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Effect of different organic nutrient management on qualitative characters of different aromatic rice varieties

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Abstract
A field experiment was carried out at Research cum Instructional Farm, IGKV, Raipur, during *kharif* season of 2011. The soil of experiment field was '*Vertisols*'. The soil was neutral (pH 7.12) in reaction and medium in fertility having 0.52% organic carbon, low N (205.5 kg ha^{-1}), medium P (17.0 kg ha^{-1}) and high K (345 kg ha^{-1}). The experiment was laid out in split plot design with 3 replications. The main plot consisting of four aromatic rice varieties *viz.* Jeeraphool, Kasturi Badshah Bhog and Sugandhamati with six organic nutrient management treatments as sub plot *viz.* T_1 (cowdung manure + composted crop residue + Vermicompost), T_2 (T_1 + BGA + PSB + *Azospirillum*), T_3 (T_1 + Rock Phosphate), T_4 (T_1 + Panchagavya), T_5 (T_2 + Rock Phosphate + Panchagavya) and T_6 (T_1 + Neemastra).The results revealed that between four varieties, Among quality characteristics like paddy length, brown rice length and kernel length, Sugandhamati variety showed outstanding results whereas, high breadth of rice was observed under variety Jeeraphool. Application of CDM, CCR and VC accompanied with BGA, PSB, *Azospirillum*, rock phosphate and Panchgavya (T_5) recorded higher value of all quality characters of aromatic rice varieties.

Keywords: Aromatic rice varieties, organic nutrient, quality characters, length and breadth etc.

Introduction
Rice is the most important and staple food crop for feeding of more than two third populations in the world. The slogan 'Rice is life' is most appropriate for India as this crop plays a vital role in our national food security and is a means of livelihood for millions of rural households. More than 90 percent of world's rice is grown and consumed in Asia, where 60 percent of the earth's people live. Rice accounts for 35 to 75 percent of the calories consumed by more than 3 billion Asians (Kumar *et al.*, 2006) [7] and is planted to about 154 m ha annually or on about 11 percent of the total world's cultivated land. India is the second largest producer after China and has an area of over 43.77 m ha under rice and produced 89.05 mt. during 2010 (Anonymous, 2011a) [1].

Rice quality is considered from the viewpoint of milling quality, grain size, shape, appearance and cooking characteristics. Consumer judges the quality of rice mostly on its appearance, particularly the colour, size and shape and on its elongation during cooking. On the other hand, millers and traders prefer a variety capable of giving high head rice recovery (Sharma, 2002) [5]. Besides this other aspects of quality like amylose content and gelatinization temperature are also important (Bhattacharya, 1989 and Jennings *et al.*, 1979). Rice with soft gel consistency cook tender and remain soft to medium gel consistency, is preferred by most rice consumers (Sarkar *et al.*, 1994) [8].

In India, Chhattisgarh state is considered as one of the centre of origin and evolution of rice and is blessed with resources of rice variability. Being endowed with the most favorable climate, the Chhattisgarh state has an excellent geographical centre of diversity particularly rice including aromatic cultivars. The demand for special purpose aromatic rice has dramatically increased over the past two decades and grain quality has been assuming an increasingly important issues particularly since last decade due to change in the consumer's preference for better quality of rice as a result of changed life style of consumers.

In Chhattisgarh, rice occupies an area around 3.61 m ha with the production of 5.22 mt and productivity of 1619 kg ha^{-1} (Anonymous, 2011b) [2]. Out of which, the productivity of aromatic rice varieties are less than improved one.

Aromatic rice varieties are very much popular for their quality and aroma. Aroma of scented rice is major quality character, which increases the value of rice. In addition to long grain Basmati type that has high export potential, there are large number of indigenous short-grained aromatic varieties cultivated in Chhattisgarh and different pockets of other states. The major portion of rice area is devoted to the course and medium slender rice varieties. However, very less area, about less than 20 percent of the total rice area, has been given to the fine and scented rice. Scented rice occupies an important status in domestic as well as in International market due to its several outstanding qualities and therefore they earn premium price. Of late, the area under scented rice has increased many folds owing to remunerative price in International market. The yields of scented rice varieties are comparatively less than high yielding non scented varieties. The farmers have switched over to high yielding coarse rice because of the higher yield from modern varieties, which compensates for the premium price of scented rice. It is therefore important to achieve high yield from scented rice varieties, while, maintaining its quality too. This objective cannot be achieved by chemical nutrients source only. Because it is considered that, the quality characteristics of aromatic rice are improved through organic sources of nutrient on sustainable yield basis.

