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EFFECT OF DIFFERENT LEVELS OF NPK ON THE YIELD AND QUALITY OF RICE CV. IR-6

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Abstract: This study was designed to investigate the effect of different levels of NPK on paddy yield and quality of rice cultivar IR-6. The proposed levels were 0-0-0, 120-0-0, 120-60-0, 120-0-60, 120-60-60, 120-90-0, 120-0-90 and 120-90-90 NPK kg ha^{-1}. The treatments were replicated four times in randomized complete block design. Data showed that plant height, tillers $hill^{-1}$, and paddy yield were affected significantly by different levels of NPK as compared to control.

Keywords: Block design, NPK levels, paddy yield, plant height, rice cultivar, tillers per hill, treatments.

INTRODUCTION

Rice is an important cereal next to wheat for domestic demands and it can be an effective weapon for increasing the foreign exchange however, its yield is low as compared to other countries. Among the various factors, which can help in increasing the yield is the use of balanced chemical fertilizer. Optimum dose of fertilizer has direct effect on yield and quality of rice. Shafi and Iqbal [1971] obtained higher yield by the application of 60 lbs. nitrogen and 30 lbs. P_2O_5 per acre in case of Bas-198. Chen *et al.* [1984] found that order of the rice yield increase was NPK > NK > NP> PK> control. Highest yield was obtained at N : P : K ratio 1:0.5:1 and most economic results at 1:0.5:1 or 1:0-0.3:0.5 for 1st and 2nd respectively the order of yield increase for separate application was N>K>P. The effect of NPK on rice yield was high for low yielding than for high yielding paddy fields. Awan *et al.* [1984] obtained the maximum plant height (98.1m), number of panicle (510 m^{-2}), 1000-grain weight (30 g) grain yield (5.2 t ha^{-1}) and straw yield (8.1 t ha^{-1}) with 138 kg N ha^{-1} applied basally before flooding. Plant height, number of panicles $hill^{-1}$ and grain yield were increased with increasing nitrogen application. Lopez *et al.* [1985] concluded that application of 156 kg N, 99 kg P and 93 kg K ha^{-1} gave the highest grain yield but the application of 143 kg N, 90 kg P and 93 kg K ha^{-1} gave the greatest economic return with good harvest index. Moreno *et al.* [1985] conducted an experiment on rice cv. CICA-8 with P and K fertilizer application. The highest yield (7.70 t ha^{-1}) was obtained with 50 kg P_2O_5 ha^{-1} + 25 kg K_2O ha^{-1} and lowest yield 6.45 t ha^{-1} with 25 kg P_2O_5 + 25 kg K_2O ha^{-1}. The effects on plant height, number of panicle m^{-2} and 1000-grain weight were recorded. Reddy *et al.* [1986] concluded the P requirement of Kharif rice cv. Swarna MTU 7633 etc. and P increased yield only at 26.2 kg P ha^{-1} and straw yields were not affected by P. Singh and Sharma [1987] found that nitrogen fertilizer application increased plant height, the number of productive tillers $hill^{-1}$ and panicle length. Nitrogen @ 180 kg ha^{-1} increased grain yield from 1.3-1.4 to 3.4-3.6 ha^{-1}

and straw yield from 2.3-2.4 to 5.9 t ha^{-1}. Nitrogen application increased grain and straw nitrogen content. Thakur [1991] found that average grain yield of rice were obtained with the application of 120 kg N ha^{-1} in field experiment at Pasa. Bajpai and Joshi [1992] found that 120 kg P ha^{-1} and the Kahhar soil type gave the highest grain and straw yield. Kushwaha *et al.* [1992] observed that rice cv. Ratna and Kranti with application of 60 kg N, 60 kg N + 40 kg P, 60 kg N + 40 kg P + 15 kg K, 60 kg N + 40 kg P + 15 kg K + 25 kg $ZnSO_4$ ha^{-1} gave average grain yield of 3.16, 3.60, 3.79, 3.98 and 2.88 t ha^{-1}, respectively. The net income and cost of cultivation were highest with NPK + Zn application. Balasubra-maniyan and Palaniappan [1992] found that grain yield and optimum plant population was obtained with 150 kg N ha^{-1} + 50 kg K_2O ha^{-1} and uptake of NPK in the grain were highest with 150 kg N + 50 kg K_2O ha^{-1}. Dixit and Patro [1994] in a field experiment on sandy loam during the summer season found that 120 kg N + 60 kg P + 60 kg K + 25 kg $ZnSO_4$ ha^{-1} gave more grain yield. Rogelio *et al*. [1997] conducted an experiment using three fertilizer groups and identified comparative analysis of balance fertilization strategy (BFS) as compared to conventional method and concluded that BFS gave maximum yield of rice. So keeping in view the present study was proposed to see the effect of NPK on the yield and quality of coarse rice variety IR-6.

