Effect Of Different Levels Of Nitrogen On Growth And Yield Attributes Of Different Varieties Of Basmati Rice (*Oryza Sativa L.)*

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ABSTRACT : A field trail was conducted during rainy season at crop research farm Allahabad agriculture institute (Deemed university) to evaluate the effect of different levels of nitrogen on growth and yield attributes of different varieties of Basmati Rice (***Oryza Sativa L.*****)**. The varieties which was evaluated were Haryana Basmati-1 , Basmati -370 and Pusa basmati -1 under three different fertility levels viz; 100 , 120 and 140 the combinations was replicated three times in factorial 3^2 (RBD). The varietal trial indicates that Pusa Basmati- 1 at nitrogen -120 level was significantly different from all the parameters measured which include plant height number of tillers/hill , dry weight , length of panicle , number of filled grains / panicle , straw yield , biological yield , harvest index, benefit cost ratio and grain yield of 4.66 tonnes / hectare at level nitrogen level-120 , 3.10 tons / hectare at nitrogen level -120 were maximum and minimum in Pusa basmati -1 and Basmati -370 respectively .

Index Terms: Basmati rice, nitrogen levels, varieties, Economic analysis and benefit cost ratio.

1 Introduction

The rice is the most widely grown cereal crop and is stable food for more than half of the world's population .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" .Aside their cooking quality , "Basmati Rice's" are also reported to have low glecemic index and are micro nutrient rich epically for iron and zinc [3]. 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 in the Indian sub Continent . Basmati has attained "Heritage rice" status as it is considered as "Farmers Cultivar" being maintained and grown by farmers of Punjab regions of India and Pakistan . In India its different varieties are mostly cultivated in the districts of karnal , Panipat , Kurukshetra, Kaithal , Amritsar, Fatahgarh, Gurdaspur , Hoshairpor , Jalandhar , Patiala and Sangruoor in Punjab ,Kangra , Solen,una , Mandi in Himachal Pardesh Bundi in Rajasthan and in several districts of Uttarpardesh . Basmati is grown in limited areas of extent in Jammu and Kashmir also [1].

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There is substantial increase of Basmati in traditional Basmati growing areas .The largest areas under Basmati Rice is in Haryana 60% . Followed by UP 17.1% and Punjab 16.1% . During 1998-99 the state contributed nearly 55% of the total Basmati rice production in the country followed by UP at 23.5% and Punjab at 12.4%. The productivity ranges from 15-18 qunatial / hectare . The less production of Basmati rice is known for its tall and week stature of the plant causing lodging besides susceptibility of pests and diseases and less number of spikelets /panicle [2].

2 MATERIALS AND METHODS

The experiment was carried out at the crop research farm Allahabad agriculture institute (Deemed University). The experiment site lies between 25- 27° N latitude, 8.5°E Longitude and 98 meters altitude. The climate is characterized by the alternate hot rainy season from late June to early September with mean temperature of 38°C. The soil was sandy loam in texture with PH of 8.0 containing 160.12 available nitrogen 2.21 available phosphorus and 263.27 available potassium kg / hectare. Three varieties Haryana Basmati -1 , Basmati -370 and Pusa Basmati -1 , Nitrogen levels 100, 120 and 140 was replicated three times factorial 3^2 randomized block design. Nursery was prepared twenty five days before transplanting. Thirteen varieties were sown in nursery and three varieties were selected for the varietal trail . Field preparation was done by giving one ploughing followed by harrowing after puddling the field . The twenty five days seedling was transplanted at the spacing of 20 cm(R X R) and 15 cm(P x P). To seedlings at the depth of 2-3 cm depth was transplanted . Entire dose of phosphorus and potassium as diammonium phosphate and murates of potash was applied as a basal dose and half of nitrogen was incorporated thoroughly into the soil at the time of final puddling , remaining the half quantity of nitrogen one fourth at 25 days at maximum tillering and one fourth at 55 days a panicle initiation . 5cm water was maintained in the field epically from tillering to hard dough stage. Two normal hand weeding was done with the help of "Khurpi" after 30 days after transplanting and 50 days after transplanting one quadrate (1 m)^2 was harvested in every plot for the

determination of results . The data collected were plant height , number of tillers /hill , Dry matter, length of panicle , number of filled grains / panicle , grain yield , straw yield , biological yield , harvest index , test weight economic analysis and BCR .The data was subjected to statistical analysis of variance using SAS software .

