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Effect of different plant spacings and nitrogen levels on growth and productivity of basmati rice (*Oryza sativa* L.) For Bathinda District of Punjab

Guranditta Singh and Karan Verma

Abstract
A Field experiment entitled "Effect of different plant spacings and nitrogen levels on growth and productivity of basmati rice (*Oryza sativa* L.) for Bathinda District of Punjab" was conducted during *Kharif* 2021 at Research Farm, Guru Kashi University, Talwandi Sabo, Bathinda (Punjab) to investigate the effect of plant spacing and nitrogen levels on yield and attributes yield of basmati rice. The experiment comprised of three plant spacing *viz.*, 20 cm × 20 cm, 20 cm × 15 cm, and 15 cm × 15 cm and five nitrogen levels *viz.* 0, 75, 100 and 125 % RDN. The results revealed that wider spacing *i.e.* 20 cm × 20 cm significantly enhanced the plant growth parameters *viz.,* plant height, dry matter, number of tillers per meter row length and yield attributing characters *viz.,* number of effective tillers per meter row length, panicle length, number of grains per panicle and test weight than closer spacing *i.e.* 15 cm × 15 cm in basmati rice. Maximum grain yield (43.7 q/ha)was produced in wider spacing *i.e.* 20 cm × 20 cm which was statistically at par with spacing of 20cm×15 cm and significantly higher than closer spacing i.e.15cm×15cm. Plant spacing of 20 cm × 20 cm recorded 2.58% and 8.17% higher grain yield than 20 cm × 15 cm and 15 cm × 15 cm, respectively. Nitrogen @ 125% RDN significantly increased the plant growth *viz.,* plant height, dry matter, number of tillers per m row length and yield attributing characters *viz.,* number of effective tillers per m row length, panicle length, number of grains/panicle and test weight than control (no fertilizer) and nitrogen @ 75% RDN in basmati rice. Nitrogen @125% RDN and nitrogen @ 100% RDN recorded statistically similar grain yield, straw yield and harvest index in basmati rice and were significantly higher than control and nitrogen @ 75% Recommended dose of nitrogen. Nitrogen level @ 125% RDN resulted in 20.8, 4.43 and 1.82% higher grain yield than control, nitrogen @ 75% Recommended of nitrogen and nitrogen level @ 100% Recommended dose of nitrogen.

Keywords: Basmati rice, grain yield, nitrogen, plant spacing and straw yield

Introduction

Indian mustard (*Brassica juncea* L.) is an important *Rabi* oilseed crop extensively grown as rainfed crop in India. Mustard oil meets the one third of edible oil requirement of the country, to meet these needs the country highly depends on imports of vegetable oil. Import of vegetable oils during July 2019 is up by 26% to 14.12 lakh tones as compared to 11.19 lakh tones in July 2018, according to data compiled by the Solvent Extractors' Association of India (SEA). There is a need to decrease the Import of vegetable oils by expanding the area under oil seed crops. It is important to increase the yields of mustard crop by improving the available germplasm lines, for that we need to know various yield contributing characters and the relationship among them and with the seed yield. In this experiment, we studied correlation or mutual association among different yield contributing characters and the direct and indirect effects also estimated through path coefficient analysis. The inter-relationship between the yield components will be helpful to a breeder to assess the nature, extent and direction of selection pressure on characters.

Basmati rice is known as queen of rice and area under basmati rice is enhancing in world market and domestic consumption (Singh *et al.* 2008) [7].

Aromatic (basmati) rice enjoys a special place both in domestic as well as the international trade (Gupta and Kumar 2008) [3]. The leading aromatic fine quality rice in the world trade, popularly known as basmati, is traditionally grown in the north and north western part of Indian sub-continent (DRR 1992) [2]. The major share of basmati production (50-70%) is exported from India.

Plant spacing is an important factor that needs to be considered during transplanting of basmati rice.

Basmati rice plants compete among themselves for space, nutrients, water, sunlight, air another factors such as photosynthesis and respiration under densely planted condition. Proper spacing may help receive maximum Leaf Area Index (LAI), light interceptions etc. are better for photosynthesis as well as yield of rice. Optimum plant spacing confirms under ground parts through efficient utilization of solar radiation and nutrients (Miah *et al.* 1990) [5].

