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## RESPONSE OF BASMATI RICE (*Oryza sativa* L.) TO NITROGEN LEVELS UNDER DIFFERENT TIMES OF APPLICATION

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### ABSTRACT

A field experiment was conducted during the *kharif* season of 2019 at Agriculture Research Farm of School of Agricultural Science and Technology, RIMT University, Mandi Gobindgarh, Punjab to study the response of basmati rice (*Oryza sativa* L.) to nitrogen levels under different times of application. The experiment was laid out in a Randomized Complete Block Design (RCBD) in three replications with three nitrogen levels viz. 75, 100 and 125% RDN (Recommended Dose of Nitrogen). The growth parameters of Punjab Basmati-5 varied significantly due to different levels of nitrogen and times of application. The result revealed that application of 125% RDN recorded significantly higher growth parameters such as plant height (115.3 cm), number of tillers hill<sup>-1</sup> (15.6) and number of panicles hill<sup>-1</sup> (13.8), over 75% RDN but which were on par with 100% RDN. Significantly higher grain yield (48.8 q ha<sup>-1</sup>) were obtained with application of 125% RDN than 75% RDN which was 27.3 per cent and 10 per cent higher, respectively. The application of nitrogen in two splits viz. 3 and 6 weeks after transplanting produced significantly less yield attributes than the application of nitrogen in three splits. Similarly, grain yield was significantly higher in three splits of nitrogen application than two splits (37.0 q ha<sup>-1</sup>). However, among the application of nitrogen in three splits viz. 2, 4 and 6 weeks after transplanting recorded the higher grain yield (46.6 q ha<sup>-1</sup>) than three splits viz. 1, 3 and 5 after transplanting (42.9 q ha<sup>-1</sup>). Interaction between nitrogen levels and time of application was non-significant in all the parameters.

**Keywords:** Basmati rice, nitrogen level, growth parameters, yield attributes and yield.

### INTRODUCTION

Rice is the most dominating *kharif* crop enterprise in Punjab. Presently, Basmati varieties are preferred over rice and occupy about 20 per cent rice area within the state (Anonymous, 2011). Rice crop occupied 31.42 lakh hectares in Punjab with total production of 189.18 lakh tonnes (126.75 lakh tonnes of rice) during 2019-20. The typical yield of paddy was 60.21 quintals per hectare (Anonymous, 2021). The productivity of Basmati rice (*Oryza sativa* L.) is very low as compared to rice which can be enhanced to some extent with the efficient utilization of nitrogen as nitrogen management results in poor nutrient supply capacity of soil and use efficiency of the applied fertilizer. Suitable nitrogen management is essential for rice as the nitrogen use efficiency is in the range of 40 to 60 per cent application of nitrogen at right time is perhaps the simplest agronomic solution for improving the use efficiency of nitrogen (Ganga Devi *et al.*, 2012 and Datta *et al.*, 1979). So, it is essential to evaluate the location specific nutrient management to restore the nutrient balance in soil and to sustain the crop productivity. Keeping these in view, the present study entitled "Response of Basmati rice (*Oryza sativa* L.) to nitrogen levels under different times of application" was undertaken.

### MATERIALS AND METHODS

The experiment was carried out during the *kharif* season 2019-20 at the Agricultural Research Farm, RIMT University, Mandi Gobindgarh, Punjab. The experimental field is located at 30.6642' N latitude and 76.2914' E longitude at an altitude of 268 meters above mean sea level. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The site was low in organic carbon (0.38%) and available nitrogen (144.6 kg N ha<sup>-1</sup>) medium in available phosphorus (17.3 P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) and potassium (168 kg K<sub>2</sub>O ha<sup>-1</sup>). The treatments comprised three nitrogen levels viz. 70, 100 and 125 kg N ha<sup>-1</sup> in two splits viz. 3 and 6 weeks after transplanting and three splits viz. 1, 3 and 5 weeks after transplanting and 2, 4 and 5 weeks after transplanting. Twenty kg seed per hectare was used for sowing. All the cultural practices were followed uniformly in the treatments. The gross plot size was 4.0m × 3m and net plot size was 3.6m × 2.7m. The crop was sown on June 12, 2019, transplanted on July 13, 2019, and harvested on November 11, 2019.

### RESULTS AND DISCUSSION

#### Growth parameters

The application of nitrogen levels and its time of application did not influence the plant population of Basmati

rice significantly (Table 1). Salahuddin *et al.* (2009) also reported no response of plant population.

