The Andhra Agric. J 66 (4): 619-622, 2019

Effect of Varied Nutrient Levels on Productivity and Economics of Different Rice Varieties in Irrigated Ecology

P Vijaykumar, N Pandey and R Mahender Kumar
ICAR-Indian Institute of Rice Research, Hyderabad

ABSTRACT

A study was undertaken to evaluate the effect of varied nutrient levels on productivity and economics of different rice varieties in irrigated ecology. The treatments consisted of combination of three levels of NPK (50% RDF, 100% RDF and 150% RDF) and six varieties (DRR Dhan 44,DRR Dhan 46, MTU1010,Varadhan, Sugandhamathi and Swarnadhan). All were tested in split plot design with 3 replications. The productivity (grain and straw yield) and economics of rice was significantly highest with the application of 150% RDF. The rice variety Varadhan produced highest grain yield and in the case of straw yield, the variety Swarnadhan gave the highest yield. The results of gross, net returns and B:C ratio was recorded highest with the 150% RDF application than the other nutrient levels and the variety Varadhan produced highest gross, net returns and B:C ratio than the other verities.

Key Words: *Rice, Economics, Productivity, NPK levels*

Rice is the staple food for about 50% of the population that resides in Asia, where 90% of the world's rice is grown and consumed. In Asia, India has the largest area under rice (44.6mha) accounting for 29.4% of the global rice area and secured the production of 104.3mt during 2014-15 and stood next only to China in the world. The yield level in India is low (2.1 t ha^{-1}) compared to other major rice producing countries. Rice is produced both upland and lowland ecosystems with about 76% of the global rice produced from irrigated areas under lowland rice systems (Fageria *et al*., 2003).

Food security in India is linked to sustainable rice production and it contributes to more than 42% of total food grain production. To safeguard and sustain the food security in India, rice productivity has to be increased by adopting appropriate measures. The suitable genotype with proper nutrient management practices is possible way to enhance the productivity of rice along with resource use efficiency.

Attaining maximum economical yield is the priority of irrigated rice farmers. Current fertilizer management practices in intensive, irrigated rice systems are, however, not tailored to the large between-field differences in indigenous nutrient supply and crop demand. Substantial improvements in nutrient use efficiency and economic performance will require a suitable nutrient management (NM) approach. So this experiment was under taken to evaluate the varied levels of nutrient application effect on yield of the rice varieties.

MATERIAL AND METHODS

Field experiment was carried out at ICAR-IIRR Hyderabad during *kharif* 2017. The soil was neutral to alkaline in reaction and medium in fertility levels having low Nitrogen, high phosphorus and medium to high Potassium. The treatments consisted of combination of three levels of NPK as 50% RDF, 100% RDF and 150% RDF in main plot and six varieties DRR Dhan 44, DRR Dhan 46, MTU1010,Varadhan, Sugandhamathi and Swarnadhan in sub plot tested in split plot design with three replications.NPK were given as basal as per the treatments to fulfil the nutrient requirement of 100% RDF as 120:60:40 Kg NPK ha^{-1}. N was supplied through urea, P was supplemented through SSP and K was given through MOP.

RESULTS AND DISCUSSION

Grain yield, straw yield and HI

Effect of nutrient levels

The effects of different nutrient levels were found to be significant on grain and straw yield (Table 1). The grain yield increased significantly with the increasing levels of nutrient from 50% RDF to 150% RDF. The highest grain (6.01 t ha^{-1}) yield was recorded with the application of 150% RDF while, the lowest grain (4.12 tha^{-1}) yield was obtained with the application of 50% RDF. The application of 150% RDF produced 6.93% higher grain yield than that of 100% RDF and 45.87% higher yield as compared to application of 50% RDF. The application of 100% RDF was also found to be significantly superior and

Table 1. Productivity of different rice varieties as influenced by the different nutrient levels.

Treatments	Grain yield (t/ha)	Straw yield (t/ha)	Harvest Index (%)
Effect of Nutrient Levels			
F1: 50% RDF	4.12	5.45	44.01
F2: 100% RDF	5.62	7.98	41.02
F3: 150%RDF	6.01	8.95	40.00
SEm±	0.12	0.23	1.53
CD (p=0.05)	0.31	0.93	NS
CV (%)	9.80	13.09	12.17
Effect of Varieties			
V1: DRR-Dhan 44	4.74	7.11	40.12
V2: DRR-Dhan 46	5.43	7.17	43.33
V3: MTU1010	5.29	7.86	40.77
V4: Varadhan	6.49	7.50	46.91
V5: Sugandhamati	3.82	6.20	38.78
V6: Swarnadhan	5.73	8.92	39.13
SEm±	0.16	0.49	1.07
CD (p=0.05)	0.47	1.52	3.92
CV (%)	9.29	8.29	7.74
Interaction (F x V)			
SEm±	0.29	0.85	2.93
CD (p=0.05)	NS	NS	NS