Nitrogen is the key element in the production of basmati rice and gives by far the largest response. It is an essential plant nutrient that plays a significant role in growth, yield and quality of basmati rice. The important role of nitrogen fertilizers in increasing rice yields has been widely recognized, particularly after the development of modern varieties. Nitrogen is an integral part of protoplasm, protein and chlorophyll and plays a remarkable role in increasing cell size which in turn increases yield. Excess amount of nitrogenous fertilizer results in lodging of plants, prolonging growing period, delayed in maturity, susceptibility to insect-pests and diseases, ultimately reduces yield (Uddin 2003) [9].

Thus, keeping these points in view the experiment entitled “Effect of different plant spacings and nitrogen levels on growth and productivity of basmati rice (*Oryza sativa* L.) for Bathinda district of Punjab” was undertaken with the following objectives:

To study the effect of different crop geometry and nitrogen levels on growth and yield of basmati rice.

Materials and Methods

The field experiment on rice crop entitled “Effect of different plant spacings and nitrogen levels on growth and productivity of basmati rice was conducted during *kharif* season 2021 at research farm of Department of Agronomy (UCOA), Guru Kashi University, Talwandi Sabo, Bathinda (Punjab). The experiment was laid out in split plot design with three replication and twelve treatments viz. Main plot: Plant spacing (3): S1: 15cm×15cm, S2: 20cm×15 cm and S3: 20cm×20 cm Subplot: Nitrogen levels: N1: Control (0 kg N/ha), N2: 75% of RDN (31.5 kg N/ha), N3 100% of RDN (42 kg N/ha) and N4: 125% of RDN (52.5 kg N/ha).

Result and Discussion

Growth parameters

Plant height (cm)

The results regarding plant of basmati rice showed that plant height at tillering stage, panicle initiation stage and at maturity was significantly influenced by different nitrogen application treatments (Table 1,2and 3). Maximum plant height was recorded in treatment where 125% RDN was applied to basmati rice crop which remained statistically at par with that obtained by nitrogen application levels of 100% RDN and it was significantly higher than control and 75% RDN. However, minimum plant height (38.0 59.0 and 97.7 cm), was achieved in control treatment where no fertilizer was applied at tillering stage, panicle initiation stage and at maturity, respectively. The increase in plant height with increased N application might be primarily due to enhanced vegetative growth with more nitrogen supply to plant. Singh and Sharma (1987) [8] reported that application of 180 kg N/ha resulted in higher plant height of rice.

Table 1: Plant height of basmati rice at tillering stage influenced by different plant spacings and nitrogen levels

Plant height (cm) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	35.2	37.7	39.8	41.7	38.6
20x15	39.2	42.8	44.2	44.4	42.7
20x20	39.7	43.1	45.0	45.5	43.3
Mean	38.0	41.2	43.0	43.9	41.5

CD(P=0.05) Plant spacings(S):1.5 Nitrogen levels (N): 1.6
Interaction(S×N) : 0.8

Table 2: Plant height of basmati rice at panicle initiation stage as influenced by different plant spacings and nitrogen levels

Plant height (cm) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	57.0	59.6	60.4	60.7	59.4
20x15	59.5	62.0	62.4	62.5	61.6
20x20	60.6	63.5	64.2	64.8	63.3
Mean	59.0	61.7	62.3	62.7	61.4

CD (P=0.05) Plant spacings (S): 1.2 Nitrogen levels (N): 0.9
Interaction (S×N) : 1.0

Table 3: Plant height of basmati rice at maturity as influenced by different plant spacings and nitrogen levels

Plant height (cm) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	96.2	99.7	102.5	102.6	100.3
20x15	98.1	101.0	107.8	108.3	103.8
20x20	98.7	103.6	109.3	109.5	105.3
Mean	97.7	101.4	106.5	106.8	103.1

CD (P=0.05) Plant spacings (S): 3.1 Nitrogen levels (N): 2.4
Interaction (S×N) : 1.2

Interaction between plant spacing and N levels was also found to be significant for Plant height. Row spacings of 20×20 cm with nitrogen level of 100 and 125% of RDN produced statically similar plant height and it was significantly higher than all other combinations of spacing and N levels.

