Int.J.Curr.Microbiol.App.Sci (2020) *9*(9): 3126-3131

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 9 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.909.385

Study of Different Nitrogen Levels on Growth, Yield and Economics of Rice Variety BPT 2270- Bavapurisannalu under Low Land Condition

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Keywords

Rice variety BPT 2270 Bavapurisannalu, Nitrogen Levels

Article Info

Accepted:
20 August 2020
Available Online:
10 September 2020

A B S T R A C T

The experiment was conducted at Agricultural Research Station, Bapatlain *kharif*2014 and 2015 to find out the effect of nitrogen levels on yield components and yield of BPT 2270 Bavapurisannalu. The experiment was laid out in a randomized block design with 7 treatments replicated thrice. Seven levels of nitrogen (80, 120, 160, 200, 240,280 and 320 kg N ha^{-1}) were used as an experimental treatments.Results revealed that nitrogen had significant positive effect in terms of tillers hill^{-1}, grains panicle^{-1} grain yield, straw yield and economics. The results revealed that application of 320 kg N ha^{-1} recorded significantly the highest yield attributing characters like productive tillers plant^{-1}, panicle length, number of filled grains per panicle and grain yield (5496 and 5738 kg ha^{-1}) while lowest yield was recorded with 80 kg N ha^{-1} treatment. Highest net returns and benefit cost ratio was recorded with 240 kg N ha^{-1}during 2014 and 2015. It can be indicated that application of 240 kg N ha^{-1} is more economical to the BPT 2270 long duration variety in both the years of experimentation.

Introduction

Rice is the most important food crop, grown in the tropics. It accounts for the bulk of the caloric intake of the people in Asia and for a considerable portion of the diets in tropical Africa and Asia. The present strategy of increasing food production essential involved the balance use of fertilizers to rice, because all the varieties of rice give their fully yield potential with adequate supply of nutrients. Various factors contributing for rice production, fertilizers play an important role.Among the major plant nutrients, nitrogen is most important for augmenting rice yield. Rice is the major consumer of fertilizer nitrogen and accounts for one third of the total nitrogen consumption in the country. Nitrogen is essential nutrient element for rice growth and metabolic process (Noor, 2017). Application of optimum dose of nitrogen to rice is gaining importance because nitrogen is a key nutrient in crop production that it can never be ignored. Use of adequate nitrogen rate is important not only for obtaining maximum economic returns, but also to reduce environmental pollution. Nitrogen management in rice field is different from other crops because of the continuous submergence of the field. Nitrogen (N) is the indispensable nutrient to rice production and its uptakes is affected by rice varieties, environment, soil conditions, crop rotations *etc*. Managing nitrogen fertilization in rice fields is a challenging task for farmers because of various kinds of losses due to de-nitrification, deep percolation and run-off in flooded soils resulting in low nitrogen use efficiency. Consequently environment of root zone is converted from aerobic to an aerobic condition. During these processes losses of nitrogen takes place through leaching and denitrification in leaching losses, unhydrolyzed nitrogen is as susceptible to leaching as nitrogen in denitrification process, after converting nitrogen in to nitrate which is soluble in water and therefore, move down to reduced layer, where it is denitrified. These types of losses are responsible forits lower efficiency. Excessive nitrogen application can result in accumulation of large amounts of post-harvest residual soil nitrogen. Residual soil nitrate (NO-3) may be available for subsequent crops in the next season, but such nitrogen is highly susceptible to leaching during non-crop periods. It is important to achieve efficient use of nitrogen in chemical fertilizers, not only through cultivation techniques, but also by breeding varieties with high nitrogen use efficiency and reducing nitrogen inputs from farming to the environment (Sachiko *et al.,* 2009).The present investigation was to assess variability in yield components, yield and economics of rice variety under different nitrogen levels.

Materials and Methods

Field experiment was carried out for two consecutive seasons of *kharif,* 2014 and 2015 at Agricultural Research Station, Bapatla. The soil is clay loam in texture. The soil is neutral (pH 7.49) in reaction with low electrical conductivity (0.24dSm^{-1}). The soil is medium in organic carbon content, low in available nitrogen, medium in available phosphorus and potash. The experiment was laid out in randomized block design with 7 treatments replicated thrice. Seven nitrogen levels (80, 120, 160, 200, 240,280 and 320 kg N ha^{-1}) were used as an experimental treatments. Rice variety BPT 2270- Bavapurisannalu was sown separately in nurseryand 25 days old seedlings were transplanted at 20 cm x 15 cm spacing @ two seedlings per hill in both the years. Nitrogen (Urea) was applied as per treatments in three equal splits (1/3 as basal, 1/3 at maximum tillering and 1/3 at panicle initiation stage). Phosphorus (60 kg ha^{-1}) and potassium (40 kg ha^{-1}) were supplied through single super phosphate and muriate of potash and were uniformly applied to all plots as basal during *kharif*2014 and 2015. Irrigation and weed management was done in time to time. The plant height was measured from ground level to the apex of last fully opened leaf during vegetative period and upto the tip of the panicle after flowering. Panicle length of ten randomly selected panicles from each plot was measured from neck node to the tip of panicle and then averaged and expressed in cm. Number of grains of 10 randomly selected panicles from each plot were counted and then averaged as grains panicle^{-1}. Samples of grain collected separately at the time of threshing from each plot were dried properly. 1000-grains from each of these samples were taken and their weights were recorded and expressed in grams. The border rows were harvested first and then, the net plot area was harvested and the produce was threshed by beating on a threshing bench, cleaned and sun dried to 14 per cent moisture level. Grain from net plot area was thoroughly sun dried, threshed, cleaned and weight of grains was recorded and expressed in yield per hectare. The data were analyzed statistically following the method given by Panse and Sukhatme (1978) and wherever the results were calculated at 5 per cent level of significance.

