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Effect of different organic nutrient management on quantitative characters of 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 treatments consisted of four aromatic rice varieties as main plot *viz.* Jeeraphool, Kasturi Badshah Bhog and Sugandhamati with six organic nutrient management treatments as sub plot *viz.* T_1 (CDM + CCR + Vermicompost), T_2 (T_1 + BGA + PSB + *Azospirillum*), T_3 (T_1 + Rock Phosphate), T_4 (T_1 + Panchgavya), T_5 (T_2 + Rock Phosphate + Panchgavya) and T_6 (T_1 + Neemastra). The results revealed that between four varieties, Sugandhamati was found to produce higher growth as compared other varieties, As regards to the effect of different organic nutrient management, the results revealed that various growth parameters and yield attributing characters were recorded highest with the application of Cow dung manure, Compost crop residue, Vermicompost, Blue Green algae, PSB, *Azospirillum*, rock phosphate and Panchgavya (T_5) which also gave the highest yield and economic return.

Keywords: Aromatic rice, organic nutrient management, varieties, quantitative characters

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 perscent of world's rice is grown and consumed in Asia, where 60 perscent of the earth's people live. Rice accounts for 35 to 75 perscent of the calories consumed by more than 3 billion Asians (Kumar *et al.*, 2006) [5] 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].

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, 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.

The role of plant nutrient would be extremely important from sustainability point of view. Nitrogen is the key nutrient element limiting the yield of rice. Fertilizer N use efficiency varies from 18 to 40 perscent in different rice soils, because applied inorganic N is rapidly lost from the soil by ammonia volatilization and denitrification. Organic materials minimize N loss and increase N use efficiency. With the increasing trend in price of fertilizers and the reduction in the use of chemical fertilizers it has become necessary to judiciously manage the inflow of organic sources of nutrients. Therefore, information needs to be generated with respect to suitable combination of different organic sources and inclusion of biofertilizers and organic preparations to develop the suitable nutrient management practices for better quality and high productive fine and fine scented rice varieties by organic sources of nutrients to increase the nutrient use efficiency as well as sustainability.

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). January is the coolest and May is the hottest month. The maximum temperature ranges from 26.7 ^{0}C and 42.5 ^{0}C. Atmospheric humidity varies between 70 to 90 per cent from mid June to March and wind velocity is high from May to August with its peak in June to July months. Soil surface temperature of this region crosses 60 ^{0}C, air temperature to 48 ^{0}C and humidity drops down to 3 to 4 per cent during summer season.

The experiment was laid out in split plot design with 3 replication. 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). Rice varieties were transplanted in rows with planting geometry of 20 X 10 cm on July 20, 2011 and harvested on November 05, 2011 and November 16, 2011 due to different duration of varieties. The crop received 1193.7 mm rainfall during the study period.

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.

Plant height, number of tillers/m^2, plant population, no. of leaves was recorded from each plot at 5 randomly selected plants

Results and Discussion

Plant population (No. m^{-2}) and Plant height (cm)

The data pertaining to plant population m^{-2} are presented in Table 1. Since the rice varieties grown under transplanted condition and seedlings of rice properly placed in experimental field, the plant population was not influenced significantly due to the different aromatic rice varieties as well as different organic nutrient management, over entire crop growth period (20 DAT and at harvest). Data revealed that average plant height increased progressively with advancement of the crop stage. Plant height varied significantly at 40, 80 DAT and at harvest due to their genetic characters and different growth habits of four varieties.

Among the varieties, Jeeraphool recorded significantly higher plant height at 40 DAT of crop growth and remained at par with variety Badshah Bhog. Variety Kasturi recorded lower plant height at 40 DAT. However, at 80 DAT, variety Sugandhamati produced significantly taller plant over Jeeraphool but remained at par with variety Kasturi and Badshah Bhog. At harvest, Badshah Bhog recorded significantly tallest of plant height. However, it was comparable with Jeeraphool and Sugandhamati. The variation in plant height amongst four varieties during different intervals might be due to their own genetic characteristics and days to maturity.

Among different organic nutrient management, plant height remained unaffected at all the crop growth stages irrespective of the organic nutrient supply. However, T_6 (T_1 + Neemastra) recorded taller plant at all the growth stages of crop followed by T_5 (T_2 + Rock phosphate + Panchagavya).

