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Effect of different nutrient sources, their dose and mode of application on profitability of Rice (*Oryza sativa* L.)

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Abstract
A field experiment was conducted at Crop Research Center, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh in *Kharif* 2022 & 2023 with a view to compare the profitability through the application of nutrients through different sources, doses and mode of application in Rice. The experiment comprised of 12 treatments and 3 replications analysed in Randomised Block Design. Treatments comprised of T_1 (Control), T_2 (100% NPK), T_3 (100% NPK + Zn 5 kg ha^{-1}), T_4 (100% NPK + Bio stimulants), T_5 (75% NPK + Bio stimulants), T_6 (100% NPK + Nano Zn spray at 40 DAT), T_7 (100% NPK Consortia), T_8 (75% NPK + NPK Consortia), T_9 (75% NPK+ Nano N spray at 40 DAT), T_{10} (75% NPK+ Nano N spray at 40 DAT+ Nano Zn spray at 40 DAT), T_{11} (75% NPK+ NPK (18:18:18) 0.5% spray at 40 DAT +Bio-stimulants) and T_{12} (75% NPK+ Zn 5 kg ha^{-1} + Bio-stimulants + Nano N + Nano Zn spray at 40 DAT). Paddy variety Pusa Basmati 1637 was grown during both the years (2022 and 2023) of experimental study. Application of nutrients through different sources, doses and mode of appliication had significant influence on yield of rice during both the years of experimental study. Results revealed that signiicantly highest value of Gross returns (₹ ha^{-1}**)** were obtained in T_{12}. In case of Net returns maximum value was obtained in T_{12} and was found to be statistically at par with T_{11} and T_7. The highest B.C. Ratio was recorded in T_{12} which was at par with T_7.

Keywords: Profitabilty, nutrient sources, nutrient doses, mode of application

Introduction
Rice (*Oryza sativa* L.) belonging to Poaceae family, is the world's most important food crop, has been grown for more than 6000 years in South Asia. Currently, rice is the staple food for about four billion people i.e., half of the humankind on the planet. Rice fields cover around 166 million hectares in a wide range of climatic conditions spanning from 44° N in North Korea to 35° S in Australia. Since last two years the country has recorded the highest rice production of about 125 million tons with productivity of 4.11t ha^{-1} (USDA 2022). It is the staple food for more than two third of Indian population contributing more than 40% to the total food grain production, thereby, occupies a pivotal role in the food and livelihood security of people. In India, rice plays a major role in diet, economy, employment, culture and history. It is estimated that about 120 and 140 Mt of rice would be required by 2025 and 2050, respectively in India. In addition, India is exporting about 10 Mt of rice per year, which earns valuable foreign exchange for the country. There is a growing middle-class, rice-consuming population in domestic as well as international markets. This will increase the demand for high-quality rice creating great opportunities for India for exporting basmati and high-quality non-basmati rice. This increased production has to necessarily come from increased productivity rather than increase in area under rice and that too under deteriorating soil, water and other natural resources.
Rice farmers and Researchers are facing new challenges of climate change, low water availability, poor soil health, low nutrient use efficiency and increased emergence of insects and diseases. There is now growing concern that non-price factors such as declining scope for further gains from existing modern varieties, deteriorating soil and ground water supplies, and reduced public investment in research have contributed to poor productivity growth in recent years. The challenge is to integrate productivity and profitability improvement of rice while enhancing the climate resilience and quality of the environment on which production depends.

Therefore, balanced and integrated application of nano nutrients, biofertilizers, bio stimulants and inorganic fertilizers should be a key factor in order to achieve sustainability in productivity and profitabilty.

