The Pharma Innovation Journal 2022; 11(8): 1370-1373

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(8): 1370-1373

www.thepharmajournal.com
Received: 21-05-2022
Accepted: 25-06-2022

Effect of integrated nutrient management on growth, yield and economics of direct seeded rice (*Oryza sativa* L.) under midland situations

Anjali Dongre, Narendra Kumar, AK Thakur, PK Salam, T Chandrakar and DP Singh

Anjali Dongre
Department of Agronomy, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

Narendra Kumar
Department of Agronomy, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

AK Thakur
Department of Agronomy, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

PK Salam
Department of Agronomy, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

T Chandrakar
Department of Soil Science and Agriculture Chemistry, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

DP Singh
Department of Agriculture Statistics & Social Science, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

Corresponding Author:
Anjali Dongre
Department of Agronomy, S.G. College of Agriculture and Research Station, Jagdalpur, I.G.K.V., Chhattisgarh, India

Abstract
An experiment was carried out during *Kharif* season of 2021 at the Instructional cum Research Farm, S. G. College of Agriculture and Research Station, Jagdalpur, Chhattisgarh, India. 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 carried out in randomized block design (RBD) with three replication consisted of nine treatments. The result revealed that treatment T_5 (100% NPK + 5t FYM/ha + *Azospirillum* and PSB) recorded significantly greater growth parameters and yield attributing characters *viz.*, plant population, plant height, number of tillers, length of panicle, test weight, number of grains panicle^{-1}, grain yield, straw yield and maximum gross and net income among all the treatments. But the highest B: C ratio was noted in treatment T_1 (100% RDF) which was on par with treatment T_5 (100% NPK + 5t FYM/ha + *Azospirillum* and PSB).

Keywords: INM, DSR, bio-fertilizers, FYM

Introduction

Rice is the world's most important food crop, feeding millions of people every day. Rice is the main staple food for about 40% of the world's population. The majority of people who eat rice as their primary dietary source live in developing countries (Dunna and Roy, 2013) [9]. According to the ministry of agriculture second advance estimate, rice production in the *Kharif* season last crop year was anticipated to be 103.75 million tonnes, compared to the objective of 102.60 million tonnes (Anonymous, 2021) [2]. Rice production in India's northern state of Chhattisgarh reached above 6 million metric tonnes in financial year 2020 (Anonymous, 2022) [3]. Chhattisgarh State is popularly recognized as India's rice bowl, with rice accounting for more than 80% of total cultivated land. The majority of rice acreage is grown under the rain-fed rice situation. Dhamtari district has about 200 per cent cropping intensity among the 27 districts of Chhattisgarh State and the district's cropping pattern is Rice-Fallow. The district is ranked 11th in terms of area and 4th in terms of production in the state (Anonymous, 2013-14) [1].

Despite several limits, direct seeded rice culture is becoming an increasingly popular alternative to transplanting in India, and it is cultivated on approximately one-third of the country's total rice area. As transplanting is a time-consuming and expensive process, direct seeding is gaining popularity even in non-traditional rice growing areas. The introduction of early maturity cultivars, as well as the availability of selective herbicides, pushed many farmers to move from transplanting to direct seeding (Umashankar *et al.*, 2005) [30].

Integrated nutrient management of fertilizers and organic manures is thus one of the potential strategies for supporting soil health in relation to crop productivity (Bajpai *et al.*, 2006) [5]. These inorganic fertilizers give major plant nutrients; nevertheless, using a high dose of inorganic fertilizers is not a good management approach since it produces various difficulties such as reduced productivity, poor water quality, soil degradation, and so on. As a result, different plant nutrient sources can be utilized to keep our land healthy and agricultural output alive. As a result, more emphasis is being placed on the usage of nitrogenous fertilizers in conjunction with bio-inoculants such as *Azotobacter*, *Azospirillum*, and others (Rawat and Agrawal, 2010) [19]. Phosphorus solubilizing bacteria (PSB) has recently developed as an efficient component in the esuriently production system (Raki *et al.*, 2019) [18]. The green revolution has caused major environmental challenges.

Farmers are increasingly complaining about soil fertility, soil salinity and alkalinity, and ground water pollution, which may be attributed to improper fertilizer application (Sharma, 1993) [22]. In conclusion, if farmers implement integrated nutrient management correctly, it has significant benefits. Several researches have shown that INM has an effect on weed control, disease resistance, increased economic yield, and soil fertility improvement in paddy (Bhanuwati and Vaidya P., 2020) [7].