Dry matter accumulation

The data pertaining to dry matter accumulation have been given in the Table 4 and 5 Dry matter accumulation decreased with decreasing plant spacing. Wider spacing (20cm×20cm) recorded the highest dry matter accumulation at tiller stages and panicle initiation stages which was significantly higher than closer spacing (15cm×15cm) but it was at par with plant spacing of 20 cm × 15 cm. Mirza *et al.* (2007) studying the effect of dry matter production in transplanted rice as affected by spacing and observed that wider spacing accumulated maximum amount of dry matter, emphasizing that productivity of tillers as well as dry matter yield was lower with closer spacing and transplanting single seedlings per hill.

Table 4: Dry matter accumulation of basmati rice at tillering stage as influenced by different plant spacings and nitrogen levels

Dry matter accumulation (g/m^2) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	123.1	142.5	154.8	160.6	145.3
20x15	130.2	145.1	158.6	163.0	149.2
20x20	135.8	148.8	160.1	165.8	152.6
Mean	129.7	145.5	157.8	163.1	149.0

CD (P=0.05) Plant spacings (S): 5.1 Nitrogen levels (N): 10.2
Interaction (S×N) : 4.1

Table 5: Dry matter accumulation of basmati rice at panicle initiation stage as influenced by different plant spacings and nitrogen levels

Dry matter accumulation (g/m^2) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	630.0	662.6	674.1	683.1	662.5
20x15	645.1	668.3	685.4	693.3	673.0
20x20	650.6	672.4	689.0	698.1	677.5
Mean	641.9	667.8	682.8	691.5	671.0

CD (P=0.05) Plant spacings (S): 6.0 Nitrogen levels (N): 12.8
Interaction (S×N) : 5.0

Number of effective tillers per meter row length

The data pertaining to number of effective tillers per meter row length have been given in the Table 6. Maximum number of tillers per meter row length were recorded in wider spacing (20 cm × 20 cm), being at par (20 cm × 15 cm) but it was significantly higher than closer spacing (15 cm × 15 cm). There was a significant increase in the number of effective tillers with increased spacing. Mirza *et al.* (2009) [6] observed that closer spacing reduced the number of effective tillers and increased tiller mortality.

Table 6: Number of effective tillers per meter row length of basmati rice as influenced by different plant spacings and nitrogen levels

Number of effective tillers per meter row length Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	55.4	70.2	74.0	77.1	69.2
20x15	65.1	74.1	80.3	80.5	75.0
20x20	68.5	76.4	80.5	82.4	77.0
Mean	63.0	73.6	78.3	80.0	73.7

CD (P=0.05) Plant spacings (S): 2.7 Nitrogen levels (N)
Interaction (S×N) : 1.5

Panicle length (cm)

The data pertaining to panicle length have been given in the Table 7. Maximum panicle length was obtained in wider spacing (20 cm × 20 cm), which was significantly higher than closer spacing (15 cm × 15 cm) but it was statistically at par (20 cm × 15 cm). Minimum panicle length was recorded in 15 cm × 15 cm treatment. Maximum panicle length (24.7 cm) in basmati rice was recorded in 125% RDN which was significantly higher than control and 75% RDN but it was statistically at par with 100% recommended dose of nitrogen. The shortest panicles (18.6 cm) were recorded in control treatment receiving no fertilizer. These results were in line with those reported by Meena *et al.* (2003) [4]

Table 7: Panicle length (cm) of basmati rice as influenced by different plant spacings and nitrogen levels

Panicle length (cm) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	16.2	22.0	23.0	23.8	21.3
20x15	19.4	23.3	23.5	24.2	22.6
20x20	20.3	23.9	25.8	26.0	24.0
Mean	18.6	23.1	24.1	24.7	22.6

CD (P=0.05) Plant spacings (S): 2.4 Nitrogen levels (N): 1.0
Interaction (S×N) : NS

Number of grains per panicle

The data pertaining to number of grains per panicle have been presented in the Table 8. The data indicated that there was significant difference among row spacings for number of grains per panicle. Maximum number of grains per panicle was produced in 20cm×20cm (126.9) which were statistically at par with 20 cm × 15 cm and it significantly higher than15 cm × 15 cm. Similar results were reported by Awan *et al.* (2007). The 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.