Results and Discussion

Effect of Nitrogen Levels on growth

At maturity, significantly the tallest plant was recorded with 320 kg N ha^{-1}(98.9 and 102.7 cm) and it was on par 280, 240, 200 and 160 kg N ha^{-1}when compared to 120 and 80 kg N ha^{-1}and the lowest plant height was recorded with 80 kg N ha^{-1} (88.7 and 93.9 cm) during both the years. Nitrogen is associated with increase in protoplasm, cell division and cell enlargement resulting in taller plants (Chamely *et al.*, 2015), and also in increased chlorophyll content at all growth stages, might have increased the photosynthesis and resulted in increased plant height (Rusdiansyah and Muhammad saleh, 2017).Similarly, higher number of tillers was observed at higher levels of nitrogen.During both the years of study significantly maximum number of productive tillers/plant were recorded with the application of 240 kg Nha^{-1} (13 and 13) where as the lowest number of tillers per plant was recorded with 80 kg N ha^{-1} (10 and 10) treatment (Table 1).

Table.1 Effect of nitrogen levels on growth of BPT 2270

Treatment	Plant height (cm)		No of tillers/plant	
	2014	2015	2014	2015
T1-80 kg N/ha	88.7	93.9	10	10
T2- 120 kg N/ha	90.5	98.2	10	11
T3- 160 kg N/ha	92.2	98.7	11	11
T4- 200 kg N/ha	94.7	98.9	12	12
T5-240 kg N/ha	96.6	99.6	13	13
T6-280 kg N/ha	98.3	100.9	12	12
T7-320 kg N/ha	98.9	102.7	12	12
SEm±	2.4	2.3	0.3	0.4
CD (0.05)	7.4	7.1	1.0	1.0
CV (%)	5.2	6.4	7.3	6.8

Table.2 Effect of nitrogen levels on yield attributes of BPT 2270

Treatment	Panicle length (cm)		No of grains/panicle		Test weight (g)	
	2014	2015	2014	2015	2014	2015
T1-80 kg N/ha	21.4	22.0	145	144	13.5	13.8
T2- 120 kg N/ha	21.6	22.2	155	150	14.1	14.0
T3- 160 kg N/ha	21.8	23.4	168	152	14.5	14.6
T4- 200 kg N/ha	22.5	23.7	172	163	14.6	14.5
T5-240 kg N/ha	23.0	24.9	180	184	14.8	15.2
T6-280 kg N/ha	22.8	24.6	174	180	14.8	14.8
T7-320 kg N/ha	22.9	24.8	175	170	14.8	14.5
SEm±	0.3	0.5	3.7	4.6	0.2	0.2
CD (0.05)	1.0	1.2	11.0	13.9	0.6	0.6
CV (%)	5.0	5.5	6.5	7.2	4.1	4.4

Table.3 Effect of nitrogen levels on grain yield, straw yield and harvest index of BPT 2270

Treatment	Grain yield (kg/ha)		Straw yield (kg/ha)		Harvest index (%)	
	2014	2015	2014	2015	2014	2015
T1-80 kg N/ha	4240	4631	5380	5735	42.5	43.5
T2- 120 kg N/ha	4630	5081	5970	6260	42.7	43.8
T3- 160 kg N/ha	4875	5125	6125	6375	43.0	44.0
T4- 200 kg N/ha	5045	5200	6445	6455	43.2	44.2
T5-240 kg N/ha	5435	5675	6895	6970	44.1	44.9
T6-280 kg N/ha	5475	5625	7120	6795	43.5	44.3
T7-320 kg N/ha	5496	5738	7340	6825	43.8	44.7
SEm±	127	122	145	152	0.2	0.2
CD (0.05)	386	378	441	459	0.7	0.6
CV (%)	5.2	7.3	5.6	6.2	5.1	5.5

Table.4 Effect of nitrogen levels on economics of BPT 2270

Treatment	Gross returns		Net returns		B:C Ratio	
	2014	2015	2014	2015	2014	2015
T1-80 kg N/ha	66860	72884	-9096	-3071	0.88	0.96
T2- 120 kg N/ha	73105	79934	-3344	3485	0.96	1.05
T3- 160 kg N/ha	76812	80687	-137	3738	1.00	1.05
T4- 200 kg N/ha	79597	81855	2154	4412	1.03	1.06
T5-240 kg N/ha	85702	89257	8765	11320	1.13	1.15
T6-280 kg N/ha	86507	88357	8076	9926	1.10	1.13
T7-320 kg N/ha	87032	90026	8106	11100	1.10	1.14