3 RESULTS AND DISCUSSION

Plant height is not a yield component especially in grain crops but it indicates the influence of various nutrients on plant metabolism .It was found the application of nitrogen level (140) increases plant height . The maximum plant height was attained by Basmati-370 (130.46 cms) followed by Haryana Basmati -1(118.90) (Table 1). Number of Tillers / hill at 20 (DAT) affected non significantly but at 40 , 60 and 80 days after transplanting the numbers of tillers / hill increased slowly from 40-60 days after transplanting there after a gradual decline was observe up to 80 days after transplanting (Table 2) . It is apparent from the data that tiller production / hill was significantly affected by the influence of levels of nitrogen at all stages . Number of tillers differ in the treatments .Maximum number of tillers was found in the variety Pusa Basmati -1 (19.29) at level (140) followed by Haryana Basmati-1 (18.60) at level (140) tillering is an important trait for grain production and is therefore an important aspect in rice yield . [5] reported that increase in number of effective tillers in rice crop is due to influence of different fertilizer combinations according to them more number of tillers / hill might be due to more availability of nitrogen which plays a vital role in cell division . Inorganic source offers more balanced nutrition to the plants which positively affect number of tillers [4] in dry matter Production , results revealed that almost a consistent increase in dry matter occurred with the advancement of crop growth stages and reaching maximum at flowering stage 75 (DAT) (Table 3) depending upon the varieties it changes and the maximum dry matter was accumulated by Haryana Basmati -1 57.11 (g) followed by Pusa Basmati -1 53.77(g) . In case of combination the dry matter accumulated was in the treatment (N3V1) 60.00 at level -140 . Length of Panicle also differs in different varieties . The maximum panicle length of 31.73 cm's (Table 4) in case of Pusa Basmati -1 at an optimal dose of Nitrogen - 120 . Number of filled grains were also influenced in different varieties . The maximum number of filled grains were found in Pusa Basmati -1 106.10 (Table 5) at the nitrogen dose of -120 . Number of filled grains were also influenced in different varieties . The maximum number of filled grains were found in Pusa Basmati -1 at the nitrogen dose of -120 . The rice yield revealed that the crop responded significantly with the varieties and Nitrogen application . In case of Variety V3 Pusa Basmati -1 shows the highest yield of 4.66 tons / hectare (Table 6) followed by Haryana Basmati -1 , 3.94 tones / hectare . Among the nitrogen levels -120 application gave the highest yield (Table 7) followed by nitrogen level application .It was apparent from the data that increasing levels of nitrogen from 100-120 exerted marked increase in straw yield among the varieties the highest straw yield was recorded in V1 Haryana Basmati -1 of 13.30 tons / hectare amongst nitrogen levels the straw yield was recorded at level nitrogen -120 and the best treatment combination was N2V1 14.58 /tons / hectare (Table 8) . The maximum test weight (Table 9) was recorded in variety Pusa Basmati 1 (18.22) and both the variety Haryana Basmatii-1 and Pusa Basmati-370 have the same test weight of 18.05 nitrogen level -120 shows the highest test weight of 20.50. The harvest index shows non significant effect (Table 10) due to varieties in case of variety the maximum harvest index was obtained in V1 Haryana Basmati -1 (.244) followed by Pusa Basmati -1 . Amongst nitrogen levels the highest harvest index (Table 11) was recorded in nitrogen level 100 followed by nitrogen level -120 (Table 12). it is apparent from the data that economic analysis that variety V3 pusa basmati -1 gave maximum profit of Rs. 32225 with a benift cost ratio of 3.6 and it was described from the data that nitrogen level 120 gave the maximum profit of Rs 30914 with the benefit cost ratio of 3.5(Table 13).

