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Effect of nitrogen doses on growth and yield of new released rice variety BPT 2295-Bapatla Mahsuri

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Abstract
A field experiment was conducted during *kharif*, 2013 at Agricultural Research Station, Bapatla to evaluate the efficiency of varying nitrogen doses on growth and yield parameters of newly released rice variety (BPT 2295-Bapatla Mashuri). The experiment was laid out in a randomized block design with 7 treatments replicated thrice. Seven nitrogen doses (*i.e.* 80, 120, 160, 200, 240, 280 and 320 kg N ha^{-1}) were used as a experimental treatments. The results indicated that application of 200 kg N ha^{-1} recorded significantly the highest grain yield (5963 kg ha^{-1}) and lowest yield was recorded with 80 kg N ha^{-1} treatment. A linear increase in grain yield was observed with continuous rate increase of nitrogen from 80 to 200 kg ha^{-1} followed by 160 kg, 240 kg, 280 kg and 320 kg N ha^{-1} treatments.

Keywords: Pre-released rice culture, Nitrogen doses, BPT 2295 variety

Introduction
Rice (*Oryza sativa* L.) is the principal cereal crop of India and world. With ever increasing population, demand for rice will continue to increase. In this endeavor, in addition to high yielding rice varieties, efficient use of nutrients 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) [3]. 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. Identification and use of high yielding potential cultivars, though ensures higher yields, the actual yield advantage depends on the agronomic management including that of nitrogen management. Yield potential of a cultivar could be exploited to a maximum extent by judicious management of applied nitrogen. Such information is lacking for the newly developed rice cultivars keeping these points in view; the present investigation was initiated to evaluate the efficiency of different nitrogen doses on rice growth and productivity of newly released rice variety.

Materials and methods
A field experiment was conducted during *kharif*, 2013 at Agricultural Research Station, Bapatla. The experiment was laid out in a randomized block design with 7 treatments replicated thrice. Seven nitrogen levels (i.e. 80, 120, 160, 200, 240, 280 and 320 kg N ha^{-1}) were used as a experimental treatments. Pre-released rice culture (BPT 2295) was sown separately in nursery and twenty five days old seedlings were transplanted into main field by adopting a spacing of 20 cm between rows and 15 cm between plants with in a row. Nitrogen was applied as per the treatments in three equal splits in the form of urea. First split of nitrogen was applied as basal dose at the time of planting of the crop remaining two equal splits of nitrogen was broadcasted at maximum tillering and panicle initiation stages. Phosphorus was applied at the rate of 60 kg P_2O_5 ha^{-1} in the form of single super phosphate as basal and potassium 40 kg K_2O ha^{-1} in the form of muriate of potash was applied in two equal splits as basal dose at the time of transplanting and panicle initiation stage. Irrigation and weed management was done in time to time. 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) [5] and wherever the results were calculated at 5 per cent level of significance.

Result and discussion

Results obtained from the study regarding the influence of nitrogen doses to pre released rice culture (BPT 2295) on growth, yield attributing characters and yield have been presented here under different heads.

Plant height (cm)

Plant height of pre-released rice culture was significantly affected by different nitrogen doses. Significantly taller plants were recorded with the application of 200 kg N/ha (110.0 cm), which was on par with the T3, T5, T6 and T7 treatments *ie* 160 kg, 240 kg, 280 kg and 320 kg N/ha. Significantly the lowest plant height (103.4 cm) of rice was observed with 80 kg N/ha applied treatment in experimentation. Nitrogen is associated with increase in protoplasm, cell division and cell enlargement resulting in taller plants (Tisdale *et al*., 1985) [8], and also in increased chlorophyll content at all growth stages, might have increased the photosynthesis and resulted in increased plant height (Gill and Harsharan Singh, 1985) [2].

Number of productive tillers/plant

Data on total number of tillers per plant significantly influenced by nitrogen doses. Maximum number of tillers were recorded with 200kg N/ha (14) treatment which was closely followed by T3, T5, T6 and T7 treatments. Significantly the lowest number of tillers was observed with 80 kg N/ha (11) applied treatments in experimentation period. Inorganic fertilizers offer nutrients which are readily soluble in soil solution and there by instantaneously available to plants. The role of nitrogen in the stimulation of cell division may have led to more tillers formation during the productive stage in rice (Sorour *et al*., 2016) [6].

Panicle length (cm)

A significant difference in length of the panicle (Table-1) was observed among the treatments tested which was followed the same trend as in the case of number of tillers/plant during the study. Significantly higher panicle length was observed with application of 200 kg N/ ha treatment (27.9 cm), which was statistically on a par with all other treatments, but proved significantly superior to 80 kg N/ha (23.2 cm) during the period of experimentation. These results are in conformity with the findings of Yadav *et al*. (2015) [10].