Table 8: Number of grains per panicle of basmati rice as influenced by different plant spacings and nitrogen levels

Number of grains per panicle Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	117.1	123.2	126.2	126.6	123.3
20x15	120.0	125.3	128.2	129.2	125.7
20x20	122.1	126.9	128.9	129.5	126.9
Mean	119.7	125.1	127.8	128.4	125.3

CD (P=0.05) Plant spacings (S): 2.0 Nitrogen levels (N): 2.5
Interaction (S×N) : NS

Test weight (g)
The data pertaining to test weight in basmati rice have been given in the Table 9. The test weight was affected significantly with plant spacing. Maximum test weight (28.2 g) was obtained in wider spacing (20 cm × 20 cm), which was significantly higher than closer spacing (15 cm × 15 cm) but it was statistically at par (20 cm × 15 cm). Minimum test weight was recorded in wider spacing. When there are more spacing there will be more air, light and inputs availability. Owing to this reason test weight was maximum at wider spacing as compared to closer spacing.

Table 9: Test weight (g) of basmati rice as influenced by different plant spacings and nitrogen levels

Test weight (g) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	22.1	25.2	27.5	27.9	25.7
20x15	23.2	26.4	29.8	29.9	27.3
20x20	25.4	26.9	30.1	30.5	28.2
Mean	23.6	26.2	29.1	29.4	27.1

CD (P=0.05) Plant spacings (S): 2.0 Nitrogen levels (N): 2.5
Interaction (S×N) : N

Grain yield
The data pertaining grain yield have been given in the Table 10. The results indicated that basmati rice yield was significantly affected by row spacing and nitrogen levels. Maximum grain yield (43.7 q/ha) was recorded in wider spacing *i.e.* 20 cm ×20 cm which was statistically at par with spacing of 20 cm × 15 cm and significantly higher than closer spacing i.e. 15 cm × 15 cm. Plant spacing of 20 cm × 20 cm recorded 2.58% and 8.17% higher grain yield than 20cm× 15cm and15cm× 15cm, respectively. The Nitrogen levels significantly influenced the grain yield in basmati rice. Nitrogen level of 125 % RDN recorded the highest grain yield (44.8q/ha) which was significantly higher than control and nitrogen 75% RDN but it was statistically at par with nitrogen level 100 % RDN. The highest grain yield at nitrogen application 125% RDN was due to highest number of grains per panicle and 1000-grain weight at this nitrogen rate.

Table 10: Grain yield of basmati rice as influenced by different plant spacings and Nitrogen levels

Grain yield (q/ha) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	35.2	40.9	42.1	43.2	40.4
20x15	37.1	43.1	44.9	45.1	42.6
20x20	38.9	44.6	45.0	46.2	43.7
Mean	37.1	42.9	44.0	44.8	42.2

CD (P=0.05) Plant spacings (S): 1.7 Nitrogen levels (N): 1.5
Interaction (S×N) : 1.0

Straw yield (q/ha)
The data pertaining straw yield have been given in the Table 11. It is obvious from the data that maximum straw yield of basmati rice yield was in wider spacing i.e. 20 cm × 20cm which was statistically at par with spacing of 20 cm × 15 cm and significantly higher than closer spacing i.e. 15 cm × 15 cm. Nitrogen levels significantly influenced the straw yield in basmati rice. Nitrogen level of 100% RDN the highest straw yield which was significantly higher than control and nitrogen 75% RDN but it was statistically at par with nitrogen level 125% RDN. The lowest straw yield was recorded in control treatment.

