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Effect of Integrated nutrient management practices on productivity and profitability of Rice (*Oryza sativa* L.)

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Abstract
A field experiment was conducted during kharif season of 2018 at Genetics and Plant Breeding Research Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya. to study the effect of integrated nutrient management practices on rice productivity and profitability. The experiment was laid out in randomized block design with 8 treatments with 3 replications. Among the INM treatments, 100% RDF alone was found to be most profitable in terms of productivity, and profitability. The crop receiving 100% RDF alone recorded the maximum plants height (110.30 cm), no. of tillers (481.00 m^{-2}), dry matter accumulation (573.96 g m^{-2}), effective tillers (14.60), grain per panicle (120.0) Panicle no. (391.00 m^{-2}), test weight. (23.90 g) grain yield (41.26 q ha^{-1}), straw yield (54.40 q ha^{-1}) harvest index (43.13%) and produced maximum net return (Rs. 32444) with higher B:C ratio (0.72).

Keywords: Fertilizer, organic manure, net return, B:C ratio

Introduction
Rice (*Oryza sativa* L.) is one of the most important food grain crops of more than 60 percent of the world's population. About 90 per cent of all rice grown in the world is produced and consumed in the Asian region. India ranks first in area with second in production of rice after China. In India, it is grown over an area of 43.79 million hectares having production of 112.91 million tonnes and average productivity of 2578 kg/ha. Rice contributes 43% of total food grain production and 46% of the total cereal production of the country. The wide scale adoption of rice-wheat system has ushered in an increase in agricultural production, but this intensive system over a period of time and nature of the crops has set declining yield trends as well as deterioration in soil productivity even with optimum use of fertilizers. Hence, for restoration of soil productivity, there is an urgent need to look forward to other options like crop residues incorporation for supplying plant nutrients. The adverse effect of incorporation of rice and wheat straw can be counteracted by integrating organic with crop residues (Singh *et al.* 2004 and Laxminarayana *et al.* 2011) [7]. INM approach is flexible and minimizes use of chemicals but maximize use efficiency and improve the soil health. Change in cropping sequence with respect to availability of resources, the integrated approach of nutrient supply through inorganic and organic has become very much promising in building soil health and quality of produce. Using judicious combination of chemical and organics for achieving enhanced and sustainable production by adopting integrated nutrient supply is imperative (Kumar *et al.* 2012) [5, 6]. Integrated use of inorganic fertilizers, organic manures, green manures and crop residue are the only alternatives which may help in improving soil health and sustained productivity. Use of organic manures, green manures, crop residues along with inorganic fertilizers not only reduces the demand of inorganic fertilizers but also increases the efficiency of applied nutrients due to their favourable effect on physical, chemical and biological properties of soil (Pandey *et al.* 2007) [8], as organic manure provide a good substrates for the growth of microorganism and maintain a favourable nutrient supply to crop and achieve sustainable crop production. Keeping the above facts in view, the present investigation was to evaluate the effect of integrated nutrient management practices on rice productivity and profitability.

Materials and Methods

A field experiment was conducted to evaluate the effect of integrated nutrient management on rice productivity and profitability during kharif season of 2018 at Genetics and Plant Breeding Research Farm of Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya. The experimental soil having silty loam in texture pH (1:2.5) 9.0, electrical conductivity (EC) 0.96 dS m-1, organic carbon 0.23%, available N 115.40 kgha^{-1}, P 15.60 kgha^{-1} and K 240.0 kg ha^{-1}. All treatments were randomly allocated and replicated three times in a randomized block design was adopted for the experimentation. The experiment was comprised with eight treatments *viz.* T_1 –Control, T_2 - RDF(150:60:60 kg ha^{-1} N:P_2O_5:K_2O), T_3 -75% RDF+25%N substitution through press mud, T_4 -75%RDF+25%N substitution through GM (Dhaincha), T_5 -75%RDF+25% N substitution through crop residues, T_6 -50%RDF+50% N substitution through press mud, T_7 - 50%RDF+50% N substitution through GM (Dhaincha), T_8 -50%RDF+50% N substitution through crop residues. The recommended dose of NPK was applied through urea, DAP and muriate of potash, respectively. The rice variety Sarju-52 was taken as a test crop. To assess the various treatment effects, Plants from 1 m row length were uprooted from sample rows of each plot at 30, 60 days after transplanting (DAT) and at harvest. After removal of root portion, the samples were first air dried for some days and finally dried in an electric oven at 70 °C and recorded the dry matter yield. Total grains were counted from the same threshed panicles used for counting spikelets per panicle. 1000-grains were counted from the grain samples drawn from each net plot grain yield. The weight of these counted grains was recorded as test weight. Threshed grains were separated out manually and grains were sun dried to moisture of 14% before recording their weight. Straw yield was recorded by subtracting the weight of grains from the weight of each net plot. Harvest index of each plot was calculated with the help of following formula:

$$\text{Harvest index (\%)} = \frac{\text{grain yield(q/ ha)}}{\text{total biological yield}(\frac{\text{q}}{\text{ha}})} \times 100$$