Material and Methods

The experiment was carried out during *Kharif* season of 2021 at the Instructional cum Research Farm, Shaheed Gundadhoor College of Agriculture and Research Station, Kumhrawand, Jagdalpur, 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 carried out in randomized block design (RBD) with three replication consisted of nine treatments *i.e.*, T_1: 100% RDF, T_2: 75% RDF, T_3: 50% RDF, T_4: 25% RDF, T_5: 100% NPK + 5t FYM/ha + *Azospirillum* and PSB, T_6: 75% NPK + 5t FYM/ha + *Azospirillum* and PSB, T_7: 50% NPK + 5t FYM/ha + *Azospirillum* and PSB, T_8: 25% NPK + 5t FYM/ha + *Azospirillum* and PSB, T_9: Control. The recommended dose of fertilizer was 120:60:40 kg N: 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. *Azosprillum* and PSB were applied with FYM as basal dose. 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) [11].

Result and Discussion

Table 1 reveals that the growth, yield and yield attributes like plant population, plant height, number of tillers $hill^{-1}$, panicle length, total number of grains $panicle^{-1,}$ and yield were significantly influenced by different integrated nutrient management treatments. Effect of different integrated nutrient management had not significantly influenced the plant population and test weight but statistically T_5 recorded maximum plant population and test weight, while minimum was recorded in control. The plant height recorded significantly highest in treatment T_5 among all the treatment which was found on par with treatment T_1, T_6, T_2, T_3 and T_7 while the lowest plant height was found in control. This could be due to the increased solubility and quicker release of nitrogen by chemical fertilizer and organic manure, allowing direct seeded rice to utilize a better quantity of nutrients. On the other hand significantly increased plant height may be due to increased availability and consistent release of nutrients from organic sources, which helps to improve plant height (Shaikh *et al*., 2017) [21]. This could be attributed to the fast release of nutrients from the inorganic source in combination with the organic supply, resulting in better vegetative development (Siddaram *et al*., 2010) [23]. The effect of different integrated nutrient management had significant effect on number of tillers $hill^{-1}$. Treatment T_5 recorded significantly maximum number of tillers at all the growth stages but it was found at par with treatment T_1 at all the growth stages. The increased number of tillers could be attributed to increased nutrient availability, which favored the development of increased number of tillers (Harijan, 2019) [12]. The slower release of nutrients from organic sources during later stages of crop growth resulted in an increased number of tillers at harvest (Babu and Reddy, 2000) [4]. The number of tillers improved as the nitrogen supply increased (Basha *et al*., 2016) [6].

Yield and Yield Attributes

Effect of different integrated nutrient treatment is presented in Table 2. Different integrated nutrient management had the significant effect on length of panicle. The data significantly reveals that treatment T_5 recorded significantly higher length but it was found at par with treatment T_1, T_2, T_6 and T_7. While, minimum length of panicle was recorded in control. Panicle length was primarily attributed to improved photosynthate partitioning and assimilation, as seen by increased dry matter synthesis and translocation to the crop (Singh *et al*., 2013) [25]. Treatment T_5 recorded the maximum number of filled grains $panicle^{-1}$ as well as total number of grains $panicle^{-1}$ and minimum number of filled grains and total number of grains $panicle^{-1}$ was found in control but it had statistically non-significant effect on number of chaffy grains $panicle^{-1}$. This could be as a result of less nutrient loss through leaching and more photosynthates being available for improved grain filling (Reddy 2006 and Siddaram *et al.*, 2010) [20, 23]. It could be because organic manures, in addition to macro- and micronutrients, also have a solubilizing effect on native soil nutrients due to the action of organic acids formed during decomposition ((Pandey *et al*., 2007; Tripathi and Verma 2008 and Chaudhary *et al*., 2011) [17, 29, 8]. The different integrated nutrient management did not influence test weight significantly but numerically maximum weight of 1000 seeds observed in treatment $T_{5,}$ while the minimum weight was recorded in control. It may be due to the genetic makeup of the plant has a greater influence on test weight of individual grain than other environmental factors (Singh *et al*., 2012) [24].