Table 2. Economics of different rice varieties as influenced by the different nutrient levels

Treatments	Cost of cultivation	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})	B:C ratio
Effect of Nutrient Levels				
F1: 50% RDF	34318	72294	37976	2.11
F2: 100% RDF	36851	99398	62547	2.70
F3: 150%RDF	39391	106877	67486	2.71
SEm ±	-	1870	1871	0.05
CD (p = 0.05)	-	7541	7541	0.20
CV (%)		8.55	14.17	8.41
Effect of Varieties				
V1 : DRR-Dhan 44	36785	84164	47379	2.28
V2 : DRR-Dhan 46	36785	94862	58076	2.56
V3 : MTU1010	36785	93835	57050	2.53
V4 : Varadhan	36785	111897	75111	3.03
V5 : Sugandhamati	37195	70084	32889	1.87
V6 : Swarnadhan	36785	102298	65513	2.77
SEm ±	-	2564	2564	0.07
CD (p = 0.05)	-	7441	7441	0.20
CV (%)		8.28	13.73	8.29
Interaction (FxV)				
SEm ±	-	4465	4465	0.12
CD (p = 0.05)	-	NS	NS	NS

produced 36.40% higher yield than that of 50% RDF. Almost similar trend was noticed for straw yield and the highest value of 8.95 t ha^{-1} was obtained with the application of 150% RDF. The lowest straw yield (7.98 t ha^{-1}) was recorded under the treatment where 50% RDF was applied. The harvest index was not influenced due to application of nutrients.

The N, P and K are most important factors to improve rice yield. The role of nitrogen helped in proper filling of seeds which resulted in higher produced plump seeds and thus the number of grains $panicle^{-1}$. Phosphorus increase the root growth of the plant that results inbetter absorption of plant nutrient for better production. Potassium application imparts the disease resistance to rice plants thus it helps to grow plant healthy which makes plant better perform for the yield. The increase in yield was mainly brought due to significant improvement in yield attributes. This was also reported by Hoang *et al*. (2015), Awan *et al* (2003), Dakshinamurthy *et al*. (2014). The increase in NPK levels might have regulated adequate supply of nutrients over prolonged period that ultimately resulted in increased grain and straw yield as also reported by Paramasivan *et al*. (2016).

Effect of varieties

The different varieties were showing significant differences on grain and straw yield (Table 1). Among the different varieties, rice variety Varadhan produced the highest grain yield of 6.49 t ha^{-1} which was significantly superior to other varieties. The rice variety Swarnadhan produced the grain yield of 5.73 t ha^{-1} followed by the variety Varadhan and produced comparable grain yield to that of DRR-Dhan 46 and MTU-1010. The highest harvest index was also obtained with rice variety Varadhan.The lowest grain yield (3.82 t ha^{-1}) was observed with variety Sugandhamati, which was significantly inferior to other varieties. Almost similar trend existed for straw yield of rice varieties. The highest yield of straw 8.92 t ha^{-1} was obtained with rice variety, Swarnadhan which was significantly superior to rest of the varieties. On the other hand, the lowest straw yield (6.20 t ha^{-1}) and harvest index was noted with the variety Sugandhamati. The rice varieties produced higher seed yield as also reported by Saha and Mittra (1984), Pandey *et al*. (1991) and Ghosh (2001). The reduction in harvest index indicates that conversion of tillers produced at early stages to in to productive tillers was probably in efficient and resulted in more straw yield and decreased the harvest index as also reported by Ajeet *et al*. (2005) Siddiq *et al*. (2011), and Hussain *et al*. (2014)The interaction between nutrient levels and varieties was found non-significant for both grain and straw yield.

Economics

The cost of cultivation gross monetary return, net returns and B:C ratio were calculated and presented in Table 2.

Effect of nutrient levels

The effects of different nutrient levels were found to be significant on cost of cultivation gross, net returns and B:C ratio (Table 2). The gross income increased significantly with increasing the nutrient levels. Thus the highest cost of cultivation (Rs 39391), gross returns (Rs.106877) was recorded with the application of 150% RDF while, the lowest gross income was (Rs. 72294) obtained with the application of 50% RDF. Almost similar trend was noticed for net returns and the highest value of Rs. 67846 was obtained with the application of 150% RDF. The lowest net return (Rs. 37976) was recorded under the treatment where 50% RDF was applied. B:C ratio also exhibited similar trend and the highest B:C ratio (2.71) was obtained with the application of 150% RDF.

