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RESPONSE OF BASMATI RICE (ORYZA SATIVA) CULTIVARS TO GRADED NITROGEN LEVELS UNDER TRANSPLANTED CONDITION

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ABSTRACT

The experiment was conducted with different Basmati rice varieties at farm of Basmati Export Development Foundation (BEDF), in *kharif* 2012 and 2013 to find out the effect of nitrogen levels on yield components of Basmati rice cultivars. Results revealed that during *Kharif* 2012 and 2013 Nitrogen had significant positive effect and was equally superior in terms of tillers hill^{-1}, tillers hill^{-1}, grains panicle^{-1} and straw yield. Highest number of panicle/m^2 was recorded with 160 kg N/ha however differences in filled grain /panicle between 120 kg N/ha and 160 kg N/ha was statistically similar. Differences in grain yield between 160 kg N/ha (44.68 q/ha) and 120 kg N/ha (43.53 q/ha) were statistically at par. Among varieties highest values of yield (43.89 q/ha) and yield attributing trays was recorded with Pusa Sugandha-5.

KEYWORDS: Basmati Rice, Nitrogen Levels, Panicle

INTRODUCTION

Rice (*Oryza sativa* L.) is the principal and one of the most important cereal crops of the India as well as world, grown in wide range of climatic zones, to nourish the mankind. The unique varietal group that has distinguished itself as a result of natural and human selection which found wider acceptance all over the world as a specialty rice is called "Basmati rice". The unique feature of "basmati Rice" such as extra long slender grain, length wise excessive elongation on cooking, soft and fluffy texture of cooked rice, and pleasant aroma which together determine uniqueness of "Basmati Rice". Basmati rice is known as queen of rice and area under scented rice varieties is also increasing day by day with the opening of world market as well as domestic consumption **(Singh et al., 2008).** Unlike other aromatic rice's the unique quality traits of Basmati Rice" found there expression only when they are grown in the north western foot hills of Himalayas and parts of Punjab, Haryana, Jammu and Kashmir and Western parts of Uttar Pradesh in the Indian sub Continent. Indian has huge market for Basmati rice; they are highly demanded not only in Indian but in foreign countries as well.

However, the price of fine rice, especially the aromatic is 2-3 times higher than that of coarse rice **(Biswas et al., 1992).** Indian homes and kitchens have been using Basmati rice since the years and they have been exported all around in the world. Given the importance of nitrogen fertilization on the yield in grain from the rice plant, it is necessary to know what the best dose is for each variety as well as its influence on components of yield and other agronomic parameters such as the cycle, plant height, lodging and moisture content of the grain, in order to obtain better knowledge of said productive response.

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. It is crucial for individual farmer as well as to the country to get the maximum economic benefit out of a huge recurring expenditure. **(Tanaka et al., 1966)** showed that the height of a rice plant is positively correlated to the length of the maturation cycle. A taller plant is more susceptible to lodging and responds less well to nitrogen **(Yashida, 1981).** Panicles with a low percentage of sterile flowers permit the application of higher doses of nitrogen and produce better yields. Factors, like increased rates of fertilizer nitrogen, may increase the yield but reduce the quality of the grain **(Conry, 1995).** An adequate supply of nitrogen to the crop plants during their early growth period is very important for the initiation of leaves and florets **primordia (Yashida, 1978).**

Recommendation on nitrogen requirement for growing coarse rice is available, but in case of Basmati rice (aromatic and non-aromatic) such information is lacking. The present study was undertaken to find out the optimum level of nitrogen and to select high yield potential nitrogen responsive Basmati rice varieties for cultivation in kharif season.

METHODS AND MATERIALS

Field experiments were carried out for consecutive seasons of *kharif* 2012 and 2013 at farm of Basmati Export Development Foundation (BEDF), Meerut (29^{o}4' N, 77^{o}46' E, 237 m above sea level). The climate of the region is broadly classified as semi-arid subtropical, characterized by very hot summers and cold winters. The experiment was laid out in randomized block design with factorial replicated thrice. Seedlings of 22 days old were transplanted at 30 cm x 30 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 (50 and 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* 2012 and 2013. Main plot comprised of Nitrogen level *i.e.* 0, 40, 60 120 and 160 kg N/ha and subplots with the treatments consisted of four Basmati rice varieties *viz*., Pusa Basmati 1121, Pusa Basmati-1, Pusa Sugandha-5 and Taraori Basmati. Other agronomical was conducted as per standard recommendation for the crop and plant protection measures were followed.

The crop field was kept weed free by twice hand weeding over the crop period. Five destructive sample hills were collected from each individual plot outside the harvested area for recording plant height, tillers/m^2, panicle number, panicle length, grains/panicle and 1000-grain weight. The grain yield was adjusted to 14% moisture content and expressed in tons/ha. The straw was dried in the sun until complete drying and the weight was expressed in tons/ha. The grain and straw samples from every plot were analyzed for N concentration.

RESULTS AND DISCUSSIONS

Effect of Nitrogen Levels on Panicles

Rice plants produced more number of productive panicles per m^2 (364.71) as well as longest panicles (27.68 cm) where 160 kg nitrogen per hectare was applied which remained statistically at par with that obtained by nitrogen application levels between 40 to 120 kg per hectare. The lowest values of number of productive panicles per m^2 (238.80) and shortest panicles (26.32 cm) were recorded in control treatment with no fertilizer. The longer panicles obtained in treatments receiving higher nitrogen rates were probably due to better nitrogen status of plant during panicle growth period. Numbers of grains per panicle were more (63.14) at a nitrogen level of 160 kg/ha which remained statistically at par with that obtained by nitrogen application levels between 40 to 120 kg per hectare.