The grain yield, straw yield and harvest index are presented in Table 3. Treatment T_5 recorded significantly higher grain yield which was found at par with treatment T_1. However, lowest yield was recorded in control. The early stages of crop growth have been promoted by the nitrogen available in urea (Zaidi *et al*., 2016) [32]. The increase in grain yield with the INM treatment could be attributed to better nutrient supply with more organics, which improved soil physico-chemical and biological aspects by giving microbes vital nutrients (Subha *et al*., 2004) [28]. Straw yield was recorded significantly higher in treatment T_5 among all the treatments but it was on par with treatment T_1 and the lowest straw yield was recorded in control. The gain in straw yield and yield attributes under higher nutrient levels could be attributed to enhanced nutrient absorption and photosynthetic activity, resulting in more biomass build up. The improved yield features can be attributed to the soil's adequate and consistent nitrogen supply capacity and nutrient translocation to the sink (Subehia and Sepehya, 2012; Gautam *et al*., 2013 and Mahmud *et al*., 2016) [27, 10, 15]. The effect of integrated nutrient management on the harvest index was recorded significant effect on treatment T_7 but it was found at par with treatment T_1, T_2, T_3, T_4, T_5, T_6 and T_8. While, the lowest harvest index was recorded in control. The higher harvest index was recorded as a result of higher rice grain yield per unit biological yield, which resulted in a higher harvest index (Stoop *et al*., 2005 and Hussain *et al*., 2003) [26].

Economics: The economics of integrated nutrient management on direct seeded rice are presented in Table 4 shows that treatment T_5 recorded significantly maximum total cost of cultivation (43288 Rs ha^{-1}) among all the treatments followed by T_6 (42185 Rs ha^{-1}) and T_7 (41082 Rs ha^{-1}). The lowest cost of cultivation was in control (31400 Rs ha^{-1}).

The highest gross income was found in treatment T_5 (102326 Rs ha^{-1}) among all the treatments followed by treatment T_1 (94533 Rs ha^{-1}) and treatment T_6 (82695 Rs ha^{-1}) whereas, the lowest gross income (32527 Rs ha^{-1}) was found in control. This was primarily due to increased grain and straw yields (Verma *et al*., 2017) [31]. The highest net return recorded in treatment T_5 (59205 Rs ha^{-1}) among all the treatments followed by treatment T_1 (57720 Rs ha^{-1}) and treatment T_6 (40510 Rs ha^{-1}). While, the lowest net income (1127 Rs ha^{-1}) was found in control. This could be attributed to a 25% nitrogen savings (25 kg N ha^{-1}) in the form of fertilizer combined with the cheapest source of organic manure (Nawlakhe and Jiotode, 2008) [16]. The maximum B: C ratio was calculated in treatment T_1 (2.57) followed by treatment T_5 (2.37) while the minimum B: C ratio was observed in control (1.04). This can be as a result of reduced cultivation costs (Koushal *et al*. 2011) [14]. This can also be due to improved yield and lower cultivation costs (Pandey *et al*. 2007) [17].

Table 1: Effect of different integrated nutrient management on growth of direct seeded rice

Treatments	Plant population (m^2)	Plant height (cm)	No. of tillers hill^{-1}
T1	48.04	118.25	12.47
T2	47.27	116.33	9.11
T3	46.22	114.10	7.97
T4	45.08	105.12	7.29
T5	48.85	121.76	13.22
T6	47.78	117.08	9.39
T7	46.89	111.73	9.51
T8	46.00	109.10	8.88
T9	44.52	98.93	5.11
S.Em±	1.53	4.01	0.29
CD at 5%	NS	12.12	0.88
CV%	5.68	6.17	5.50

Table 2: Effect of different integrated nutrient management on yield attributes of direct seeded rice

Treatments	Panicle length (cm)	Test weight (g)	Number. of filled grains Panicle^{-1}	Number. of chaffy grains Panicle^{-1}	Number of total grains panicle^{-1}
T1	27.28	28.73	177.66	22.67	200.33
T2	25.77	28.63	175.89	23.56	199.45
T3	24.79	28.59	182.00	25.22	207.22
T4	23.89	28.55	145.45	25.89	171.34
T5	28.50	28.75	229.44	23.33	253.11
T6	26.12	28.64	141.45	21.78	163.22
T7	25.35	28.61	197.78	22.00	219.78
T8	24.33	28.52	164.00	22.45	186.45
T9	21.30	28.48	99.89	20.78	120.67
S.Em±	1.11	0.18	6.96	1.74	7.55
CD at 5%	3.36	NS	21.06	NS	22.84
CV%	7.63	1.12	7.17	13.05	6.84