MATERIALS AND METHODS

The proposed investigations were carried out to study the effect of nitrogen, phosphorus and potash on the yield and quality of coarse rice IR-6. Eight treatments with different combination of NPK fertilizers i.e. (F0) Check, (F1) 120-0-0, (F2) 120-60-0, (F3) 120-0-60, (F4) 120-60-60, (F5) 120-90-0, (F6) 120-0-90 and (F7) 120-90-90 were tested to study their effects on yield and quality of rice. The experiment was conducted at the research area of Agronomy Department, University of Agriculture, Faisalabad during the year 1995. Treatments were replicated four times in a randomized complete design with a net plot size of 3m x 2m. One-month-old seedlings were transplanted maintaining one seedling per hill at 22 cm x 22cm plant-to-plant and row-to-row distance. The transplanting was done on a puddle soil. The $2/3^{rd}$ of nitrogen in the form of urea and all phosphorus in form of SSP and all K_2O in the form of potassium sulphate were applied at the time of transplanting. The remaining $1/3^{rd}$ of nitrogen was supplied at panicle emergence stage. Ten plants in each treatment were randomly selected and kept under constant observations from transplanting to harvesting. Final plants height (cm), tillers $hill^{-1}$, normal kernel (%), 1000-grain weight (g), paddy yield $plot^{-1}$ (kg), straw yield $plot^{-1}$ (kg) were recorded during the study. The harvest index was calculated as the ratio of grain yield to biological yield and was expressed as percentage. The data were analyzed statistically using analysis of variance technique [Steel and Torrie 1984] and Duncan's Multiple Range

test [Duncan 1955] was used to see the significance of treatments means at 5% probability level.

RESULTS AND DISCUSSION

According to Table 1 plant height was increased in all the treated plots as compared to control (F0). In general, difference between the treatments however could not reach the level of significance. NPK at rate of 120-90-0 kg ha^{-1} proved to be the most appropriate dose for getting optimum plant height. This may be due to the adequate availability of NP but this level differed in different situations according to the fertility level of a particular soil and genetic characteristic of the variety. These findings are in conformity with those of Awan *et al*. [1984], Singh and Sharma [1987].

Table 1: Yield and quality of rice IR-6 as influenced by NPK application.

Treatments NPK (kg ha^{-1})	Final plant height (cm)	Tillers $hill^{-1}$	Normal Kernels (%)	1000-grain weight (g)	Paddy yield (kg $plot^{-1}$)	Straw yield (kg $plot^{-1}$)	Harvest index
0-0-0	57.45 d	8.79 c	62.09 c	18.19	1.49 d	2.93 c	28.64 c
120-0-0	74.33 c	16.47 ab	81.76 b	19.62	1.97 bc	3.32 bc	31.90 bc
120-60-0	75.48 c	15.51 ab	83.71 a	20.06	1.73 cd	3.53 abc	32.84 ab
120-0-60	74.98 c	15.24 b	83.83 a	19.56	2.03 bc	3.82 ab	33.32 ab
120-60-60	77.40 bc	16.32 ab	84.89 a	20.92	2.74 a	4.39 a	37.68 a
120-90-0	80.89 a	16.24 ab	84.43 a	20.32	2.08 bc	3.85 ab	35.13 ab
120-0-90	78.63 ab	15.69 ab	83.71 a	18.99	2.32 b	3.90 ab	33.35 ab
120-90-90	79.44 ab	16.96 a	84.58 a	20.16	2.28 b	4.06 ab	35.45 ab

Means not sharing a letter differ significantly at 0.05 probability level.

The data pertaining to the tiller $hill^{-1}$ as given in Table 1 showed treatment F7 (120-90-90) produced more tiller $hill^{-1}$ as compared to other treatments. This may be attributable to the adequate availability of N at tillering or before tillering stages in these treatments. The effect of P and K fertilization on tiller $hill^{-1}$ does not show any significance. It is pointed out here that more tiller $hill^{-1}$ does not mean more yields, because many of the tillers will meet mortality before panicle emergence and more over many of them will produce panicle of sub-normal size. These results are in agreement with those reported by Thakur [1991], Balasubramaniyan and Palaniappan [1992].

The data presented indicates that normal kernel (%) was substantially affected by application of NPK levels. The plots resulted in more normal kernel as compared to control. But within the treated plots no statistical difference was found. However, the treatment (120-60-60) seems to be suitable and appropriate level to get maximum normal kernel. The results are in agreement with those reported by Chen *et al*. [1984] and Kushwaha *et al*. [1992].

The data given in Table 1 suggest that 1000-grain weight (g) was not affected significantly by the application of different levels of NPK fertilizers. The treatment F4 (120-60-60) produced the maximum 1000-grain weight, which however did not differ from rest of the treatments. The

statistical difference of the treatments could not reach the level of significance. These findings are in partial agreement with those reported by Moreno *et al*. [1985] and Lopez *et al*. [1986].

Result showed that the treated plots resulted markedly in more paddy yield than that of control. Among the treatments, treatment F4 (120-60-60) produced more paddy yield. This treatment was followed by the treatments F6 (120-0-90), F7 (120-90-90), F3 (120-0-60), F5 (120-90-0). However, these treatments did not differ when compared among them. So the level of 120-60-60 is most suitable and going beyond this level will be an uneconomical and wasteful exercise. These results are in conformity with others [Dixit and Patro 1994, Rogelio *et al*. 1997].

The data presented in Table 1 show that within the treatments, treatment F4 (120-60-60) produced more straw yield but now difference was recorded when this treatment F4 (120-60-60) was compared with F7 (120-90-90), F6 (120-0-90), F5 (120-90-0), and F3 (120-0-60). Rest of the treatments F1 (120-0-0), and F2 (120-60-0) responded intermediately. So as in case of paddy yield here to treatment F4 (120-60-60) seems to be most appropriate dose. These findings are in agreement with those reported by Singh and Sharma [1984] and Thakur [1991].

The trend in harvest index is almost the same as recorded in paddy yield (kg plot^{-1}). Treatment F4 (120-60-60) showed maximum harvest index (37.68) as compared to other treatments. These results are similar to those reported by Counce *et al*. [1992] and Rogelio *et al*. [1997].

CONCLUSION

In general the fertilizer level 120-60-60 NPK kg ha^{-1} proved to be the most appropriate and economically best dose under the given conditions.

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