4 CONCLUSION

Considering the results obtained from the study it can be concluded that Pusa Basmati- 1 was found superior from rest of the varieties and among nitrogen levels the best level was 120.

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Table 1 Effect of Different Treatment Combinations on Plant Height (cm)

Varieties	20 DAT				40 DAT				60 DAT				80 DAT			
Nitrogen Level	V1	V2	V3	Mean	V1	V2	V3	Mean	V1	V2	V3	Mean	V1	V2	V3	Mean
N1	38.20	49.00	36.26	41.15	58.33	82.50	62.66	67.73	84.63	103.03	86.33	91.33	111.10	118.16	116.06	114.77
N2	41.90	40.33	38.96	40.40	67.96	68.56	69.26	68.60	96.66	92.80	93.06	94.17	120.63	124.96	117.53	121.04
N3	40.83	45.20	38.96	41.65	68.30	83.96	67.26	73.17	94.83	114.53	87.70	99.02	118.90	130.46	115.36	121.57
Mean	40.31	44.84	38.05		64.86	78.34	66.30		93.04	103.45	89.03		118.87	124.53	115.76	

Table 2 Effect of Different Treatments on Average No. of Tillers / Hill

Varietes	20 DAT				40 DAT				60 DAT				80 DAT			
Nitrogen Level	V1	V2	V3	Mean	V1	V2	V3	Mean	V1	V2	V3	Mean	V1	V2	V3	Mean
N1	7.13	8.40	6.53	7.85	14.53	19.73	18.06	17.44	16.74	16.93	19.90	17.57	13.86	16.33	14.26	14.92
N2	7.6	7.06	6.26	6.97	21.33	20.43	17.80	19.85	20.40	18.80		19.51	19.93	18.26	16.43	18.21
N3	7.60	7.80	7.66	7.68	18.53	16.73	19.60	18.28	18.66	17.93	19.66	18.42	14.93	14.00	16.10	15.01
Mean	7.44	7.75	6.82		18.13	18.96	18.48		18.60	17.88	19.29		16.24	16.20	15.60	

Table 3 Effect of Different Treatment Combination on Plant Dry Weight (g)

Varieties	20 DAT				40 DAT				60 DAT				80 DAT			
Nitrogen Level	V1	V2	V3	Mean	V1	V2	V3	Mean	V1	V2	V3	Mean	V1	V2	V3	Mean
N1	4.46	11.76	3.53	6.58	35.33	48.00	36.00	39.77	48.33	54.33	55.00	52.55	38.00	51.65	49.00	46.22
N2	6.03	2.76	2.1	3.65	42.16	37.53	21.83	31.84	52.66	45.66	61.33	53.22	30.00	51.66	51.33	44.33
N3	6.56	5.30	5.30	5.72	39.00	57.83	41.33	46.33	70.33	60.00	45.00	58.44	51.33	32.33	51.00	44.88
Mean	5.68	6.61	3.66		39.11	45.78	30.05		57.11	53.33	53.77		39.77	45.22	50.44	

Table 4 Effect of Different Treatment Combination on Length of Panicle (cm)

Variety / Nitrogen	V1	V2	V3	Mean
N1	28.16	26.16	32.00	28.77
N2	30.00	30.00	33.10	28.52
N3	33.00	27.23	30.10	28.17
Mean	30.38	26.32	31.73	

Table 5 Effect of Different Treatment Combination on Average Number of Filled Grains / Panicles

Variety / Nitrogen	V1	V2	V3	Mean
N1	60.00	77.00	90.00	75.66
N2	88.00	95.66	106.10	96.55
N3	123.33	126.00	106.00	118.44
Mean	90.44	89.55	100.68	