Table 3: Effect of integrated nutrient management on grain and straw yield, and harvest index of direct seeded rice

Treatments	Grains yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest Index (%)
T1	46.97	68.10	40.76
T2	33.13	47.37	41.13
T3	28.90	42.99	40.18
T4	24.65	35.98	40.62
T5	50.95	73.00	41.13
T6	41.07	60.26	40.55
T7	32.41	45.37	41.62
T8	25.61	39.95	39.02
T9	15.97	30.77	34.38
S.Em±	1.65	1.85	1.18
CD at 5%	5.00	5.61	3.58
CV	8.60	6.51	5.13

Table 4: Effect of integrated nutrient management on economics of direct seeded rice

Treatments	Cost of cultivation (Rs ha^{-1})	Gross income (Rs ha^{-1})	Net income (Rs ha^{-1})	B:C ratio (%)
T1	36813	94533	57720	2.57
T2	35710	66634	30925	1.87
T3	34607	58209	23602	1.68
T4	33504	49620	16116	1.48
T5	43288	102326	59205	2.37
T6	42185	82695	40510	1.96
T7	41082	65137	24055	1.59
T8	39979	51675	11696	1.29
T9	31400	32527	1127	1.04
S.Em±	-	-	-	0.08
CD at 5%	-	-	-	0.25
CV%	-	-	-	8.27

Conclusion

Based on the results of the one-year trial, it is concluded that treatment T_5 (100% NPK + 5t FYM/ha + *Azospirillum* and PSB) was found most effective treatment for all the crop growth parameters and yield attributes of rice crop. But treatment T_1 (100% RDF) was found most economical due to higher B: C ratio among all the treatments.

References

1. Anonymous. Economic Survey of Chhattisgarh. Ministry of Agriculture government of India, 2013-14
2. Anonymous. The Hindu, 2021. Retrieved from https://www.thehindu.com/business/agri-business/govt-sets-record-1043-million-tonne-rice-production- target-for-2021-22-kharif-season/article34449163.ece.
3. Anonymous. Volume of rice production in Chhattisgarh FY 2009-2020. Statista Research Department, 2022. Retrieved from https://www.statista.com/statistics/1019621/india-rice-production-volume-in-chhattisgarh.
4. Babu RBT, Reddy VC. Effect of nutrient sources on growth and yield of direct seeded rice (*Oryza sativa* L.). Crop Res. 2000;19(2):189-193.
5. Bajpai RK, Chitale S, Upadhyay SK, Urkurkar JS. Long-term studies on soil physico-chemical properties and productivity of rice - wheat system as influenced by integrated nutrient management in Inceptisols of Chhattisgarh. Journal of the Indian Society of Soil Science. 2006;54(1):24-29.