Materials and Methods

The experiment was carried out at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to study the effect of different nutrient sources, their dose and mode of application on profitability of Rice in Randomized Block Design with 12 treatments, replicated three times. The mean maximum temperature was noticed in June, which is the hottest month of the year, ranges from 31.1 ˚C to 43.1 ˚C and minimum temperature ranges from 16 ˚C to 26.5 ˚C. The mean annual rainfall is about 800 mm, of which nearly 80% is received in the monsoon period from July to September and the remaining in the period between Octobers to May. Mean relative humidity attains the maximum value (46.7 to 92.3%) during the monsoon season and the minimum (26.3 to 72.7%) during the summer months. The soil of the experimental field was sandy loam in texture, low in available nitrogen (222.7 kg ha^{-1}) and organic carbon (0.43%), medium in available phosphorous (12.8 kg ha^{-1}) and potassium (234.2 kg ha^{-1}) and slightly alkaline (pH 7.7) in reaction with electrical conductivity of 0.23 dS m^{-1}. The gross and net plot size were 5 m X 4 m and 4 m X 2.8 m respectively. The crop variety Pusa Basmati 1637(PB-1637) was sown on 10-06-2022 & 06-06-2022, transplanted on 05-07-2022 & 03-07-2023 and harvested on 31-10-2022 & 28-10-2023. The seed rate was 20 kg ha^{-1}. Pre-germinated seeds were used in nursery. Recommended practices were adopted for nursery raising. Seedling was transplanted manually in the rows with the help of nylon rope at 20 cm x 15 cm spacing. The fertilizers @ 120-60-40 kg, N-P_2O_5-K_2O ha^{-1}, were applied in experiment. Nitrogen was applied through urea & DAP, P_2O_5 from DAP and K_2O through MOP. One third dose of nitrogen (RDN) and full dose of P_2O_5, K_2O and $ZnSO_4$ as basal was applied at the time of transplanting. Rest half amount of nitrogen was applied in two equal split, 1/4th dose was top dressed at active tillering stage and remaining dose was applied at panicle initiation stage through urea. Zinc was applied @ 5 kg ha^{-1} in respective treatments in the form of $ZnSO_4$. The NPK (18:18:18) complex is a 100% water soluble fertilizer, containing 18% Nitrogen, 18% Phosphorus and 18% Potassium as its grade. It was sprayed @ 15 g $litre^{-1}$ in 500 litre as per the treatments. Nano N-@ 4 ml L^{-1} and Bio Nano Zinc @ 10 ml L^{-1} in 500 L water each were sprayed at 40 DAT as per treatments. NPK consortia was applied through root dipping of seedlings for 20-30 minutes @ 500 ml liquid biofertilizer in 4-5 litres of water. Biostimulant Sagarika (Seaweed fortified granules were applied @ 8-10 kg/acre at transplanting as per treatments. One hand weeding was done and 8 irrgiations were given at different intervals. At harvest, no of grains per panicle, test weight, grain yield and straw yield were calculated. Economics of treatments were computed on the basis of prevailing market price of inputs and outputs under each treatment. The total cost of cultivation of crop was calculated on the basis of different operations performed and materials used for raising the crop including the cost of fertilizers and seeds. The cost of labour incurred in performing different operation was also included. Statistical analysis of the data was done as per the standard analysis of variance technique for the experimental designs following SPSS software- based programme, and the treatment means were compared at $p<0.05$ level of probability using t-test and calculating CD values.

Results and Discussion

From the data presented in Table 1 it can be inferred that the application of nutrients through different sources, doses and mode of application had significant influence on yield of rice during both the years (2022 & 2023) of experimental study. The maximum value of grain yield (45.6 & 46.4 q ha^{-1}) was recorded in T_{12} (75% NPK+ Zn 5 kg ha^{-1} + Bio-stimulants + Nano N + Nano Zn spray at 40 DAT) which was significantly higher than rest of the treatments.