Total number of grains panicle^{-1}

The data on total number of grains panicle^{-1} was presented in Table-1 which revealed significant influence on total number of grains panicle^{-1} by different doses of nitrogen fertilizer during the study. Significantly higher number of grains panicle^{-1} was recorded with the treatment that received 200 kg N/ha (277), which was statistically on a par with 160 kg, 240 kg, 280 kg and 320 kg N/ha treatments but proved significantly superior to the 120 kg and 80 kg N/ha treatments. 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 favored the cellular activities during panicle formation and development that might have led to increased number of grains panicle^{-1} (Yadav *et al*., 2015) [10].

Test weight (g)

Data on test weight are presented in Table-1 and results revealed that different doses of nitrogen fertilizers were found to be significantly differed during the year of study. Results revealed that, significantly highest test weight was recorded with 200 kg N/ha treatment (18.6 g), which was statistically on a par with all other treatments but proved significantly superior to 80 kg N/ha treatment (17.0 g). 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 Bandyopadhyay and Puste (2002) [1].

Grain yield (kg/ha)

The differences found in growth parameters and yield attributes presented earlier were reflected in grain yield of rice. It was significantly influenced by various nitrogen fertilizer doses during the study. The data revealed that significantly the highest grain yield (5963 kg/ha) was recorded with 200 kg N/ha applied treatment followed by T3, T5, T6 and T7 *i.e* 160 kg, 240 kg, 280 kg and 320 kg N/ha treatments. Significantly the lowest yield (5069 kg/ha) was recorded with 80 kg N/ha treatment. The economic yield is a fraction of the total biological yield of the crop and drymatter accumulation, which is an important determinant of the grain yield (Donald, 1962). The yield increase was basically due to greater number of panicles per unit urea and number of grains per panicle reaching maturity. Rice is relatively leafy in its early stages and adequate supply of nitrogen improves the photosynthetic rate and better nutrient uptake and ultimately the grain yield (Padmaja, 2014) [4].

Straw yield (kg/ha)

Perusal of the data on straw yield (Table-2) revealed that the straw yield also followed almost similar trend as that of grain yield during the study. Significantly the highest straw yield (7450 kg/ha) was recorded with the treatment that received 200 kg N/ha, which was statistically on a par with the treatments T3, T5, T6 and T7 treatments but proved significantly superior to rest of the T1 and T2 treatments. This might be due to stimulated vegetative growth as evidenced through higher plant height, tiller production and drymatter accumulation on account of adequate and prolonged supply of essential nutrients received during each split application, greater availability of nutrients in soil, improved soil environment and higher root penetration leading to better absorption of moisture and nutrients (Urkurkar *et al*., 2010) [9].

Harvest Index (%)

Harvest index (44.5%) was the maximum with treatment that received 200 kg N/ha treatment which was statistically on a par with rest of the treatments. This might be due to the positive response to the higher availability of nitrogen and grain yields which could be ascribed to overall improvement in crop growth enabling the plant to absorb more quantity of nutrients, increased photosynthetic activity and accumulating them in sink. These findings are in close accordance with those of Suryavanshi *et al.* (2008) [7].

Table 1: Effect of nitrogen doses on growth and yield attributes of BPT 2295

Treatment	Plant height (cm)	No of tillers/plant	Panicle length (cm)	No of grains/panicle	Test weight (g)
T1-80 kg N/ha	103.4	11	23.2	236	17.0
T2- 120 kg N/ha	105.3	12	26.3	249	17.3
T3- 160 kg N/ha	108.4	13	27.8	270	18.4

T4- 200 kg N/ha	110.0	14	27.9	277	18.6
T5-240 kg N/ha	107.6	13	27.0	264	18.1
T6-280 kg N/ha	104.9	13	27.4	274	18.3
T7-320 kg N/ha	105.0	13	27.0	267	18.2
SEm±	1.82	0.32	1.09	6.75	0.45
CD (0.05)	5.41	0.96	3.25	20.1	1.36
CV (%)	8.41	5.14	8.19	5.12	7.30

Table 2: Effect of nitrogen doses on grain yield, straw yield and harvest index of BPT 2295

Treatment	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
T1-80 kg N/ha	5069	6550	43.6
T2- 120 kg N/ha	5110	6575	43.7
T3- 160 kg N/ha	5912	7400	44.4
T4- 200 kg N/ha	5963	7450	44.5
T5-240 kg N/ha	5613	7300	43.5
T6-280 kg N/ha	5575	7050	44.2
T7-320 kg N/ha	5530	7000	44.1
SEm±	137.8	276.5	3.5
CD (0.05)	409.5	821.4	NS
CV (%)	9.97	7.94	8.3

Conclusion

Application of appropriate doses of nitrogen fertilizer is one of important factor to increase the growth and yield of newly released rice cultivars. The results of this study indicated that the increased nitrogen rates up to 200 kg N ha^{-1} significantly enhanced the grain yield and the yield components. The optimum dose of nitrogen for newly released rice culture is not only essential for producing higher rice yield, but also for improving soil fertility.

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