6. Basha, Jaffer S, Basavarajappa R, Babalad HB. Influence of organic and inorganic nutrient management practices on yield, economics and quality parameters of aerobic rice. Crop Res. 2016;17(2):178-187.
7. Bhanuwati, Vaidya P. A Review on Effect of Integrated Nutrient Management on Paddy. Int. J Curr. Microbiol. App. Sci. 2020;9(10):1160-1166.
8. 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.
9. Dunna V, Roy B. Rice (*Oryza sativa* L.). Breeding, Biotechnology and Seed Production of Field Crops. 2013;4:71-122.
10. Gautam P, Sharma GD, Rachana R, Lal B. Effect of integrated nutrient management and spacing on growth parameters, nutrient content and productivity of rice under system of rice intensification. International Journal of Research in Bio Sciences. 2013;2(3):53-59.
11. Gomez KA, Gomez AA. Statistical procedures for agricultural research. A Willey- Inter Sci. Publication. John Willey & Sons, New York, 1984.
12. Harijan HS. Effect of integrated nutrient management in direct seeded rice (*Oryza sativa* L.) in southern transitional zone of Karnataka. Thesis submitted to the University of Agricultural and Horticultural Sciences, Shivamogga, 2019.
13. Husain MM, Haque MA, Khan MAI, Rashid MM, Islam MF. Direct wet-seeded method of establishment of rice under irrigated condition. The Agriculturists. 2003;1(1):106-113.
14. Koushal S, Sharma AK, Singh A. Yield performance, economics and soil fertility through direct and residual effects of organic and inorganic sources of nitrogen as substitute to chemical fertilizer in rice-wheat cropping system. Res. J Agril. Sci. 2011;43(3):189-193.
15. Mahmud AJ, Shamsuddoha ATM, Nazmul HM. Effect of Organic and Inorganic Fertilizer on the Growth and Yield of Rice (*Oryza sativa* L.). Nature and Science. 2016;14(2):45-54.
16. Nawlakhe M, Jiotode DJ. Integrated nutrient management in transplanted rice (*Oryza sativa* L.). Res. Crops. 2008;9(2):209-211.
17. Pandey N, Verma AK, Anurag, Tripathi RS. Integrated nutrient management in transplanted hybrid rice (*Oryza sativa* L.). Indian Journal of Agronomy. 2007;52(1):40–42.
18. Raki, Tandon A, Kurre DK. Effect of integrated nutrient management practices on yield, nutrient content and uptake of aerobic rice. The Pharma Innovation Journal. 2019;8(1):211-213.
19. Rawat A, Agrawal SB. Effect of soil enrichment in conjuction with bio-organics and chemical fertilizers on yield and quality of rice. Research J Agril. Sci. 2010;35(4):190-192.
20. Reddy R. Agronomic investigations on integrated nutrient management in aerobic paddy (*Oryza sativa* L.). M.Sc. (Agri.) Thesis, UAS, Bengaluru, 2006.
21. Shaikh AA, Kulkarnik V, Alekya P. Effect of different organic manures on growth contributing characters in paddy. Contemporary Res. in India. 2017;7(3):28-32.
22. Sharma AK. Sources of Differences in Input Use: The Case of Fertilizer in India. Journal of Indian School of Political Economy. 1993;5(2):320-329.
23. Siddaram, Murali K, Manjunatha BN, Ramesha YM, Basavaraja MK, Patil AS. Effect of nitrogen levels through organic sources on growth, dry matter production and nutrient uptake of irrigated aerobic rice (*Oryza sativa* L.). Int. J Agril. Sci. 2010;6(2):426-429.
24. Singh YV, Singh KK, Sharma SK. Influence of Crop Nutrition and Rice Varieties under Two Systems of Cultivation on Grain Quality, Yield and Water Use. Rice Science, 2012, 19(4).
25. Singh YV, Singh KK, Sharma SK. Influence of crop nutrition on grain yield, seed quality and water productivity under two rice cultivation systems. Rice Sci. 2013;20(2):129-138.
26. Stoop WA, Uphoff N, Kassam A. A review of agriculture research issue raised by the system of rice intensification (SRI) from Madagascar: opportunities for improving farming system for resource-poor farmers. Agriculture system. 2005;71:249-274.
27. Subehia SK, Sepehya S. Influence of long term nitrogen substitution through organics on yield, uptake and available nutrients in a rice-wheat system in an acidic soil. Journal of the Indian Society of Soil Science. 2012;60(3):213-217.
28. Subha KM, Chandrasekharan B, Parasuraman P, Sivakumar SD, Rubapathi K, Chozhan K. Performance of scented rice variety basmati 370 under organic farming. Madras Agric. J. 2004;91(7-12):353-358.
29. Tripathi N, Verma RS. Assessment of grain quality attributes of basmati rice produced by organic system, Pantnagar Journal of research. 2008;6(2):192-195.
30. Umashankar R, Babu C, Kumar PS, Prakash R. Integrated nutrient management practices on growth and yield of direct seeded low land rice. Asian Journal of Plant Sciences. 2005;4(1):23-26.
31. Verma RK, Shivay YS, Ghasal PC. Effect of different cropping systems and nutrient sources on growth, productivity and economics of direct seeded basmati rice (*Oryza sativa*). Indian J Agril. Sci. 2017;87(10):1377-1383.
32. Zaidi SFA, Kumar S, Bharose R, Kumar R, Singh G, Verma KK. Effect of different nutrient resources on yield and quality of basmati/aromatic rice in Inceptisol of Eastern Uttar Pradesh, An Asian Journal of Soil Science. 2016;11(1):230-234.S