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Impact of Different Nitrogen Levels on Rice Varieties to Major Nitrogen Uptake and Soil Nitrogen Status in South Odisha

Dukka Pranav Reddy, Arunabha Pal, Devender Reddy

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ABSTRACT

Rice (*Oryza sativa* L.) is one of the most domesticated cereal crops worldwide cultivate. Rice is a staple food crop consumed by about half of the world's population. Rice is mainly grown in subtropical, tropical temperate climates all around India and the world. The current experiment was conducted at the Bagusala Farm, M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha in *kharif* season 2021. The experiment was laid out in split plot design with four nitrogen levels treatments (0, 50, 100, 150 %) replicated thrice in 5 m × 4 m plots with three rice varieties V_1- MTU-7029 (Swarna), V_2- BPT -5204 (Sambha Masoori), V_3- BPT-3291 (Sona Masuri). Nitrogen uptake in rice seed observed 43 kg ha^{-1} is more than straw and highest uptake received in seed and straw in variety BPT 5204 found available nitrogen content in soil gradually decrease from 230 to average 120 kg ha^{-1}. The following experiment is covering SDG2 and SDG15 points under sustainable-development (FAO 2021).

Keywords Nitrogen uptake, Available nitrogen, Interaction varieties, Nitrogen.

Dukka Pranav Reddy
MSc Ag Scholar, Centurion University of Technology and Management, Odisha 752050, India

Arunabha Pal*
Associate Professor, Centurion University of Technology and Management, Odisha 752050, India

Devender Reddy
Professor, Centurion University of Technology and Management, Odisha, India

Email : arunabha@cutm.ac.in
*Corresponding author

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the useful main food grain crops in world and India both. It has great role in global food security. Globally, the largest area under rice cultivation is in India (43.8 M ha) and it is the second largest producer in the world (112.9 Mt) with an average productivity of 2.78 t ha^{-1} (Agriculture Statistics at a Glance 2018). Rice is mainly grown in South Odisha climatic conditions during the period in *kharif* and summer seasons. As rice is the major nutrient draining crop, there will be huge deficit in the soil nutrients in rice based cropping system. To overwhelmed problems have to maintain soil fertility and need to application nitrogen through organic and inorganic sources which can help in obtaining good crop yields as well as the production sustainability (Sahu *et al*. 2017, Ullah *et al.* 2019). The combined use of inorganic fertilizers along with organic sources like FYM and vermin-compost can improve the soil health and also helps in proper growth and produc-

Table 1. Soil characteristics before cultivation.

Sl. No.	Properties	Value	Method	
A	Physical properties			
1.	Sand (%)	54.50	Hydrometer method (Bouyoucos 1962)	
2.	Silt (%)	28.40		
3.	Clay (%)	17		
4.	Textural class	Sandy clay soil	Textural triangle USDA (Black 1965)	
B	Chemical properties			
1.	Soil reaction (pH)	5.2	Slightly acidic	1:2.5 soil: water suspension, using glass electrode pH meter (Jackson 1973)
2.	Electrical conductivity (dSm^{-1})	0.2	Normal	Electrical conductivity (Jackson 1973)
3.	Organic carbon (%)	3.25	Low	Walkley and Black's rapid titration method (Black 1965)
4.	Available nitrogen ($kg\ ha^{-1}$)	2.30	Low	Alkaline permanganate method (Sub biah and Asija 1956)
5.	Available phosphorus ($kg\ ha^{-1}$)	14.5	Moderate	Olsen's method (Olsen *et al.* 1954)
6.	Available potassium ($kg\ ha^{-1}$)	112	Low	Flame photometric method (Jackson 1973)

tivity of rice.

Rice production of the world during 2019-2020 is 503.17 million metric tons. In the world, China is the leading country in production of rice with (148.5 million metric tons) and it was followed by India (118.43 million metric tons) and Indonesia (36.7 million metric tons). Rice is grown in around 162.06 million hectares in the world. Highest area rice cultivation in India ranks first in the world (43.78 million hectares), followed by china. In India, West Bengal ranks first in total rice production of (15.57 million tons), second by Uttar Pradesh (15.52 million tons) and followed by Punjab (11.78 million tons), Andhra Pradesh, Tamil Nadu, Bihar, Chhattisgarh, Odisha (Agriculture at glance 2020). At all over India, yield of rice 4769 kg/ha (Agricultural statistics at a glance 2020). Per capita net availability of food grain of rice per annum in India is 73.4 kg/year and per capita net availability of food grain of rice in India per day is 201.2 grams/day (Directorate of Economics and Statistics). In India Odisha state is one of the rice producing state with the production of 7.08 million tons and cultivating in the area of 3.71 million hectares. There are some major districts which contribute rice production to the state of Odisha, Sambalpur, Koraput, Ganjam, Cuttack, Bolangir.

