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Jyoti Nag
Department of Agronomy, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

PK Salam
Department of Agronomy, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. AK Thakur
Department of Agronomy, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Narendra Kumar
Department of Agronomy, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. T Chandrakar
Department of Soil Science and Agricultural Chemistry, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Dr. DP Singh
Department of Agricultural Statistics and Social Science, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Corresponding Author:
Jyoti Nag
Department of Agronomy, Shaheed Gundadhur College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

Effect of integrated nutrient management on growth and yield of scented rice variety TCDM-1

Jyoti Nag, PK Salam, Dr. AK Thakur, Narendra Kumar, Dr. T Chandrakar and Dr. DP Singh

Abstract
An experiment was conducted during *kharif* season of 2022 at Research cum Instructional Farm, S.G. College of Agriculture and Research Station, Kumhrawand, Jagdalpur (C.G.). The experiment was laid out in randomized block design with 3 replication and the study comprises of 10 treatments i.e., (T_1) Absolute control, (T_2) 60 kg N (through urea): 50:30 kg P. K. ha^{-1}, (T_3) 80 kg N (through urea): 50:30 kg P. K. ha^{-1}, (T_4) 100 kg N (through urea): 50:30 kg P. K. ha^{-1}, (T_5) 60 kg N (50% through urea + 50% through FYM): 38:23 kg P. K. ha^{-1}, (T_6) 80 kg N (50% through urea + 50% through FYM): 38:23 kg P. K. ha^{-1}, (T_7) 100 kg N (50% through urea + 50% through FYM): 38:23 kg P. K. ha^{-1}, (T_8) 60 kg N (through FYM): 25:15 kg P. K. ha^{-1}, (T_9) 80 kg N (through FYM): 25:15 kg P. K. ha^{-1}, (T_{10}) 100 kg N (through FYM): 25:15 kg P. K. ha^{-1} The result revealed that, treatment T_4: 100 kg N (through urea): 50:30 kg P. K. ha$^{-1.}$ In this experiment only nitrogen doses are quantify through urea & FYM in different treatments and remaining nutrients are supplied through inorganic sources of fertilizers. recorded significantly higher growth parameters, yield and yield attributing characters viz., plant height, number of tillers plant^{-1}, dry matter accumulation, crop growth rate, number of panicles plant^{-1}, no. of filled grains panicle^{-1}, length of panicle, grain yield and straw yield, while test weight and harvest index did not influenced singnificantaly, but numerically higher test was found in treatment T_6 and higher harvest index was observed in treatment T_{10}.

Keywords: *Kharif* season, randomized block design, nitrogen fertilizer, urea, FYM (Farmyard manure)

Introduction
Rice (*Oryza sativa* L.) belongs to family poaceae and it is one of the world's most important cereal crops grown extensively in tropical and sub-tropical regions. About 70% of the world population takes rice as staple food, while it is also the staple food and about 65% of the total population of our country. Rice is the second most widely consumed cereal in the world next to wheat. It is the staple food for two thirds of the world's population (Kumari *et al*., 2014) [11]. In world, rice is cultivated over an area of 165.22 million hectares and yielding 509.29 million tonnes during 2022-23 (Anonymous, 2022) [3]. In India, rice is cultivated over an area of 45 million hectares, 127.93 million tonnes of rice produced and productivity was about 23.90 qha^{-1} during 2021-22 (Anonymous, 2021) [2].
In Chhattisgarh, rice is cultivated over an area of 4.04 million hectares, 8.0 million tonnes of rice produced and productivity was about 16.83 q ha^{-1} during 2019-20 (Anonymous, 2019) [1]. Dubraj is the most popular scented paddy variety which is available in the local markets of Chhattisgarh and with popular brand names "Pride of Chhattisgarh and Chhattisgarh ka Basmati", fetches a high value in the market due to its very good cooking quality, aroma and taste. Among the scented two paddy varieties, Dubraj occupies 10 per cent of the total paddy growing area of the Chhattisgarh state (Sharma *et al.*, 2017) [16]. Most of the traditional aromatic paddy varieties are taller, low production capacity, low input reactive, long duration and susceptible for the biotic stress. The productivity of paddy is less than 2 tonnes ha^{-1} in most of the states of India (Dash, 2009) [6].