The lowest value of this parameter (54.74) was recorded in control treatment. Panicle weight was highest (2.18 g) in treatment getting 160 kg/ha nitrogen level which was statistically similar with that produced by each of the nitrogen level of 40, 60 and 120 kg/ha in which grain weight (2.06, 2.13 and 2.16 g respectively). Minimum grain weight (1.89 g) obtained in treatment where Zero kg/ha nitrogen used. Increase in grain weight at higher nitrogen rates might be primarily due to increase in chlorophyll content of leaves which led to higher photosynthetic rate and ultimately plenty of photosynthesis available during grain development. The similar results were found by the **Singh and Sharma (1987), Munda (1989), Maqsood (1998), Nawaz (1999) and Meena et al., (2003).**

GROWTH AND YIELD ATTRIBUTES

Pooled data of two years on growth and yield attributes were significantly superior over control. At maturity, the tallest plant was found where higher amount of nitrogen was applied. Similarly, higher number of tillers and dry matter were observed at higher levels of nitrogen. Application of 40 to 160 kg N/ha produced significantly similar panicle length and all were significantly superior over control (28.32 cm). Highest number of panicle/m^2 was recorded with 160 kg N/ha (364.71) which was found significantly superior over other treatments, followed by 120 kg N/ha which also was found significantly superior over 40, 80 kg N/ha and over control. Differences in panicle weight between 40 to 160 kg N/ha was found statistically at par. Highest panicle weight was recorded with 160 kg N/ha (2.18). Differences in filled grain /panicle between 120 kg N/ha and 160 kg N/ha was statistically similar and both were significantly superior over N @ 40, 80 kg N/ha and control. Significant increase in panicles/unit area due to N was also reported by **Reddy and Reddy (1989).**

The varieties differed significantly for growth and yield attributing characters. Highest values of panicle length (29.14 cm) Panicles/m^2 (340) were recorded with variety Pusa Sugandha -5 which was significantly superior over other varieties under test. However, the differences in panicle weight and filled grains /panicle between Pusa Sugandha-5 and Pusa Basmati 1121 varieties were statistically at par **(table-1).**

GRAIN AND STRAW YIELD

Graded levels of nitrogen had marked effect on grain and straw yield. Grain and straw yield increased with increase in N levels, however the differences in grain yield between 160 kg N/ha (44.68 q/ha) and 120 kg N/ha (43.53 q/ha) were statistically at par. Straw yield was increased significantly with an increase of nitrogen level up to 160 kg N/ha. Similar results were also reported by **Thakur (1989).** 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 **(Dalal & Dixit, 1987).** The improvement in panicle length, panicle/ m^2 and panicle weight was mainly responsible for higher yield with supply of nitrogen **(Singh and Singh, 1993).** The increase in grain yields at 40, 80, 120 and 160 kg N/ha over control was 21.05, 52.02, 114.6 and 120.31 per cent, respectively. Similar trend of results were also reported by **Thakur (1989).**

The varieties differed significantly in respect to grain and straw yield. Highest grain yield was recorded with variety Pusa Sugandha-5 (43.89 q/ha) which found significantly superior over other varieties. Lowest grain yield was found with Taraori Basmati (26.67 q/ha). The highest yield with Pusa Sugandha-5 was owing to more panicle/m^2. The results are in agreement with that of **Dalal and Dixit (1987).** Lower yield with Taraori Basmati was mainly due to less number of tillers and its lodging character. A similar trend of result was also found in respect to straw yield which are in conformity to that reported by **Dahatonde (1992).** The variation in grain yield among different varieties was due to the differential efficiency of these varieties in converting dry matter into grain. Similar findings were also reported regarding varietal performance under different nitrogen levels in rice by **Priydarshini and Prasad (2003) and Srilaxmi et al., (2005). Kanade and Kalra (1986) and Spanu and Pruneddu (1997)** also reported a highest paddy yield by nitrogen application of 150 kg/ha and 250 kg/ha, respectively.

CONCLUSIONS

Yield potential of a cultivar could be exploited to a maximum extent by judicious management of applied nitrogen. The actual yield advantage depends on the agronomic management including that of nitrogen management. As nitrogen deficiency is universal, significant yield increase due to nitrogen use is common. In general, about 10-12 kg of rice is obtained per every kg of applied nitrogen **(Pillai et al., 1976).** The higher paddy yield at higher nitrogen rates was also reported by **Marazi et al., (1993), Dixit and Patro (1994), Daniel and Wahab (1994), Bali et al., (1995), and Meena et al., (2003).**

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APPENDICES

Table 1: Yield Attributes and Yields of Rice as Effected by Nitrogen Levels and Varieties (Pooled Data of 2 Years)

Treatments	Panicle Length (cm)	Panicles/m^2	Panicle Weight (g)	Filled Grain/Panicle	Grain Yield (q/ha)	Straw Yield (q/ha)
Nitrogen Levels						
N_o	26.32	238.80	1.89	54.74	20.28	47.63
N_{40}	27.24	294.44	2.06	56.18	24.55	53.27
N_{60}	27.54	332.45	2.13	58.10	30.83	61.68
N_{120}	27.64	347.18	2.16	60.66	43.53	85.55
N_{160}	27.68	364.71	2.18	63.14	44.68	90.89
C D at 5%	0.52	13.68	0.20	4.24	0.72	1.70
Varieties						
Pusa Basmati 1121	28.14	325.67	2.14	62.12	41.24	82.68
Pusa Basmati -1	26.68	306.32	2.10	57.24	39.88	80.14
Pusa Sugandha-5	29.14	340.54	2.24	66.42	43.89	87.26
Taraori Basmati	26.32	289.88	1.70	45.80	26.67	58.12
C.D. at 5%	0.45	10.66	0.14	3.23	1.64	2.34