Sustainable agricultural productivity and improvement in soil health and soil physical properties can be achieved by the use of organic manures and biofertilizer etc. Using organic resources like, cow dung manure, compost crop residue, vermicompost, blue green algae, phosphorus solubilizing bacteria, rock phosphate and *Azospirillum* etc deserves priority for sustained production and better resource utilization in organic nutrient management.

Materials and Methods

The field experiment was conducted during *Kharif* season of 2011 at the Research cum Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). Raipur is situated in mid – eastern part of Chhattisgarh state and lies at 21^0 16' North Latitude and 81^0 36' East Longitude with an altitude of 314.15 m above the mean sea level. Raipur comes under the Chhattisgarh plains agro climatic sub zone and having dry moist to sub humid climatic condition. The region receives an average of 1200-1400 mm annual rainfall, out of which about 87 percent received during the rainy season (June to September) and the rest 13 percent during the winter season (October to February). The crop received 1193.7 mm rainfall during entire growth period. The maximum temperature during crop period varied from 33.4 °C in the first week of July to 28.3 °C in the first week of September, while minimum temperature ranged between 15.2 °C in the fifth week of October to 25.8°C in the fifth week of July. The soil was *vertisol*, low in organic carbon (0.48%), available N is low (205.5 kg/ha), available P is medium (17.00 kg/ha) and high in available K (345 kg/ha), EC (ds m^{-1}) 0.34 with acidic (pH 7.12) in reaction.

Rice seedlings of all 4 varieties were grown separately in nursery by dry seedbed method of 5.0 m x 1.5 m size. Beds were raised up to 20 cm height. Seed treatment with *Trichoderma viridae* @ 5 g kg^{-1} of seed + *Pseudomonas florescence* @ 3 g kg^{-1} of seed was done before the sowing of seeds in all the treatments. Rice seedlings were treated with PSB and *Azospirillum* treatment of rice seedling was applied as per the Transplanting was done on 24th July 2011 with 25 days old seedlings keeping distance of 20x10 cm in each plot of replications and harvesting of Kasturi, Sugandhamati and Jeeraphool, Badshah Bhog variety was done on 05th November 2011 and 16th November 2011 respectively.

All the organic sources of nutrients and rock phosphate were applied as per the treatments in respective plots to fulfill the nutrient requirement of 50:50:30 kg N: P_2O_5: K_2O ha^{-1}. Entire quantity of all sources was applied 4 days before the transplanting. Blue green algae were applied 10 days after transplanting as top dressing. 3-5 cm water level was maintained to up 25-30 days for better growth of Blue green algae. All the three main sources- i.e. cow dung manure, compost crop residue, and vermicompost were applied on N basis (1/3 of each) 4 days before the transplanting. Accordingly, 2563 kg ha^{-1} cow dung manure, 3332 kg ha^{-1} compost crop residue, and 1041 kg ha^{-1} of vermicompost were required to fulfill the required N to the crop in each and every treatment. These quantities of all three nutrient sources supplied 21.53 kg ha^{-1} (6.92+7.33+7.28 respectively) of P and 37.71 kg ha^{-1} (12.30+15.00+10.41 respectively) of K.

All qualitative characters was recorded from each plot at 5 randomly selected plants. Data on dry matter accumulation were recorded on five random places in each plot and computation Leaf area index, Crop growth rate and relative growth rate taken. Quality characters observation to be recorded grain classification and milling quality.

Results and Discussion

Length, breadth and L: B ratio of paddy

Data pertaining to length, breadth and L: B ratio of paddy is presented in Table 1. Among the varieties, Sugandhamati recorded significantly higher values of length of paddy and was comparable with Kasturi, however breadth of paddy was recorded higher (2.31mm) with Jeeraphool but found non significant due to varieties. Similarly, L:B ratio of paddy was highest (4.75) with variety Kasturi and was at par with variety Sugandhamati (4.74). Both were significantly superior to rest of two varieties namely Jeeraphool and Badshah Bhog.