Material and Methods
The experiment was conducted during Kharif season of 2022 (August to November) at the Instructional cum Research Farm, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Chhattisgarh located at 19^0 10' N latitude and 81^0 95' E longitutde with an elevation of 552 meters above mean sea level of Bastar district of Chhattisgarh.

The soil in the experimental field was Inceptisol, which was acidic in nature, poor in organic carbon, low in available N and P, and medium in K. The experiment was framed in randomized block design (RBD) with three replication consisted of ten treatments i.e., T_1: Absolute control, T_2: 60 kg N (through urea): 50:30 kg P. K. ha^{-1}, T_3: 80 kg N (through urea): 50:30 kg P. K. ha^{-1}, T_4: 100 kg N (through urea): 50:30 kg P. K. ha^{-1}, T_5: 60 kg N (50% through urea + 50% through FYM): 38:23 kg P. K. ha^{-1}, T_6: 80 kg N (50%through urea + 50% through FYM): 38:23 kg P. K. ha^{-1}, T_7: 100 kg N (50% through urea + 50% through FYM): 38:23 kg P. K. ha^{-1}, T_8:60 kg N (through FYM): 25:15 kg P. K. ha^{-1}, T_9: 80 kg N (through FYM): 25:15 kg P. K. ha^{-1}, T_{10}: 100 kg N (through FYM): 25:15 kg P. K. ha^{-1} for rice field by urea, single super phosphate and muriate of potash respectively applied to all plots except control. 50% of nitrogen, 100% phosphorus and potash were applied during sowing of crop and remaining half dose of nitrogen was applied at 25-30 DAS and 40-45 DAS FYM was applied as basal dose. TCDM-1 variety of rice crop was used as a test crop All the data collected on various parameters were subjected to statistical analysis by applying the procedure for Randomized Block Design suggested by Gomez and Gomez (1984) [7].

Results and Discussion

Growth Parameters

Table 1 reveals that the growth parameters like plant height, no. of tillers plant^{-1}, dry matter accumulation, crop growth rate, were significantly influenced by organic and inorganic sources of nitrogen management. The plant height recorded significantly taller plant in treatment T_4 among all the treatment T_7, T_2, and T_3. The increment of plant height at different growing stages under particular treatment was due to regular supply of growth nutrients and maintained the pace of growth. The minimum plant height was with absolute control (T_1). This result confirms with the findings of Singh *et al.* (2018) [15, 17] and Yadav *et al.*, (2021) [14, 18]. The effect organic and inorganic source of nitrogen management had significant effect on no. of tillers plant^{-1}, treatment T_4 recorded significantly more no. of tillers plant^{-1} at harvest among all the treatments but treatment T_3, T_5, T_6 and T_7 was recorded significantly on par to each other. Similar trend of increment was observed with the finding of Yadav *et al*., (2021) [14, 18]. Dry matter accumulation shows significant effect, treatment T_4 (100 kg N through urea + 50 kg P + 30 kg K ha^{-1}) produced significantly higher dry matter among all the treatment but it was found statistically on par with T_3, T_2,T_{10}. Similar results were observed by Paul, K. *et al*., (2021) [13] through their experiment on combination of organic and inorganic source of nutrient. Crop growth rate (CGR) was increased with advancement of growth and found significant change was noticed among treatments imposed while conducting experiment. CGR affected significantly at harvest treatment T_4 produced significantly higher CGR among all the treatments. The lowest CGR was noticed under absolute control throughout the period of observations. The higher CGR was recorded in particular treatment due to initial growth and growth parameters which was directly influenced the whole growing period, even higher growth and dry matter accumulation of leaves by enhancing cell division increased better absorption and utilization or radiant energy, thereby resulting higher photosynthesis and better CGR. This is greater conformity with the finding of Chandra *et al.,* (2022) [5].