Effect of Nitrogen Levels on yield attributes

Pooled data of two years on yield attributes were significantly superior over lowest level of nitrogen. Rice plants produced longest panicles (23 and 24.9 cm) where 240 kg nitrogen per hectare was applied which remained statistically at par with that obtained by nitrogen application levels between 200 to 320 kg per hectare. The longer panicles obtained in treatments receiving higher nitrogen rates were probably due to better nitrogen status of plant during panicle growth period. The lowest shortest panicles (21.4 and 22.0 cm) were recorded in T_1 treatment*i.e* 80 kg N ha^{-1}. Numbers of grains per panicle were more (180 and 184) at a nitrogen level of 240 kgha^{-1} which remained statistically at par with that obtained by nitrogen application levels between 200 to 320 kg per hectare. The lowest value of this parameter (145 and 144) was recorded in T_1treatment. Maximum number of total grains panicle^{-1} with the application of inorganic fertilizers might be due to better nutrition especially quick and adequacy of nitrogen probably favoured the cellular activities during panicle formation and development that might have led to increased number of grains panicle^{-1} (Tayef*e al*., 2014). Significantly maximum grain weight (14.8 and 15.2 g) obtained in treatment where 240 kg/ha nitrogen used. This might be due to increased translocation of more carbohydrates from source to sink, hence better filling of grains and bold seeds were obtained. These results are in conformity with the findings of Riteshsharma (2014) and Parimal panda *et al.,* (2017) (Table 2).

Effect of Nitrogen Levels on yield

Graded levels of nitrogen had marked effect on grain yield, straw yield and harvest index. Grain and straw yield increased with increase in N levels, however significantly highest grain yield (5496 and 5738 kg ha^{-1}) was recorded with 320 kg N ha^{-1}when compared to 200, 160, 120 and 80 kg N ha^{-1}and it was statistically at par with 280 and 240 kg N ha^{-1} applied treatments during both the years of study. Straw yield also fallowed the same trend. Highest yield with higher nitrogen level might be due to better N uptake leading to greater dry matter accumulation and its translocation to their sink (Rajesh *et al.,* 2015**).** The improvement in panicle length, panicle/ m^2 and panicle weight was mainly responsible for higher yield with supply of nitrogen (Haque and Haque, 2016). Rice straw yield found to increase with increasing rate of nitrogen application significantly up to 320 kg N ha^{-1} (7340 and 6825 kg ha^{-1}) and the lowest straw yield was recorded with 80 kg N ha^{-1}(5380 and5735 kg ha^{-1}) in 2014 and 2015. Significantly the highest harvest index of 44.1 % and 44.9 % was recorded with 240 kg N ha^{-1}when compared to T1, T2 and T3 treatments and the lowest harvest index was recorded with 80 kg N ha^{-1} applied treatment(42.5 and 43.5 %) in 2014 and 2015 but it was on a par with all other treatments (Table 3).

The increase in harvest index with increasing levels of nitrogen might be due to better translocation of assimilates from source to sink as was observed with number of filled grains per panicle and 1000 grain weight. These similar results are in conformity with the findings of Koffi Djaman *et al.,* (2016) and Djaman *et al.,* (2018).

Effect of nitrogen levels on economics

Gross returns, net returns and benefit cost ratio were worked out for different nitrogen levels for BPT 2270-Bavapuri sannalu variety. The data on economics presented in Table-4. Among the nitrogen levels320 kg N ha^{-1} recorded maximum gross returns (87,032 and 90,026 Rs. ha^{-1}) and 240 kg N ha^{-1} recorded highest net returns (8,765 and 11,320 Rs. ha^{-1}) and benefit cost ratio (1.3and 1.5) during both the years of study. These results are in agreement with the findings of Dushyant Mishra *et al.,* (2015) and Kuldeep Dangi *et al.,* (2017).

In conclusions the application of different levels of nitrogen is one of important factor to increase the growth and yield of rice varieties. The results of this study indicated that the increased nitrogen levels up to 320 kg N ha^{-1} significantly enhanced the grain yield and the yield components.Thus, it is concluded that for achieving maximum yield and net return rice variety BPT 2270-Bhavapuri sannalu fertilized with240 kg ha^{-1} may be adopted under irrigated condition of Krishna Western delta. The results are to be confirmed further for making the recommendation.

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How to cite this article:

Anny Mrudhula, K., B. Krishna Veni and Suneetha, Y. 2020. Study of Different Nitrogen Levels on Growth, Yield and Economics of Rice Variety BPT 2270- Bavapurisannalu under Low Land Condition. *Int.J.Curr.Microbiol.App.Sci.* 9(09): 3126-3131.
doi: https://doi.org/10.20546/ijcmas.2020.909.385