Table 1: Effect of organic nutrient management on plant population and plant height of different aromatic rice varieties

Treatment	Plant population (No. m^{-2})		Plant height (cm)		
	20 DAT	At harvest	40 DAT	80 DAT	At harvest
Aromatic rice varieties					
V_1=Jeeraphool	49.61	49.03	85.0	117.5	144.9
V_2=Kasturi	49.50	49.01	74.9	126.1	136.3
V_3=Badshahbhog	49.64	49.19	83.8	120.5	145.5
V_4=Sugandhmati	49.75	48.75	75.7	127.2	143.4
S.Em+	1.04	2.07	2.3	2.1	2.2
CD (P = 0.05)	NS	NS	7.8	7.3	7.6
Organic nutrient management					
T_1= CDM+CCR+VC	49.25	48.75	79.8	122.3	141.8
T_2=T1+BGA+PSB+Azo	49.46	49.17	80.0	123.1	142.5
T_3=T1+RP	49.42	47.96	79.4	120.9	142.3
T_4=T1+ Panchagavya	49.25	48.54	79.4	122.8	142.6
T_5=T2+RP+ Panchagavya	50.00	50.00	80.1	123.8	142.7
T_6=T1+Neemastra	49.58	49.56	80.3	124.1	143.3
S.Em+	0.97	2.21	2.2	2.3	2.2
CD (P = 0.05)	NS	NS	NS	NS	NS

Number of leaves hill^{-1}

The data pertaining to number of leaves hill^{-1} are presented in Table 2. The data reveal that the number of leaves hill^{-1} was increased with increase in plant age. All the four varieties showed non significant results at 20, 40 and 60 DAT. However, at 80 DAT, Badshah Bhog recorded significantly higher number of leaves (65.58 hill^{-1}) although it was at par with Kasturi and Sugandhamati and showed superiority over Jeeraphool. The variability in number of leaves was might be due to the varietal characteristics.

Among different organic nutrient supply, number of leaves hill^{-1} was non significant at 20 and 40 DAT. However at 60 and 80 DAT, the significantly higher number of leaves hill^{-1} was recorded under T_2 + rock phosphate and panchagavya (T_5) over T_1 (CDM + CCR + Vermicompost) and remained at par with all the other organic nutrient management. T_1 resulted in lowest number of leaves hill^{-1} at all the growth stages of crop. Higher number of leaves hill^{-1} in respective treatments except T_1 might be due to supply of nutrients under these treatments which were sufficient to meet the demand of

the crop and thereby increased the number of leaves.
Similar results were also reported by Sarawgi and Sarawgi (2004) [4], Jha *et al*. (2006) [5] and Netam *et al.* (2008) [6]. Interaction between varieties and organic nutrient management was found non significant.

Number of tillers m^{-2}

Data pertaining to number of tillers m^{-2} are presented in Table 2. In general tillers m^{-2} increased rapidly with increasing the crop age up to 60 DAT and gradually slowed down thereafter. Among the varieties, Badshah Bhog recorded significantly higher number of tillers m^{-2} at 60 DAT, and was significantly superior over other varieties except Jeeraphool. Variety Sugandhamati recorded lowest number of tillers m^{-2} at 60 DAT. On the other hand, at harvest, all the four varieties failed to produce significant effect on number of tillers m^{-2}. However, higher number of tillers m^{-2} was recorded with Badshah Bhog followed by Sugandamati and Kasturi. The lowest number of tillers m^{-2} was observed in variety Jeeraphool.
Among different organic nutrient management treatments, application of T_2 + RP+ Panchagavya (T_5) recorded significantly highest number of tillers m^{-2} (285) at 60 DAT. However, it was found to be at par with the treatments of T_4, T_2 and T_3. While at harvest, total numbers tillers did not influence significantly due to different organic nutrient supply.

Table 2: Effect of organic nutrient management on number of leaves $hill^{-1}$ and number of tillers m^{-2} of different aromatic rice varieties

Treatment	No of leaves $hill^{-1}$				Total no. of tillers m^{-2}	
	20 DAT	40 DAT	60 DAT	80 DAT	60 DAT	At harvest
Aromatic rice varieties						
V_1=Jeeraphool	28.9	40.3	43.2	53.22	276	292
V_2=Kasturi	30.2	40.8	57.7	61.54	266	308
V_3=Badshahbhog	23.8	42.5	53.5	65.58	290	313
V_4=Sugandhmati	24.6	38.1	54.2	61.16	264	309
S.Em+	4.5	4.4	5.9	3.23	6	12
CD (P = 0.05)	NS	NS	NS	11.9	20	NS
Organic Nutrient management						
T_1= CDM+CCR+VC	25.1	38.2	42.5	55.90	265	301
T_2=T1+BGA+PSB+Azo	26.0	39.5	53.8	61.24	275	299
T_3=T1+RP	26.5	39.9	56.6	62.00	272	298
T_4=T1+ Panchagavya	27.8	41.6	54.8	60.38	282	310
T_5=T2+RP+ Panchagavya	29.6	42.8	58.6	63.44	285	319
T_6=T1+Neemastra	26.3	40.5	46.5	59.29	267	306
S.Em+	2.0	2.6	4.8	2.43	6	7
CD (P = 0.05)	NS	NS	13.8	6.95	17	NS

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