Yield and yield attributing characters

Effect of organic and inorganic sources of nitrogen management on yield and yield attributing characters are presented in Table 2. The data reveals that the yield and yield attributing characters like number of panicles plant^{-1}, length of panicles (cm), number of filled grains panicle^{-1}, grain yield, straw yield were significantly influenced while test weight (gm) and harvest index were not affected significantly due to different organic and inorganic sources of nitrogen management. The data reveals that treatment T_4 recorded significantly more no. panicles plant^{-1} which is on par with treatment T_3 and minimum number of panicles plant^{-1} was recorded in absolute control; even all imposed treatments were higher than absolute control. 60 kg N through urea + 50 kg P + 30 kg K ha^{-1}, 80 kg N (50% through urea+ 50% through urea FYM) + 38 kg P + 23 kg K ha^{-1} and 100 kg N (50% through urea+ 50% through urea FYM) + 38 kg P + 23 kg K ha^{-1} were statistically similar to each other in attaining more number of panicles plant^{-1}. Instant supply system of synthetic fertilizers exhibited apparent growth of plant than other source of nutrition, which reflected in panicle number (Imade *et al.*, 2017) [10]. The minimum panicle length was recorded under absolute control which was improved with incorporation of fertilizer alone and integrated form of nitrogen managements, when 100 kg N through urea + 50 kg P + 30 kg K ha^{-1} i.e., 23.88 cm (T_4) was applied gave highest panicle length as compared to other treatments but reduced dose of nitrogenous fertilizer also posed similar effect on increasing panicle length under 80 kg N through urea + 50 kg P + 30 kg K ha^{-1} i.e., 22.42 cm which is relative at par with treatment T_2 and T_7. Rice attained significantly higher panicle length under 100 kg N through urea + 50 kg P + 30 kg K ha^{-1} being on par to 80 kg N through urea + 50 kg P + 30 kg K ha^{-1} due to regular supply of nutrients from rhizosphere during critical period of growth (Hussain *et al.*, 2012) [9]. The maximum number of filled grains plant^{-1} was recorded significantly higher with treatment T_4 (100 kg N through urea + 50 kg P + 30 kg K) i.e., 102.71 which was found to be at par with T_2, T_7), T_8, T_6, T_9, T_5 and due to appropriate supply through sink-source relation which is directly governed plant growth in accumulation of growth resources to sink site. Result is in accordance with that Chandra *et al.* (2022) [5] and Mangaraj *et al.*, (2022) [12]. Test weight was not affected significantly due to different treatments organic and inorganic source of nitrogen but numerically higher test weight was observed in treatment T_6 (80 kg N (50% through urea + 50% through FYM): 38:23 kg PK ha^{-1}) among all the treatments which found to be 21.56 as in case of Borkar *et al.*, (2008) [4] who experimented on different effect of nitrogen management through FYM and N fertilizers. The grain yield was influenced significantly by different treatments, in which the application of 100 kg N through urea + 50 kg P + 30 kg K ha^{-1} had maximum grain yield (49.31 q ha^{-1}) being at par with 80 kg N through urea + 50 kg P + 30 kg K ha^{-1} (44.69 q ha^{-1}). The lowest grain yield was recorded with absolute control (17.93 q ha^{-1}). The straw yield was influenced significantly by different treatments, in which the application of 100 kg N through urea + 50 kg P + 30 kg K ha^{-1} had maximum straw yield (63.23 q ha^{-1}) being at par with 80 kg N through urea + 50 kg P + 30 kg K ha^{-1} (58.13 q ha^{-1}). The lowest straw yield was recorded with absolute control (43.20 q ha^{-1}). The yield is