Table 6 Effect of Different Treatment Combination on Grain Yield (tonnes/ hectare)

Variety / Nitrogen	V1	V2	V3	Mean
N1	4.08	3.00	4.25	3.77
N2	4.25	3.10	4.66	4.00
N3	3.50	2.68	3.76	3.316
Mean	3.94	2.92	4.22	

Table 7 Effect of Different Treatment Combinations on Average Straw Yield (tonnes/hectare)

Variety / Nitrogen	V1	V2	V3	Mean
N1	12.0	12.33	11.58	11.97
N2	14.58	12.75	12.0	13.86
N3	13.33	11.25	14.00	12.86
Mean	13.30	12.11	12.52	

Table 8 Effect of Different Treatment Combination on Biological Yield (tonnes/hectare)

Variety / Nitrogen	V1	V2	V3	Mean
N1	16.11	15.29	15.86	15.75
N2	17.53	15.88	16.69	16.70
N3	16.86	13.79	17.80	16.15
Mean	16.83	14.99	16.78	

Table 9: Effect of Different Treatment Combinations on Test Weight (g)

	V1	V2	V3	Mean
N1	18.33	15.50	18.66	17.50
N2	17.66	20.50	17.66	18.61
N3	18.16	18.16	18.33	18.22
Mean	18.05	18.05	18.22	

Table 10 Effect of Different Treatment Combinations on Harvest Index

Variety / Nitrogen	V1	V2	V3	Mean
N1	.266	.2008	.273	.246
N2	.253	.200	.283	. 245
N3	. 213	.206	.213	.211
Mean	.2441	.2023	.213	

Table 11 Total Cost of Cultivation for Each Treatment Combination

Treatment combination	Cost of cultivation Rs ha^{-1}	Interest rate @8% for 4.5	Total cost of cultivation Rs ha^{-1}
N_1V_1	11467	344	11811
N_1V_2	11467	344	11811
N_1V_3	11467	344	11811
N_2V_1	11666	350	12016
N_2V_2	11666	350	12016
N_2V_3	11666	350	12016
N_3V_1	11863	356	12219
N_3V_2	11863	356	12219
N_3V_3	11863	356	12219

Table 12 Mean Grain And Stover Yield (Q/ha) And Net Realization (Rs ha^{-1}) Cost of Cultivation (Rs ha^{-1}) And Benefit Cost Ratio(BCR) of Rice as Influenced by Various Treatment Combination

Treatment combination	Yield q/ha		Gross Realization Rs ha^{-1}	Total cost of cultivation	Net Realization Rs ha^{-1}	Benefit cost ratio (BCR)
	Grain	Stover				
N_1V_1	40.8	120.0	42720	11811	30909	3.6
N_1V_2	30.0	123.3	33150	11811	21339	2.8
N_1V_3	42.5	115.8	44040	11811	32229	3.7
N_2V_1	42.5	145.8	45540	12016	33534	3.7
N_2V_2	31.0	127.5	34275	12016	22259	2.8
N_2V_3	46.6	120.0	47940	12016	35924	3.9
N_3V_1	35.0	133.3	38165	12219	25946	3.1
N_3V_2	26.8	112.5	29745	12219	17526	2.4
N_3V_3	37.6	140.0	40840	12219	28621	3.3

Table 13 Mean Effects of Different Treatment Factors on Gross And Net Realization (Rs/ha) And Benefit Cost Ratio (BCR) in Rice

Treatment Factor	Gross Realization	Total cost of Cultivation	Net Realization Rs/ha	Benefit cost ratio (BCR)
Varieties				
V_1	42110	12015	30095	3.5
V_2	32335	12015	20320	2.6
V_3	44240	12015	32225	3.6
Nitrogen				
N_1	39915	11811	28104	3.3
N_2	42930	12016	30914	3.5
N_3	36274	24055	24055	2.9