The data recorded on various parameters were subjected to statistical analysis following analysis of variance technique and were tested at 5% level of significance to interpret the significant differences.

Growth attributes

Various sources of organic manure and inorganic fertilizers influenced positively the growth and yield of paddy. The crop receiving higher amount of nutrients through organic or inorganic sources recorded higher growth and yield. Data depicted in the Table-1 that among the nutrient management practices, the crop receiving (T_2) 100% RDF recorded the taller plants, maximum no. of tillers, dry matter accumulation at 30, 60 DAT and at harvest which is closely followed by (T_4) 75% RDF+25% N through Dhaincha. The lowest growth attributes found in control. These results were in agreement with the findings of Sharma *et al.* (2014) [12]. Babu *et al.* (2001) [1, 10] who found that increase in plant height is a function of cell expansion and depend upon nitrogen availability. Higher number of tillers might be due to more availability of nitrogen which plays a vital role in cell division. Organic sources after more balanced nutrition to the plants especially micronutrients which positively affect number of tillers in plants (Shrivastava and Singh, 2017) [14]. Kumar *et al.* (2012) [5, 6] and Sultana *et al.* (2015) [15] also reported that production of more number of tillers and number of panicle m^{-2} due to higher amount of chemical fertilizer established in treatment T_2 (100% RDF).

Yield and yield attributes

The scrutiny of data (Table-2) of yield attributes clearly reveals that there was a significant impact of INM practices on yield attributing characters like number of panicles m^{-2}, number of grains panicle^{-1} however the 1000- grains weight (g) was not affected significantly. The crop transplanted with T_2 (100% RDF) recorded the significantly highest number of panicles m^{-2}, number of grains panicle^{-1} which might be due to chemical fertilizers while provide readily available plant nutrients to crop. Almost all yield attributes were at par with treatment T_4 (75% RDF+25% N through Dhaincha). This might be due to improvement in nutrient supply with more organics, which improve soil physico-chemical and biological properties by providing essential food to microbes (Thulasi *et al.* 2016). Organics also increase the activity of soil enzymes responsible for conversion of unavailable form of nutrients to available form Singh *et al.* (2006) [13]. Similar results were also reported by Kumar *et al.* (2003), Kharub (2010), Sultana *et al.* (2015) [15] and Gupta and Sharma (2006) [3].

Twenty five per cent integration of N through organic manure with 75% inorganic was found better than 50% integration of N through organics + 50% RDF through inorganic. It might be because higher availability of nutrient NPK in 75% RDF + 25% RDN integration through organic manure. These results could be corroborated with the findings of Zaidi *et al.* (2006), Gupta and Sharma (2006) [3]. The favourable effect of INM through inorganic fertilizer and organic manure on higher crop growth and yield was also reported by Kumar (2008). These results were obtained by Mandal *et al.* (2005), Shrivastava and Singh (2017) [14] and Sultana *et al.* (2015) [15].

The maximum grain (41.26 q ha^{-1}) and straw (54.40 q ha^{-1}) yields were recorded with the treatments T_2 (100% RDF), followed by T_4 (75% RDF + 25% N through Dhaincha) (40.15 q ha^{-1} and 53.28 q ha^{-1}), respectively. The minimum grain and straw yields were recorded in control (17.50 q ha^{-1} and 26.40 q ha^{-1} respectively) during the investigation. The grain yield is cumulative effect of different growth and yield contributing characters as well as higher uptake of nutrients by the crop. These results corroborate with the finding of Prakasha *et al.* (2010) [9].

The maximum harvest index was recorded with the treatment T_2 (100% RDF) (43.13%) and the minimum with control (39.85%). The effect of different nutrient management on harvest index was found non-significant. These result corroborated with the findings of Sarkar *et al.* (2014) [11], Kumar *et al.* (2011, 2012) [5, 6] and Singh *et al.* (2011).