Nitrogen fertilizer plays an important role in agricultural production and has the strongest effect on increasing agricultural production and income (Pal *et al.* 2020 and Krishna *et al.* 2020). Nitrogen is an essential part where it lays out of cell material,

Table 2. Experimental details.

Crop	Rice
Variety	MTU -7029 (Swarna), BPT - 5204 (Samba masuri), BPT - 3291 (Sona masuri)
Duration	125–150 days
Number of treatments	12
Design	Split plot design
Replications	03
Total number of plots	36
Plot size	5 m × 4 m = 20 m^2
Total plot size	720 m^2
Irrigation channel	50 cm
Spacing	20 cm × 15 cm
Sub plot treatments (Nitrogen)	four levels 0 (Control), 50, 100 and 150 Nitrogen $kg\ ha^{-1}$

Table 3. Effect of different levels of nitrogen on nutrients uptake.

Treatments Varieties	Nitrogen uptake by plant: Uptake N seed kg/ha	Straw N uptake kg/ha	Total N uptake by plant kg/ha	Available nitrogen in soil after harvest kg/ha
MTU 7029 (Swarna)	35	24	60	104
BPT 5204 (Samba masuri)	43	26	69	127
BPT 3291 (Sona masuri)	34	25	60	121
F test	NS	S	S	S
SEm±	1.81	0.27	1.64	2.83
CD (5%)	-	1.12	6.63	11.41
Nitrogen levels				
0	21	14	35	89
50	35	26	61	94
100	39	28	68	136
150	54	33	87	150
F test	S	S	S	S
SEm±	2.63	0.40	2.75	4.69
CD (5%)	7.87	1.20	8.24	14.04
V×N				
F test	S	S	S	S
SEm±	4.34	0.66	4.44	7.58
CD (5%)	13.79	2.11	13.94	23.81

proteins, and chlorophyll. Nitrogen fertilizers are applied to the soil conditions where it goes through the physical, manufactured and regular and moreover microbial activities and in the long run it will available for crops (Garnayak *et al.* 2020, Adhikary *et al.* 2016 and Pal *et al.* 2020). Application of the appropriate level of nitrogen fertilizers is a major discussion with regards to economic viability of rice crop production (Pal *et al.* 2020).

MATERIALS AND METHODS

The present chapter entitled "Impact of different nitrogen levels on rice varieties to major nitrogen uptake and soil nitrogen status in South Odisha" field experiment was conducted during the *kharif* season of 2021-22 at the agriculture research farm of M. S. Swaminathan School of Agriculture, Bagusala, Centurion University of technology and management, Paralakhemundi, Odisha, India. This chapter describes the material and methods used in carrying out the particular experiment. The experimental site was located at 18.80°N latitude, 84.20°E longitude and at an altitude of 145 meters above mean sea level under the sub-humid and sub-tropical climatic conditions of the North-Eastern Ghat of Odisha state, India. The maximum temperature ranged from 37°C in July to 31°C in November whereas the minimum temperature ranged from 24°C in July to 18°C in November during the cropping season. This region receives a mean annual rainfall of 1400 mm. Before sowing of the crop, the data recorded in respect of physico–chemical properties of the experimental site (Table 1) revealed that the soil was clay loam in texture with slightly acidic pH and low in available nitrogen and organic carbon and medium in phosphorus and less in potassium. The field experiment was carried out in a 720 square meter area dividing the experimental site into plots of equal sizes with drainage channels (Table 2).