Table 1: Effect of organic nutrient management on paddy length, breadth and its ratio of different aromatic rice varieties

Treatment	Paddy length (mm)	Paddy breadth (mm)	Paddy L:B ratio
Aromatic rice varieties			
V_1=Jeeraphool	5.66	2.31	2.46
V_2=Kasturi	10.22	2.16	4.75
V_3=Badshahbhog	6.56	2.23	2.95
V_4=Sugandhmati	10.73	2.27	4.74
S.Em+	0.34	0.09	0.24
CD (P = 0.05)	1.17	NS	0.83
Organic nutrient management			
T_1= CDM+CCR+VC	8.18	2.18	3.76
T_2=T1+BGA+PSB+Azo	8.30	2.22	3.77
T_3=T1+RP	8.33	2.22	3.79
T_4=T1+ Panchagavya	8.38	2.28	3.69
T_5=T2+RP+ Panchagavya	8.41	2.28	3.74
T_6=T1+Neemastra	8.16	2.27	3.60
S.Em+	8.18	0.10	0.23
CD (P = 0.05)	NS	NS	NS

Different organic nutrient practices were unable to bring significant variation for length, breadth and L: B ratio of paddy. However longer and wider paddy was observed under application of BGA+ PSB +*Azospirillum* + rock phosphate + panchagavya +CDM +CCR +VC (T_5). However, its ratio was higher under application of CDM +CCR +VC with rock phosphate (T_3). Similar results were also found by Kumar *et al.* (1996), Singh *et al.* (2005) [9] and Dahiphale *et al.* (2004) [4].

Length, breadth and L: B ratio of brown rice

Data on length, breath and L:B ratio of brown rice are presented in Table 2. Sugandhamati recorded significantly higher value of length of brown rice over rest of the varieties, however breadth of paddy was not affected due to the varieties. On the other hand, L:B ratio of brown rice was highest (4.17) with variety Kasturi and was significantly superior over rest of varieties except Sugandhamati (4.03).

Table 2: Effect of organic nutrient management on brown rice length, breadth and its ratio of different aromatic rice varieties

Treatment	Brown rice length (mm)	Brown rice breadth (mm)	Brown rice L: B ratio
Aromatic rice varieties			
V_1=Jeeraphool	4.79	2.16	2.22
V_2=Kasturi	7.77	1.87	4.17
V_3=Badshahbhog	5.82	1.99	2.93
V_4=Sugandhmati	8.29	2.06	4.03
S.Em+	**0.10**	**0.09**	**0.17**
CD (P = 0.05)	**0.35**	**NS**	**0.60**
Organic nutrient management			
T_1= CDM+CCR+VC	6.67	1.98	3.39
T_2=T1+BGA+PSB+Azo	6.68	1.99	3.40
T_3=T1+RP	6.65	2.00	3.36
T_4=T1+ Panchagavya	6.67	2.08	3.26
T_5=T2+RP+ Panchagavya	6.63	2.00	3.34
T_6=T1+Neemastra	6.70	2.08	3.26
S.Em+	0.12	0.10	0.16
CD (P = 0.05)	NS	NS	NS

Different organic nutrient practices were unable to bring any significant variation for length, breadth and L: B ratio of brown rice.

Length, breadth and L:B ratio of kernel

Data pertaining to length, breath and L: B ratios of kernel are presented in Table 3. Sugandhamati recorded significantly maximum kernel length (7.56 mm) and L:B ratio (4.37 mm) over other varieties. Kasturi variety also produced comparable longer kernel (6.70 mm) and registered appreciable kernel L:B ratio (3.98) to those of Jeeraphool and Badshah Bhog. Different organic nutrient practices unable to bring any significant variation for length, breadth and L: B ratio of kernel.

Table 3: Effect of organic nutrient management on kernel rice length, breadth and its ratio of different aromatic rice varieties

Treatment	Kernel length (mm)	Kernel breadth (mm)	Kernel L:B ratio
Aromatic rice varieties			
V_1=Jeeraphool	3.89	1.75	2.23
V_2=Kasturi	6.70	1.69	3.98
V_3=Badshahbhog	4.76	1.72	2.78
V_4=Sugandhmati	7.56	1.73	4.37
S.Em+	0.25	0.08	0.11
CD (P = 0.05)	0.82	NS	0.39
Organic nutrient management			
T_1= CDM+CCR+VC	5.76	1.72	3.37
T_2=T1+BGA+PSB+Azo	5.76	1.73	3.35
T_3=T1+RP	5.68	1.70	3.34
T_4=T1+ Panchagavya	5.73	1.72	3.35
T_5=T2+RP +Panchagavya	5.72	1.73	3.31
T_6=T1+Neemastra	5.72	1.74	3.30
S.Em+	0.14	0.11	0.20
CD (P = 0.05)	NS	NS	NS

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