Table 11: Straw yield of basmati rice as influenced by different plant spacings and Nitrogen level

Straw yield (q/ha) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	79.7	90.1	89.1	88.7	86.9
20x15	78.1	91.0	94.2	93.2	89.1
20x20	82.1	91.8	94.3	95.0	90.8
Mean	80.0	91.0	92.5	92.3	88.9

CD (P=0.05) Plant spacings (S): 0.6 Nitrogen levels (N): 2.0
Interaction (S×N) : 1.1

Harvest index
The data pertaining harvest index have been given in the Table 12. The plants pacing differed non-significantly in harvest index. Although, the highest values of harvest index was found in wider spacing (20 cm × 20 cm) and lower values were obtained in closer spacing of 15 cm × 15 cm. Accordingly out of different levels of nitrogen, nitrogen 125% and100% recorded statistically similar harvest index values and were significantly higher than control and 75% RDN level.

Table 12: Harvest index (%) of basmati rice as influenced by different plant spacings and Nitrogen levels

Harvest index (%) Nitrogen levels (% of RDN)					
Plant spacing (cm)	**0**	**75**	**100**	**125**	**Mean**
15x15	30.64	31.21	32.10	32.75	31.68
20x15	32.20	32.14	32.28	32.60	32.31
20x20	32.14	32.70	32.30	32.72	32.47
Mean	31.66	32.02	32.23	32.69	32.15

CD (P=0.05) Plant spacings (S): NS Nitrogen levels (N): 0.51
Interaction (S×N) : NS

Conclusion
It may be concluded that wider spacing *i.e.* 20cm × 20cm significantly enhanced the plant growth parameters, yield attributing characters and productivity in basmati rice. Plant spacing of 20cm × 20cm recorded 2.58% and 8.17% higher grain yield than 20cm × 15cm and 15cm × 15cm, respectively. Among nitrogen levels, nitrogen 125% RDN

significantly increased the plant growth, yield attributing characters and productivity in basmati rice. Nitrogen 125% RDN and nitrogen 100% recorded statistically similar grain yield, straw yield and harvest index in basmati rice and were significantly higher than control and nitrogen 75% RDN.
Nitrogen level 125% RDN resulted in 20.8, 4.43 and 1.82% higher grain yield than control, nitrogen 75% RDN and nitrogen level 100% RDN.

References

1. Awan, Manzoor Z TH, Zahid MA, Faiz FA. Response of Rice crop (Super Basmati) to different Nitrogen levels. Journal of Animal and Plant Sciences, 2006, 16 (1- 2).
2. DRR, (Directorate of Rice Research) (1992).Basmati rice, Hyderabad, 1992, 4-18.
3. Gupta KR, Kumar R. Inheritance of photoperiodic response in basmati rice. Agricultural Science Digest. 2008;28(1):65–66.
4. Meena SL, Surendra S, Shivay YS, Singh S. Response of hybrid rice (Oryza sativa) to nitrogen andpotassium application in sandy clay loam soils. Indian Journal of Agronomy. 2003;73(1):8-11.
5. Miah MHN, Karim MA, Rahman MS, Islam MS. Performance of Nizersail mutants under different row spacing. Bangladesh Journal of Training and Development. 1990;3(2):31–34.
6. Mirza H, Kamrunt N, Roy TS, Rahman ML, Hossain MZ, Ahmed JU. Tiller dynamics and dry matter production of transplanted rice as affected by plant spacing and number of seedlings per hill. Academic Journal of Plant Science. 2009;2(3):162-168.
7. Singh RP, Singh N, Mehta S, Godara A. Adoption of fertilizers and weedicides in basmati paddy crop in productivity in rice (*Oryza sativa*) and wheat (*Triticum aestivum*) system. Indian Journal of Agronomy. 2008;48(1):8-11.
8. Singh KN, Sharma DK. Response to nitrogen of rice in sodic soil. Inter. Rice Research News Letter. 1987;12(3):45.
9. Uddin MH. Effect of plant spacing and Nitrogen levelson yield of transplanted Aman rice cv. BR39. MSc Thesis, Dept. Agron. Bangladesh Agric. Univ., Mymensingh, 2003, pp. 16–44.