Economics

Data (Table-3) clearly shows that the variation in cost of cultivation was recorded due to variation in cost of nutrients either through fertilizers or organic manures (Press mud, Crop residue and Dhaincha as green manure), as well. Further, grain and straw yield were the major factors which caused differences in gross income and net return per rupee invested, respectively. The highest cost of cultivation of Rs. 56612.00 ha^{-1} was incurred in T_8 (50% RDF + 50% N through crop residue), might be due to higher cost of crop residue and fertilizers. The highest net income of Rs. 32444.00 ha^{-1} was noted under T_2 (100% RDF) might be due to the highest grain yield of rice. The highest net income per rupee investment i.e.

Re. 0.72 was associated with T_2 (100% RDF) followed by T_4 (75% RDF + 25% N through Dhaincha) which recorded net income per rupee investment of Re. 0.64. This might be because of comparatively higher cost of cultivation under integration of organic and inorganic fertilizers. These results corroborated with the findings of Zayed *et al.* (2013) [16], Kumar *et al.* (2007), Khan *et al.* (2009) [4], Chaudhary *et al.* (2011) [2] and Shrivastava and Singh (2017) [14].

Table 1: Effect of integrated nutrient management practices on growth attributes of Rice.

Treatments		Plant height (cm)			No. of Tillers			Dry matter (g m^{-2})	
		30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest	30 DAT	60 DAT
T_1	Control	33.85	70.80	88.50	168.00	230.00	251.00	201.35	263.40
T_2	100% RDF (150:60:60)N:P_2O_5:K_2O	38.80	88.24	110.30	198.00	410.00	510.00	234.52	573.96
T_3	75% RDF + 25% N through press mud	36.34	83.36	104.20	188.00	380.00	481.00	227.28	475.26
T_4	75% RDF + 25% N through green manure (Dhaincha)	38.50	87.52	109.40	191.00	383.00	486.00	230.12	560.58
T_5	75% RDF + 25% N through crop residue(Oat)	35.46	82.16	102.70	186.00	375.00	478.00	225.83	462.54
T_6	50% RDF + 50% N through press mud	37.12	83.68	104.60	179.00	355.00	430.00	219.62	457.62
T_7	50% RDF + 50% N through green manure (Dhaincha)	37.85	84.96	106.20	182.00	358.00	435.00	221.64	475.68
T_8	50% RDF + 50% N through crop residue (Oat)	34.97	81.44	101.80	175.00	352.00	426.00	216.93	441.12
	S.Em±	1.833	3.115	3.240	6.873	13.484	17.104	11.028	21.573
	CD at 5%	NS	9.448	9.827	20.846	40.899	51.879	NS	65.434

Table 2: Effect of integrated nutrient management practices on Yield and Yields attributes of Rice.

Treatments		Yields attributes			Yield		
		Panicles (m^{-2})	Grain/panicle	Test weight (g)	Grain yield(q/ha)	Straw yield(q/ha)	Harvest index (%)
T_1	Control	195.00	92.00	23.10	17.50	26.40	39.85
T_2	100% RDF (150:60:60)N:P_2O_5:K_2O	391.00	120.00	23.90	41.26	54.40	43.13
T_3	75% RDF + 25% N through press mud	368.00	114.00	23.60	33.60	45.61	42.42
T_4	75% RDF + 25% N through green manure(Dhaincha)	372.00	117.00	23.70	40.15	53.28	42.97
T_5	75% RDF + 25% N through crop residue(Oat)	366.00	111.00	23.40	31.80	45.29	41.25
T_6	50% RDF + 50% N through press mud	329.00	105.00	23.30	31.40	44.87	41.17
T_7	50% RDF + 50% N through green manure (Dhaincha)	333.00	107.00	23.35	32.90	46.38	41.50
T_8	50% RDF + 50% N through crop residue (Oat)	326.00	103.00	23.25	29.86	43.66	40.61
	S.Em±	13.686	5.365	0.790	1.480	2.032	1.420
	CD at 5%	41.513	16.272	NS	4.489	6.165	NS

Table 3: Effect of integrated nutrient management practices on Economics.

