Breeding and testing methods in the U.S. In U.S. Department of Agric. Rice in the U.S.: Varieties and Production. *USDA Agri. Rs. Serv. Handbook*, 289, *pp*. 19-64.

Ahmed, J., H. S. Ramaswamy and V. G. S. Raghavan, (2007), Dielectric properties of Indian Basmati rice flour slurry. *J Food Eng* 80: 1125- 1133.

Anonymous, (2011), Report of Agriculture Department, Chhattisgarh Government. Krishi Diary, Directorate of Extension Services, IGKV, Raipur pp 05.

Azeez, M. A. and Shafi, M. (1966), Quality in Rice.Department of Agric, *West Pakistan Technology Bulletin.* No. 13 pp. 50.

Bajpai, A. and Singh, Y. (2010), Study of quality characteristics of some small and medium grained aromatic rice's of Uttarpradesh and Uttarakhand. *Agric. Sci. Digest*, 30 (4): 241-245.

BeacheII. H. M. and Stansel, J. W. (1963), *Int. RicfI Comm. Nflwsl* (Spl Issue) 12: 25-40.

Bhandarkar, S. and Sharma, B. (2012), Results of all India Coordinated Rice Improvement Programme, Indira Gandhi Krishi Vishwavidyalaya. 07.

Bhattacharya, K. R. and Sowbhagya, C. M. (1971), Water uptake of rice during cooking. Cereal Science Today 16: 420-424.

IRRI. (1997), Standard evaluation system for rice. 4th edition. International Rice Testing Programme, Manila, Philippines (IRRI).

Krishnaveni, B. and Shobha Rani, N. (2006), Association of grain yield with quality characteristics and other yield components in rice. *Oryza*, 43(4): 320-322.

Reddy, J. N., De, R. N and Suriya Rao, A. V. (1997), Correlation and path analysis in low land rice under intermediate (0-50 cm) water depth. *Oryza*, 34 (3) : 187-190.

Reddy, Y. S. and P. V. R. Kumar. (1996), Studies on genetic variability, correlation and path analysis in rice. *New Botanist.* 23: 129-133.

Roy, A., Panwar, D. V. S and Sarma, R. N. (1995), Genetic variability and causal relationships in rice. *Madras Agricultural Journal*, 82 (4): 251-255.

Shastry, S. V., Tran, D. V., Naguyen, V. N. and Nanda, J. S. (2000), Sustainable integrated rice production. ***In:*** Nanda, J. S. (Ed) *Rice Breeding and Genetics:* Research Priorities and Challenges. Oxford and IBH Pub. New Delhi, pp. 53-72.

Siddiqui, S. U., T. Kumamaru and H. Satoh, (2007), Pakistan rice genetic resources-I: grain morphological diversity and its distribution, *Pak J Bot* 39: 841-848.

Singh, N., Kumar, D. and Tyagi, V. K. (2012), Influence of spacing and weed management on rice (*Oryza sativa* L.) varieties under system of rice intensification. *Indian Journal of Agronomy* 57 (2): pp. 138-142.

Singh, R. K. and Chaudhary, B. D., Biometrical methods in quantitative genetic analysis. Kalyani Publishers New Delhi 1995, pp. 215-218.

Sood, B. C. and Saddiq, N. (1986), Current status and future outlook for hybrid rice technology in India. In: Hybrid Rice Technology, Directorate of Rice Research, Hyderabad, pp. 1-26.

Tomar, A. and Tiwari, S. (1990), Production potential and economics of different crop sequences. *Indian Journal of Agronomy*. 35: 30-35.

Yadav, R. B., B. S. Khatkar and B. S. Yadav, (2007), Morphological, physicochemical and cooking properties of some Indian rice (*Oryza sativa* L.) Cultivars. *J Agricl Technol* 3: 203-210.

Yang, D. S., K. S. Lee and S. J. Kays, (2010), Characterization and discrimination of premiumquality, waxy, and black-pigmented rice based on odor-active compounds. *J Sci. Food Agric, n/a. doi:10.1002/jsfa.4126.*