RESULTS AND DISCUSSION

The nitrogen uptakes in grain and straw of *kharif* rice were determined by multiplying the nutrient contents in grain and straw with grain and straw yield respectively at maturity. The nutrient uptake varied by different organic manures and their combinations with inorganic fertilizer. The nitrogen uptakes observed in seed were more than that straw. Crop nutrition played an important role in increasing the nutrient uptake by grain and straw of *kharif* rice. Nitrogen uptake by seed found higher (Table 3) in BPT 5204, 43 kg ha^{-1} than all other varieties and it's closely followed by MTU 7029 and BPT 3291 record 35 and 34 kg ha^{-1} which in not significant. As per fertilizer treatments application, 150% (N3) nitrogen got higher nitrogen uptake (kg ha^{-1}) by seed, significantly followed by 100% (N_2), 50% (N_1) over control 0% (N0). The interaction between variety and fertilizer statistically significantly inferior found under seed nitrogen uptake. Similarly straw nitrogen uptake found in variety BPT5204 (V_2), 26 kg ha^{-1} which is significantly higher than other BPT 3291 (V_3) and MTU7029 (V1) 25 and 24 kg/ha. Comparison with nitrogen levels recorded 33 kg ha^{-1} nitrogen found in straw under 150%

(N_3) which is significantly higher over control. The interaction between variety and fertilizer treatments statistically significantly inferior found under straw nitrogen uptake. As per (Tables 1 and 3) total nitrogen uptake by seed and straw found significantly higher 69 kg ha^{-1} in BPT5204 followed by BPT3291 and MTU7029. All the fertility treatments decrease the available nitrogen, in post-harvest soil over those of the initial values. Available nitrogen content in soil recorded lower than initial soil is average 127 kg ha^{-1} BPT 5204 which is significantly higher than BPT 3291 and MTU 7029 varieties plot.

CONCLUSION

Application of nitrogen fertilizer in rice crop to find the nutrient uptake, observed that seed nitrogen uptake more than straw and after post harvested soil nutrient status found particularly nitrogen is decreased during the period.

REFERENCES

Agricultural Statistics at a Glance (2018) Directorate of Conomics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India.

Agricultural Statistics at a Glance (2020) Directorate of Economic and Statistics, Ministry of Agriculture, Government of India.

Adhikary N, Disha A, Mahata A, Pal A, Adhikary R, Sardar M, Saha A, Bauri SK, Tarafdar PK, De SK (2016) Efficient use of jute agro textiles as soil conditioner to increase chilli productivity on Inceptisol of West Bengal. *J Soil Water Conserv* 15 (3) : 242—245.

Adhikary R, Pal A (2020) Clay Pot Irrigation–A Review Study. *Asian Pl Res J* 5 (1) : 37—41.

FAO (2021) https://www.fao.org/sustainable-development-goals/indicators/en/#:~:text=FAO%20is%20the%20custodian%20UN,results%2C%20events%20and%20focal%20points.

Garanayak R, Bera M, Adhikary R, Pal A (2020) Soil Nutrient status of different farms of M.S. Swaminathan School of Agriculture, Gajapati District, Odisha, India. *Ind J Natural Sci* 10 (59) : 18896—18901.

Krishna KV, Deepthi CH, Reddy MD, Raju PS, Pal A (2020) Effect of nitrogen and phosphorus levels on growth and yield of finger millet *Eleusine coracana* (L.) during summer. *Ind J Agricult Res* 54 (2) : 227—231.

Pal A, Adhikary R, Bera M, De SK, Sarder M (2020) Application of Different Geotextile in Soil to Improve the Soil Health in Humid and Hot Sub Humid Region of West Bengal, India. *Int J Curr Microbiol Appl Sci* 9 (6) : 2812—2818.

Pal A, De SK, Sarder M (2020) Effect of different geotextile treatments in soil to increase the yield and yield attribute of capsicum (*Capsicum annuum*). *Int J Chem Stud* 8 (3) : 2620—2622.

Pal A, Adhikary R, Barman S, Maitra R (2020) Nitrogen transformation and losses in soil: A cost effective review study for farmer. *Int J Chem Stu* 8 (3) : 2623—2626.

Pal A, Adhikary R, Shankar T, Sahu AK, Maitra S (2020) Cultivation of cucumber in greenhouse. Protected Cultivation and Smart Agriculture; Sagar Maitra, DJGATS, Ed.; New Delhi Publishers: New Delhi, India, pp 139—145.

Pal A, Adhikary R, Barman S, Maitra S (2020) Nitrogen transformation and losses in soil: A cost-effective review study for farmer. *Int J Chem Stud* 8(3): 2623—2626.

Sahu G, Chatterjee N, Ghosh GK (2017) Integrated nutrient management in rice (*Oryza sativa*) in red and lateritic soils of West Bengal. *Ind J Ecol* 44 (5) : 349—354.

Ullah H, Datta A, Noor AS, Ud Din S (2019) Growth and yield of lowland rice a affected by integrated nutrient management and cultivation method under alternate wetting and drying water regime. *J Pl Nutr* 42 (6) : 580—594.