The plant height was influenced significantly with application of nitrogen levels and its time of application (Table 1). Significantly higher plant height (115.3 cm) was recorded with the application of 125% recommended dose of nitrogen (RDN) over 75% recommended dose of nitrogen (RDN) i.e. 108.4 cm and application of 100% recommended dose of nitrogen (RDN) i.e. 113.2 cm. Among different times of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 weeks after transplanting (WAT) i.e. 115.9 recorded significantly higher plant height than two splits viz. 3 and 6 weeks after transplanting (WAT) i.e. 108.7 cm and three splits viz. 1, 3 and 5 weeks after transplanting (WAT) i.e. 113.8 cm. The increase in plant height with increased nitrogen application might be due to enhanced vegetative growth with more nitrogen supply to plant. Hossain *et al.* (2008) stated that the increase in plant height was due to various physiological processes including cell division and cell elongation of the plant. The interaction between nitrogen levels and time of application was found non-significant. Singh and Sharma (1987) reported that application of 180 kg N ha<sup>-1</sup> resulted in higher plant height of Basmati rice. Maqsood (2013) also reported similar results.

The tillers hill<sup>-1</sup> were influenced significantly with application of nitrogen level and its time of application (Table 1). Significantly higher tillers hill<sup>-1</sup> (15.6) were recorded with the application of 125% RDN over 75% RDN (11.4) but was on par with the application of 100% RDN (14.5). Among different times of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 WAT (15.7) recorded significantly higher tillers hill<sup>-1</sup> than two splits viz. 3 and 6 WAT (11.9) and three splits viz. 1, 3 and 5 WAT (14.8). The increase in number of tillers hill<sup>-1</sup> by increased nitrogen application might be attributed to more nitrogen supply to plant at active tillering stage. Non-significant interaction between effect of nitrogen levels and time of application was recorded. Similar results were also reported by Meena *et al.* (2003).

#### Yield attributes

The panicles hill<sup>-1</sup> was influenced significantly with application of nitrogen level and its time of application (Table 1). Significantly higher panicles hill<sup>-1</sup> (13.8) were recorded with the application of 125% RDN over 75% RDN (10.1) and the application of 100% RDN (13.2). Among different times of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 WAT (14.0) recorded significantly higher panicles hill<sup>-1</sup> than two splits viz. 3 and 6 WAT (10.4) and three splits viz. 1, 3 and 5 WAT (13.4). Anonymous (2002) also observed that increasing trend of panicle at the higher levels of nitrogen. The interaction between nitrogen levels and time of application was found non-significant.

The grains panicle<sup>-1</sup> was also influenced significantly with application of nitrogen level and its time of application (Table 1). Significantly higher grains panicle<sup>-1</sup> (124.3) were recorded with the application of 125% RDN over 75% RDN (118.7) and application of 100% RDN (123.5). Among different time of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 WAT (125.2) recorded significantly higher plant height than two splits viz. 3 and 6 WAT (119.7) and three splits viz. 1, 3 and 5 WAT (124.6). More number of grains per panicle obtained in treatments receiving higher

nitrogen rates were probably due to better nitrogen status of plant during panicle growth period. Non-significant interaction between effect of nitrogen levels and times of application was recorded. Rahman *et al.* (2007) also recorded the higher number of grains panicle<sup>-1</sup> at higher nitrogen rate might be due to higher nitrogen absorption which favored formation of higher number of tiller panicle<sup>-1</sup>.

Nitrogen levels and times of application did not influence significantly in 1000 grains weight (Table 1). Islam *et al.* (2008) also reported that weight of 1000 grain weight was not significantly influenced by nitrogen level. Tayefe *et al.* (2014) and Siddique *et al.* (2014) also found no significant effect of nitrogen on 1000 grains weight.