Table 1: Effect of different nutrient sources, their dose and mode of application on Yield (q ha^{-1}) of Rice during *Kharif* 2022 & 2023

Symbol	Treatments	Grain Yield (q ha^{-1})		Straw Yield (q ha^{-1})	
		2022	2023	2022	2023
T_1	Control	22.8	23.6	39.2	40.4
T_2	NPK (120:60:40 kg ha^{-1})	37.3	39.0	57.1	58.2
T_3	100% NPK + Zn 5 kg ha^{-1}	39.7	41.4	60.4	61.0
T_4	100% NPK + Bio stimulants	40.0	42.6	60.8	61.5
T_5	75% NPK+ Bio-stimulants	37.8	40.2	57.3	58.6
T_6	100% NPK + Nano Zn spray at 40 DAT	40.4	41.0	60.8	61.4
T_7	100% NPK + NPK Consortia	43.4	43.7	62.6	63.2
T_8	75% NPK+ NPK Consortia	40.9	41.2	59.3	60.0
T_9	75% NPK+ Nano N spray at 40 DAT	38.8	39.5	58.9	59.6
T_{10}	75% NPK+ Nano N spray at 40 DAT+ Nano Zn spray at 40 DAT	41.9	42.9	60.5	61.2
T_{11}	75% NPK+ NPK (18:18:18) 0.5% spray at 40 DAT +Bio-stimulants	42.7	43.9	60.7	61.4
T_{12}	75% NPK+ Zn 5 kg ha^{-1} + Bio-stimulants + Nano N + Nano Zn spray at 40 DAT	45.6	46.4	63.8	64.4
	SEm±	0.6	0.8	0.9	0.9
	CD (P= 0.05)	2.0	2.3	2.8	2.7

In case of straw yield, it was found that higher value (63.8 & 64.4 q ha^{-1}) was recorded in T_{12} (75% NPK+ Zn 5 kg ha^{-1} + Bio-stimulants + Nano N + Nano Zn spray at 40 DAT) and was statiscally at par with T_7 (100% NPK + NPK Consortia). The lowest value of grain yield (22.8 & 23.6 q ha^{-1}) and straw yield (39.2 & 40.4 q ha^{-1}) was obtained in T_1 (Control). The maximum grain yield was recorded due to the integrated application of various nutrient sources such as inorganic nutrients (75% NPK + Zn), Nano N & Nano Zn spray and Biostimulants through soil, foliar spray and Seedling treatment respectively. Because of the availability of nutrients from nutrients sources, especially during the early phases of crop growth, and the subsequent gradual and steady supply of nutrients by organic matter, the combination of different nutrients sources produces a better result. Also, the profound influence of combined application of both macro and micro essential nutrients led to achievement of higher straw

yield. These results are in conformity with the findings of Pramanick *et al.* 2014 [8], Singh *et al*, 2015, Modi *et al.*, 2022 [3], Meenakshi *et al.*, 2022, Sahu *et al.*, 2022 [6] and Sharma *et al.*, 2023. Nutrient management practices consisting of nutrients from different sources, doses and mode of application had significant influence on economics of rice. The highest value of gross returns were obtained in Gross returns (₹119456 & ₹133874 ha^{-1}**)** were obtained in T_{12}. Although.

Table 2: Effect of different nutrient sources, their dose and mode of application on Profitability of rice.

Symbol	Treatments	Cost of cultivation (₹ ha^{-1})		Gross returns (₹ ha^{-1})		Net returns (₹ ha^{-1})		B:C ratio	
		2022	2023	2022	2023	2022	2023	2022	2023
T_1	Control	44,688	45205	62882	72138	11564	19473	1.2	1.4
T_2	NPK (120:60:40 kg ha^{-1}	50,874	51931	99780	114322	47152	60485	2.0	2.3
T_3	100% NPK + Zn 5 kg ha^{-1}	51224	51741	106017	121051	53056	66989	2.2	2.4
T_4	100% NPK + Bio stimulants	51218	51735	106758	124130	53712	70421	2.2	2.4
T_5	75% NPK+ Bio-stimulants	48773	49634	100936	117324	49219	67594	2.1	2.4
T_6	100% NPK + Nano Zn spray at 40 DAT	51239	51756	107550	120478	54696	66085	2.2	2.4
T_7	100% NPK + NPK Consortia	52124	52641	114449	127313	62076	74065	2.5	2.6
T_8	75% NPK+ NPK Consortia	49679	50540	108065	120273	56008	67381	2.2	2.4
T_9	75% NPK+ Nano N spray at 40 DAT	49817	50678	103641	116168	50924	61930	2.1	2.3
T_{10}	75% NPK+ Nano N spray at 40 DAT+ Nano Zn spray at 40 DAT	50182	51043	110602	124652	58468	65406	2.3	2.4
T_{11}	75% NPK+ NPK (18:18:18) 0.5% spray at 40 DAT +Bio-stimulants	51513	52374	112268	127009	60354	68588	2.3	2.5
T_{12}	75% NPK+ Zn 5 kg ha^{-1} + Bio-stimulants + Nano N + Nano Zn spray at 40 DAT	50876	51737	119456	133874	67488	79484	2.6	2.7
	SEm±	-	-	1470	1992	2951	3737	0.04	0.06
	CD (P= 0.05)	-	-	4314	5845	8655	10962	0.12	0.18