Effect of varieties

The different varieties had shown significant differences on grain and straw yield (Table 2). Among the different varieties, rice variety, Varadhan produced the highest gross returns (Rs.111897) which was significantly superior to other varieties. The highest net returns and B:C ratio were also obtained with rice variety Varadhan (Rs. 75111 and 3.03). The lowest gross returns (Rs.70084) was observed with variety, Sugandhamati, which was significantly inferior to other varieties. Almost similar trend existed for net returns and B:C ratio of rice varieties. The application of higher doses of NPK fetched significantly the highest net returns and benefit: cost ratio. This might be due to increased higher productivity and lower cost of cultivation. The variation in the cost of cultivation under different treatments was recorded due to variable costs of fertilizers. Grain and straw yield were the major factors, which caused differences in net return. These results are in close conformity with the findings of Santosh *et al*. (2014), Siddiq *et al*. (2011), Kuldeep *et al*. (2017) and Paramasivan *et al*. (2016).

CONCLUSION

This research results indicated that application of higher dose of nutrients is required to get maximum yield and resulting high in high B:C ratio. Improved rice varieties also produced more yield due to its higher yield potential with supply of required nutrient application. This might be helpful to paddy farmers to produce more yield by managing their resources efficiently while growing improved rice varieties.

LITERATURE CITED

Ajeet, Singh, Raman and Namdeo K N 2005. Performance of conventional and hybrid rice varieties under different fertility levels. *Annals of PlantSoil Research*. 7(1): 91-92.

Awan K H, Ranjha A M, Mehdi S M, Sarfraz and Hassan G2003. Response of Rice Line PB-95 to Different NPK Levels.*Online Journal of Biological Sciences*. 3(2): 157-166.

Dakshinamurthy K M, RaoA U, Vijay D and SridharT V. 2015 Effect of levels of nitrogen, phosphorus and potassium on performance of rice. *Indian J. Agric. Res.*, 49(1): 83-87.

Fageria N K, Slaton N A and Baligar V C. 2003. Nutrient management for improving lowland rice productivity and sustainability. *Advances in Agronomy*. 80: 63-152

Ghosh2001. Performance of hybrid and high yielding rice varieties is Tarai region of West Bengal. J. Interacademicia. 5(4): 578-581.

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agriculture Research. John Wiley and Sons Publishers, New York. 357-423.

Hoang M T, Nguyen H H, Nguyen T T, Nguyen V T and Luu N Q 2015. Study on the effect of some of N, P, K Fertilizer Compounds on the Yield and Quality of Bp53 Rice Variety. *Journal of Agricultural Technology.* 11(8): 2149-2156.

Hussain S, FujiiT, McGoeyS,Yamada M, Ramzan M and AkmalM 2014. Evaluation of different rice varieties for growth and yield characteristics. *The Journal of Animal & Plant Sciences*. 24(5): 1504-1510.

Kuldeep D, SinghS K, Malviya1 D K, Gautam A, KanapuriyaN and KumarB. 2017.Effect of Rice Varieties on Growth, Yield and Economics at Varying Levels of Nitrogen under Direct Seeded Upland Condition Rewa Region. *International Journal of Current Microbiology and Applied Sciences*. 6(9): 2313-2318.

Pandey N, Verma A K and Tripathi R S 2001. Effect of planting time and nitrogen on tillering pattern, dry matter accumulation and grain yield of hybrid rice (*Oryza sativa*). *Indian Journal of agricultural Science*.71(5): 337-338.

Paramasivan M, Arunkumar V and Senthilkumar N 2016. Effect of Nutrient Levels on Productivity, Profitability and Soil Fertility in Rice (Oryza sativa) in Alfisols of Tambiraparani Tract. *Madras Agricultural Journal.* 103(1-3): 31-34.

Saha G P and Mittra B N 1984. Effect of management of urea on rice culture and nitrogen uptake in low land conditions. *Indian Journal of Agronomy.* 29(4): 563-565

Santosh K, Singh, Shanker R,Yadav and Lalji. 2014. Effect of moisture regime and integrated nutrient supply on yield and economics of transplanted rice (*Oryza sativa* L.). *Internat. J. agric.*, (1):298-301.

Siddiq S,AnayatA, Sattar A, Ali M. A and Yaseen M 2011. Response of different rice (*Oryza sativa* L.) Cultivars to different NPK levels in the central cropping zone of punjab. *Agricultural Science Digest.* 31(3): 155 - 160.

Received on 12.07.2019 and revised on 5.01.2020