Treatments		Cost of Cultivation (Rs.)	Gross return (Rs.)	Net return (Rs.)	B:C Ratio
T_1	Control	37366	33725	-3641	-0.09
T_2	100% RDF (150:60:60)N:P_2O_5:K_2O	45109	77553	32444	0.72
T_3	75% RDF + 25% N through press mud	47797	63483	15686	0.33
T_4	75% RDF + 25% N through green manure(Dhaincha)	46172	75553	29381	0.64
T_5	75% RDF + 25% N through crop residue(Oat)	50859	60613	9754	0.19
T_6	50% RDF + 50% N through press mud	50488	59888	9400	0.19
T_7	50% RDF + 50% N through green manure (Dhaincha)	47237	62590	15353	0.32
T_8	50% RDF + 50% N through crop residue (Oat)	56612	57198	586	0.01

Conclusion

It can be concluded that application of 100% RDF alone recorded taller plants height, maximum no. of tillers, dry matter accumulation, higher effective tillers, grain weight per panicle panicle no., test wt. grain yield, straw yield, harvest index considered to be most effective for sustainable rice production and profitability over other treatments and may be opted for getting higher benefit: cost ratio.

References

1. Babu S, Marimuthu R, Manivannan V, Kumar RS. Effect of organic and inorganic manures on growth and yield of rice. Agricultural Science Digest 2001;21(4):232-234.
2. Chaudhary SK, Singh JP, Jha S. Effect of Integrated Nitrogen Management on yield, quality and nutrient uptake of rice (*Oryza sativa*) under different dates of planting. Indian Journal of Agronomy 2011;56(3):228-231.
3. Gupta V, Sharma RS, Vishvakarma SK. Long-term effect of Integrated Nutrient Management on yield sustainability and soil fertility of rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system. Indian Journal of Agronomy 2006;51(2):160-164.
4. Khan WA, Sarangi SK, Pandey N, Mishra VN, Lakhera ML, Sarangi AK. Effect of INM on yield and quality of rice variety. Abstract of I.G.K.V. Thesis 2009, 24-25.
5. Kumar Mukesh, Yaduvanshi NPS, Singh YV. Effects of Integrated Nutrient Management on rice yield, nutrient uptake and soil fertility status in reclaimed sodic soils. Journal of the Indian Society of Soil Science 2012;60(2):132-137.
6. Kumar A, Meena RN, Yadav L, Gilotia YK. Effect of organic and inorganic source of nutrient on yield, yield attributes and nutrient uptake of rice CV. PRH-10. Journal of life Science 2012;9(2):595-597.
7. Laxminarayana K, Susan JK, Ravindran CS, Naskar SK. Effect of lime, inorganic, and organic sources on soil fertility, yield, quality, and nutrient uptake of sweet potato in Alfisols. Communications in Soil Science and Plant Analysis 2011;42(3):2515-2525.

8. Pandey N, Verma AK, Anurag, Tripathi RS. Integrated Nutrient Management in transplanted hybrid rice (*Oryza sativa* L.). Journal of Agronomy 2007;52(1):40-42.
9. Prakasha HC, Sunitha BP, Gurumurthy K. Effect of INM approach on productivity and economics of rice cultivation (*Oryza sativa* L.) in Bhadra Command, Karnataka, in relation to soil properties. Mysore Journal of Agricultural Sciences 2010;44(4):786.
10. Babu S, Marimuthu R, Manivannan V, Kumar RS. Effect of organic and inorganic manures on growth and yield of rice. Agricultural Science Digest 2001;21(4):232-234.
11. Sarkar S, Singh SR, Singh RP. The effect of organic and inorganic fertilizers on soil physical condition and the productivity of a rice-lentil cropping sequence in India. Journal of Agricultural Science 2014;40(4):419-425.
12. Sharma Upinder, Subehia SK. Effect of Long-Term Integrated Nutrient Management on Rice (*Oryza sativa* L.) - Wheat (*Triticum aestivum* L.) productivity and soil properties in North-Western Himalaya. Journal of the Indian Society of Soil Science 2014;62(3):248-254.792.
13. Singh S, Singh RN, Prasad J, Singh BP. Effect of Integrated Nutrient Management on yield and uptake of nutrients by rice and soil fertility in rainfed uplands. Journal of the Indian Society of Soil Science 2006;54(3):327-330.
14. Srivastava AK, Singh AK. Growth, yield and nutrient uptake of hybrid rice as influenced by nutrient management modules and its impact on economics of the treatments. Journal of Applied and Natural Science 2017;9(4):2414-2420.
15. Sultana MS, Paul AK, Rahman MH, Kaium A, Shahriar S, Bari ASMF, *et al*. Influence of integrated use of vermicompost, pressmud and urea on the growth and yield of hybrid dhan Hira-2. Scholarly Journal of Agricultural Sciences 2015;5(3):95-102.
16. Zayed BA, Elkhoby WM, Saleem AK, Ceesay M. Effect of integrated nitrogen fertilizer on rice productivity and soil fertility under saline soil conditions. Journal of Plant Biology Research 2013;2(1):14-24.