highest value of Net returns was gained in T_{12} (₹ 67488 & 79484 ha^{-1}), it was also statistically at par with T_{11} and T_7. The highest B.C. Ratio was recorded in T_{12} (2.6 & 2.7) which was at par with T_7 (2.5 & 2.6). The lowest value of gross returns, net returns and B.C. Ratio were obtained in Control). The higher value of net returns and B.C ratio was mainly due to increment in grain yield. Also high net returns and BCR from T_7 might be due to the less cost of NPK consortia and comparitively better growth during the early stages of crop growth. Similar findings were reported by Mondal *et al.*, 2020 [1], Mote *et al*, 2022 [5], Meenakshi *et al*, 2022 and Sharma *et al.*, 2023 [2], Namasharma *et al.* 2023 [2].

Conclusion

From the above results it can be concluded that the application of 75% NPK+ Zn 5 kg ha^{-1} + Bio-stimulants + Nano N + Nano Zn spray at 40 DAT resulted in significantly higher grain yield in rice with better economic reutrns (Gross returns, Net returns and Benefit cost Ratio) in Rice.

References

1. Mondal R, Goswami SB, Goswami S, Jana K. Effect of different nutrient management practices on growth, grain yield, production economics, soil nutrient availability of transplanted kharif rice (*Oryza sativa* L.) and correlation studies. J Crop Weed. 2020;16(1):172-179.
2. Namasharma S, Pahari A, Banik A, Pal S, Sana M, Pal S. Impact of foliar applied nano-urea on growth, productivity and profitability of hybrid rice (*Oryza sativa* L.). Oryza. 2023;60(3):464-472.
3. Modi K, Jha S, Patel P, Suthar H. Isolation and characterization of Bacillus consortia for plant growth promotion in rice (*Oryza sativa* L.). Plant Sci. 2022;5(1):17-28.
4. Attri M, Sharma N, Sharma BC. Effect of foliar application of nano urea on productivity and profitability of fine rice under irrigated subtropics of Jammu region. Indian J Ecol. 2022;49(5):1935-1938.
5. Mote GK, Mane MJ, Bodake PS, Thorat TN, Mane AV, Wahane MR. Bio efficacy of foliar applied biostimulants on nutrient uptake, yield and economics of rice (*Oryza sativa* L.) under lateritic soils of Konkan region. The Pharma Innovation Journal. 2022;11(12):318-22.
6. Sahu TK, Kumar M, Kumar M, Chandrakar T, Singh DP. Effect of nano urea application on growth and productivity of rice (*Oryza sativa* L.) under midland situation of Bastar region. The Pharma Innovation Journal. 2022;11(6):185-187.
7. Singh SK, Thakur R, Singh MK, Singh CS, Pal SK. Effect of fertilizer level and seaweed sap on productivity and profitability of rice (*Oryza sativa*). Indian J Agron. 2015;60(3):420-425.
8. Pramanick B, Brahmachari A, Ghosh S, Zodape S. Effect of seaweed saps on growth and yield improvement of transplanted rice in old alluvial soil of West Bengal. Bangladesh J Bot. 2014;43(1):53-58.
9. USDA. World agricultural production. Foreign Agricultural Service. Circular Series WAP 7-21; c2021.