#### Yield parameters

The grain yield was influenced significantly with application of nitrogen level and its time of application (Table 1). Significantly higher grain yield (48.0 q ha<sup>-1</sup>) was recorded with the application of 125% RDN recorded 27.3 per cent and 10 per cent higher grain yield of Basmati rice than 100% RDN (43.6 q ha<sup>-1</sup>) and 75% RDN (37.7 q ha<sup>-1</sup>). Among different times of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 WAT (46.6 q ha<sup>-1</sup>) recorded significantly higher grain yield than the application of nitrogen in three splits viz. 1, 3 and 5 WAT (42.9 q ha<sup>-1</sup>) and application of nitrogen in two splits viz. 3 and 6 WAT (37.0 q ha<sup>-1</sup>). The magnitude of increase in grain yield was 8.6 per cent and 25.9 per cent, respectively. Increase in grain yield was might be due to highest number of grains per panicle at this nitrogen rate. Non-significant interaction between effect of nitrogen levels and time of application was recorded. Kanade and Kalra (1986) also reported a highest grain yield by nitrogen application of 150 kg/ha and 250 kg/ha, respectively. Koutroubas and Ntanos (2003) also reported that increasing nitrogen level enhanced grain yield.

The biological yield was influenced significantly with application of nitrogen level and its time of application (Table 1). Significantly higher biological yield (146.1 q ha<sup>-1</sup>) was recorded with the application of 125% RDN over 100% RDN (138.9 q ha<sup>-1</sup>) and 75% RDN (125.9 q ha<sup>-1</sup>) was 5.1 per cent and 16 per cent, respectively. Among different times of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 WAT (147.3 q ha<sup>-1</sup>) recorded significantly higher grain yield than the application of nitrogen in three splits viz. 1, 3 and 5 WAT (138.5 q ha<sup>-1</sup>) and application of nitrogen in two splits viz. 3 and 6 WAT (125.1 q ha<sup>-1</sup>). The biological yield increased by 6.3 per cent and 17.7 per cent with increase in nitrogen from 75 and 100 % RDN to 125% RDN, respectively. Increase in biological yield might be due to the increased numbers of grain yield and straw yield. Adhikari *et al.* (2018) also reported that biological yield was significantly affected due to the application of nitrogenous fertilizer. The interaction between nitrogen levels and time of application was found non-significant.

The harvest index was influenced significantly with the application of nitrogen levels and its time of application (Table 1). Significantly higher harvest index (33.0) was recorded with the application of 125% RDN over 75% RDN (31.0) but which was on par with the application of 100 kg N ha<sup>-1</sup> (32.3). Among different times of application of nitrogen, nitrogen in three splits viz. 2, 4 and 6 WAT (33.0) recorded significantly higher harvest index than two splits viz. 3 and 6 WAT (31.1) but was at par with three splits viz. 1, 3 and 5

WAT (32.3). Meena *et al.* (2019) also obtained that maximum value of harvest index (45.7) with application of 150 kg N/ha in rice. Adhikari *et al.* (2018) and Siddique *et al.* (2014) also reported similar results.

### CONCLUSION

It may be concluded that higher grain yield of Basmati rice can be obtained with the nitrogen level of 125% RDN

(48.0 kg N ha<sup>-1</sup>) over 100% RDN and 75% RDN. Among the application of nitrogen, nitrogen applied in three splits viz. 2, 4 and 6 weeks after transplanting (46.6q ha<sup>-1</sup>) recorded the higher grain yield than three splits viz. 1, 3 and 5 weeks after transplanting and two splits viz. 3 and 6 weeks after transplanting.

**Table 1:** Effect of nitrogen levels and times of application on growth parameters, yield attributes and yield of Basmati rice (*Oryza sativa* L.)

Treatments	Plant population (m <sup>2</sup> )	Plant height (cm)	Tillers/hill	Panicle/hills	Grains/panicle	1000-grains weight (g)	Grain yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
Nitrogen levels (kg N/ha)									
70% RDN	30.1	108.4	11.4	10.1	118.7	30.6	37.7	125.9	31.0
100% RDN	30.2	113.2	14.5	13.2	123.5	30.9	43.6	138.9	32.3
125% RDN	30.4	115.3	15.6	13.8	124.3	31.2	48.0	146.1	33.0
CD at 5%	NS	1.43	0.53	0.38	0.61	NS	2.83	3.22	0.08
Times of application									
3 and 6 WAT	30.2	108.7	11.9	10.4	119.7	30.8	37.0	125.1	31.1
1, 3 and 5 WAT	30.4	113.8	14.8	13.4	124.6	31.4	42.9	138.5	32.3
2,4 and 6 WAT	30.6	115.9	15.7	14.0	125.2	31.8	46.6	147.3	33.0
CD at 5%	NS	1.43	0.53	0.38	0.61	NS	2.83	3.22	0.08
CD interaction at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	1.69	5.84	4.68	4.35	5.89	1.86	4.82	6.43	1.93

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