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Effect of Nitrogen and Potassium Levels on Growth and Yield of Hybrid Rice (*Oryza sativa* L.)

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Abstract

A field experiment with four levels of nitrogen (0, 60, 120 and 180 kg/ha) and three levels of potassium (0, 40 and 80 kg/ha) was conducted during *kharif* season of 2003 on growth and yield of hybrid rice (*Oryza sativa* L.). Application of nitrogen significantly increased the growth yield attributing characters, grain and straw yield and protein content upto 180 kg N/ha. All the growth, developmental and yield characters were also significantly influenced by the application of potassium upto 80 kg K_2O/ha.
Key words : Nitrogen, Potassium, Hybrid rice, Grain yield.

Rice (*Oryza sativa* L.) is the most important crop of India and it is a staple food of more than 60% of the world population. In the post WTO-ear,adequate rice is to be produced not only for the self-sufficiency but also for export purposes. To meet challenges of WTO regime in the immediate future, hybrid rice is the practically feasible and adaptable technology for enhancement of rice production and productivity. Hybrid rice has recorded 15—20% higher yield than the highest yielding inbred varieties in the farmers fields (1). The potential area in the country for hybrid rice is 8—15 million hectares and adoption in this large area will increase the rice production by 10—20 million tonnes. So, it is essential to develop a better production technology for exploiting the full heterotic potential of hybrid rice varieties. The rice is generally fertilized by farmers either with nitrogen or with nitrogen and phosphorus only, though potassium is equally important. Application of potassium along with nitrogen has become necessary due to intensified agriculture with high yielding varieties. Hybrid rice is highly fertilizer responsive, but information on hybrid rice nutrition is meager under the soil and climatic condition of North Bihar. Therefore, adequate fertilization at right time in a proper dose is essential to achieve potential yield of hybrid rice.

Methods

A field experiment with four levels of nitrogen (0, 60, 120 and 180 kg/ha) and three levels of potassium (0, 40 and 80 kg/ha) was conducted at Rajendra Agricultural University Farm, Pusa during *kharif* season of 2003 in factorial randomized block design with three replications to study the effect on growth, yield and quality of hybrid rice (*Oryza sativa* L.). The test variety was NDRH-2. The soil of the experimental plot was sandy loam, calcareous and low in available N and K with pH of 8.3; 30 days old seedlings were transplanted at 20 cm × 15 cm spacing at one seedling per hill. Nitrogen was applied through urea in respective plots whereas potassium was used through muriate of potash and 60 kg P_2O_5/ha was applied through SSP.

Results and Discussion

Effect of Nitrogen

Maximum plant height (118.24 cm) was recorded under 180 kg N/ha which was followed in order of 120, 60, 0 kg/N/ha. Significant increase in plant height with increasing level of nitrogen might be attributed to rapid elongation and multiplication of cells in the presence of higher amount of nitrogen (2).

The application of nitrogen significantly increased the dry matter production and LAI upto 180 kg N/ha. This might be due to better N-uptake by sink. By increasing the levels of nitrogen, the chlorophyll content of cells, photosynthesis activity and protein content of cells increased resulting into increase in the dry matter accumulation factors like plant height, number of tillers and number of panicles.

All the yield attributing characters (except 1,000-grain weight) significantly improved by increasing

Table 1. Growth, yield and quality of hybrid rice as influenced by N and K levels.

Treatments	Plant height (cm)	Leaf area index (LAI)	Dry weight of plant (g/m^2)	No. of panicles /m^2	Length of panicle (cm)	No. of grain per panicle	Grain yield (q/ha)	Straw yield (q/ha)	Grain : Straw ratio	Harvest index (%)
N-Levels (kg/ha)										
0	102.29	2.24	925.34	216.00	20.03	112.00	35.03	51.44	0.68	40.49
60	111.28	2.76	1163.27	291.00	25.23	149.00	44.10	63.60	0.69	40.93
120	115.39	3.10	1361.00	314.00	28.13	167.00	51.90	72.96	0.71	41.55
180	118.24	3.53	1466.00	329.00	30.83	179.00	55.70	77.57	0.72	41.71
CD (*P*= 0.05)	9.54	0.15	89.27	32.58	2.15	15.86	5.28	6.18	NS	NS
K-Levels (kg/ha)										
0	104.28	2.73	1158.46	253.00	24.90	139.00	43.57	63.02	0.69	40.78
40	113.13	2.96	1247.07	299.00	26.25	157.00	47.34	67.40	0.70	41.16
80	118.00	3.04	1281.19	310.00	27.02	160.00	49.13	68.75	0.71	41.62
CD (*P*= 0.05)	8.26	0.13	77.31	28.22	1.86	13.72	4.58	5.35	NS	NS

nitrogen levels (3). This might be due to increased accumulation of photosynthates from source to sink with increased levels of nitrogen; 1,000-grain weight did not differ significantly due to increasing levels of nitrogen. This might be due to genetic make up of the variety (NDRH-2). There was a significant increase in grain yield of rice with an increase in levels of nitrogen upto 180 kg/ha. This might be owing to better niitrogen uptake leading to greater dry matter production and its translocation to the sink. Grain yield is the function of yield attributing characters. Thus increased number of panicles/m^2, panicle length, number of grains/ panicles, 1,000-grain weight were mainly responsible for the increased yield which varied with levels of nitrogen. Similarly straw yield is function of vegetative growth of plant in terms of plant height, LAI and number of tillers, which resulted higher straw yield with increasing levels of N upto 180 kg/ha.

Effect of Potassium

The application of potassium significantly increased the growth and yield attributing characters and grain and straw yield of the hybrid rice upto 80 kg/K_2O/ha.

Plant height increased with increasing levels of potassium might be due to the reason that this nutrient (K) had an indirect influence in increasing the uptake of N which in turn might have increased the plant height (4). Increase in dry matter production and grain yield with increase in potassium levels upto 80 kg/ha might be owing to better K-uptake leading to greater dry matter production and its translocation to the sink.

Length of panicle increase was observed with increasing levels of potassium upto 80 kg/ha. It might be due to better nutrition of panicle primordial. Similarly total number of grains/panicle were increased significantly with potassium upto 80 kg/ha. The improved grain filling due to k-application was ascribed to increasing photosynthetic activity, as K-stimulates some vital biochemical process like oxidative phosphorylation, photo-phosphorylation (5).

Straw yield is the function of growth attributing characters viz. number of tillers/m^2 and plant height these were favorably modified by potassium addition and this ultimately lead to more straw yield. The enhancement of N-uptake in presence of adequate K- might also have result in an increased yield of straw.

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