directly dependent on various growth and yield parameters and expression was observed with their integrated influence with the increment of supply of growth resources. Thus, improved growth boosted up yield component for leading higher yield. The regular interval of nutrient supply proved yield enhancement significantly than control treatment. The present findings are in accordance with the findings of Yadav *et al.* (2021) [14, 18]; Sharma *et al.* (2018) [15] and Yadav *et al.*, (2021) [14, 18]. Harvest Index (HI) was also affected by different organic and inorganic source of nitrogen management treatments as observed in grain and straw yields because HI is product of both based on grain and straw yield calculation. The harvest index was recorded non significant due to different organic and inorganic nutrients but it had found numerically higher in T_{10} N (100 kg N (through FYM): 25: 15 kg PK ha^{-1}) (44.26%) and the lowest harvest index was under absolute control and treatment T_{8h} (43.20%) as supported by Gupta and Handore (2009) [8].

Table 1: Effect of organic and inorganic source of nitrogen on growth parameters

Treatment	Plant Height (cm)	No. of tillers plant^{-1}	Dry matter Accumulation (g plant^{-1})	CGR (g cm^{-2} day^{-1})
T_1	86.10	2.00	31.48	0.0617
T_2	96.63	3.73	36.72	0.0827
T_3	96.29	4.40	37.52	0.0698
T_4	102.31	4.93	40.32	0.1056
T_5	93.72	4.40	35.19	0.0710
T_6	93.32	4.11	36.24	0.0834
T_7	99.20	4.14	35.91	0.0800
T_8	88.10	4.31	34.27	0.0741
T_9	90.67	3.78	34.97	0.0799
T_{10}	93.58	3.93	36.34	0.0739
SEm±	2.78	0.27	1.34	0.006
CD at 5%	8.33	0.81	4.00	0.018
CV%	5.13	12.13	6.50	13.435

Table 2: Effect of organic and inorganic source of nitrogen on yield attributing parameters

Treatment	Number of panicles plant^{-1}	Length of panicles (cm)	Number of filled grains panicle^{-1}	Test weight (g)
T_1	1.78	19.87	97.45	20.68
T_2	3.72	22.35	101.67	21.10
T_3	4.30	22.42	98.75	21.05
T_4	4.54	23.88	102.71	21.15
T_5	3.60	21.82	100.37	20.77
T_6	3.44	20.94	100.67	21.56
T_7	3.56	22.24	101.67	21.14
T_8	2.80	21.67	101.33	21.53
T_9	2.97	21.71	100.53	21.36
T_{10}	3.20	21.90	98.73	21.25
SEm±	0.26	0.64	3.08	0.68
CD at 5%	0.77	1.93	9.16	NS
CV%	13.19	5.10	5.27	5.59

Table 3: Effect of organic and inorganic source of nitrogen on grain and straw yield and harvest index

Treatment	Grain Yield (q ha^{-1})	Straw Yield (q ha^{-1})	Harvest Index (%)
T_1	17.93	23.76	43.20
T_2	39.91	52.08	43.37
T_3	44.69	58.13	43.49
T_4	49.31	63.23	43.80
T_5	36.94	47.94	43.56
T_6	37.19	50.30	42.50
T_7	38.22	50.39	43.02
T_8	30.48	40.02	43.20
T_9	31.87	41.52	43.49
T_{10}	33.48	42.22	44.26
SEm±	2.29	2.91	0.64
CD at 5%	6.87	8.71	NS
CV%	11.03	10.73	2.57

Conclusion

Based on the results of the one-year trial, it is revealed that application of T_4: 100 kg N (through urea): 50:30 kg PK ha^{-1} found to be effective for maximum growth parameters, yield attributes, grain yield (49.31kgha^{-1}) and straw yield (63.23 kg ha^{-1}) of rice crop.

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