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The Effect of NPK Application in Different Proportions on the Growth and Yield of Spring Maize

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Abstract: Fertilizer levels were kept at 0, 100, 150, 200, 250 and 300 kg N/ha with a constant dose of 100 kg/ha of phosphorus and potash. Maize variety Sunehri was used as a source of trial. Treatment (200-100-100 kg NPK ha^{-1}) seems to be most appropriate to get increased grain yield under the Faisalabad conditions. More precise studies of this nature however, are recommended to be carried out for further confirmation.

Key word: Pakistan, Growth, Yield

Introduction

In Pakistan area under Maize cultivation is about 815 thousands hectares with annual production of 1,111 thousand tones grain. The average per hectare yield of grain. The average per hectare yield of grain is 1.36 tones which is far below as compared to the other maize growing countries of the world (Anonymous, 1998). The yield potential of our present varieties is fairly large but it is not being explored at the farmers field due to some constraints. It is a well known fact that the yield potential of variety is considerably influenced by physical environmental conditions but other important factors which become the limiting and are responsible for low yield in our country are inadequate use of fertilizers and absence of appropriate use of fertilizers and absence of appropriate crop management technology. Out of these application of nitrogen fertilizer can contribute a lot. It has been observed that maize crop response very well to different rates of nitrogen fertilizer and increase the yield and protein contents of grain. By applying a suitable rate of nitrogen fertilizer, the yield and protein contents of maize grain can be improved.

Materials and Methods

The experiment was conducted during 1995 to determine the effect of NPK applications in different proportions on the growth and yield of Spring maize at the postgraduate Agricultural Research Station, university of Agriculture, Faisalabad.

The experiment design was Randomized Complete Block Design (RCBD) with four replications. The net plot size was 2.4 m X 13 m. Maize variety Sunehri was used as a source of trial. The experiment was sown on 10th March, 1995 with the help of a single row hand drill, using a seed rate of 30 kg ha^{-1}. The plant to plant distance was main-tained approximately as 20 cm by thinning out the surplus plants. The whole of the phosphorus and potash along with the half of nitrogen fertilizer in the form of single super phosphate, sulphate of potash and urea respectively, were applied at sowing and subsequent amount of nitrogen fertilizer was given after one and a half month of sowing. The amount of fertilizer applied at sowing was side dressed approximately at 5 cm depth and 10 cm away from the plant row with the help of a single row hand drill. All other agronomic practices were kept normal and uniform for all the treatments. Irrigation was given when needed and field was kept weed free through out the growing season. The observations recorded at different stages of crop growth and development were plant height at maturity, length of cob (cm), number of grains per cob, 1000-grain weight (g) and grain yield per hectare (q/ha).

The data collected were analyzed statistically by the analysis of variance technique and treatments means compared according to DMR test at 5 percent probability level was applied to test the significance of the treatment means (Steel and Torrie, 1980).

Result and Discussion

Application of 100-100-100 kg NPK ha^{-1} applied in treatment 100-100-100 kg NPK ha^{-1} produced plants of maximum height than the plants produced in control. It will be therefore, an uneconomical and wasteful practice applying NPK beyond, treatment 100-100-100 kg NPK ha^{-1}. It can further be pointed out that the initial fertility level of soil used was not very low and that the NPK at the rate of 100-100-100 kg ha^{-1} would be sufficient to obtain plants of optimum height under the conditions. Similar results were reported by El-Sharkawy *et al*. (1976) and Chao *et al*. (1982) observed that maize plant height was increased significantly with the application of 100 lbs N + 100 lbs P_2O_5 per acre.

The data clearly indicate that the length of cob was substantially affected by different levels of NPK applied. From the comparison of individual treatment means it can be seen that all the treated plots produced cobs of more length as compared with the control and they did not differ statistically when compared among themselves. The length of cob is almost increased with increased level of NPK except the highest level, that is 300-100-100 kg NPK ha^{-1} where the length of cob was rather depressed. The reason for more cob length in treatment 200-100-100 kg NPK ha^{-1} and treatment 250-100-100 kg NPK ha^{-1} may be due to the more photosynthetic activities of the plant on account of adequate supply of N in these treatments. These results are partly in agreement with Salem *et al*. (1982) and Hasan and Miro (1984) (Table 1).

Number of grains per cob as influenced by different NPK levels indicate that number of grains per cob was affected markedly by different levels of NPK used. Treatment 250-100-100 kg NPK ha^{-1} resulted in more number of grains per cob but this treatment did not differ from treatment 200-100-100 kg NPK ha^{-1} and treatment 150-100-100 kg NPK ha^{-1}. These treatments were followed by rest of the treatments which did not differ when compared among themselves.

It can be concluded from the data that rather higher levels of nitrogen will help increase the size of cob and number of grains per cob. Too lower or too higher NPK levels will discourage the same. The minimum number of grains per cob in control and treatment 100-100-100 kg NPK ha^{-1} may be due to requirement of nitrogen at different growth stages.

The decrease in number of grains per cob in treatment 300-100-100 kg NPK ha^{-1} may be due to excessive nitrogen which might have disturbed the physiological functioning of the crop plant. Application rate 150-100-100 kg NPK ha^{-1} seems to be an optimum level to get optimum number of grains per cob under the conditions. The results are partly in agreement with Short *et al*. (1982).

Table 1: Effect of NPK application in different proportions on the growth and yield of spring maize

Treatment (NPK)	Plant height (cm)	Cob length (cm)	Number of grains per cob	1000-grain weight (g)	Grain yield (q/ha)
Control	150.82b	13.77b	339.2b	218.9e	31.1c
100-100-100	185.4a	14.5ab	335.01b	239.9d	47.4d
150-100-100	192.2a	14.9ab	359.4a	303.4a	63.9bc
200-100-100	197.7a	15.5a	467.6a	294.4b	66.4ab
250-100-100	194.9a	15.7a	486.2a	270.9c	68.4a
300-100-100	200.00a	14.1ab	392.7b	278.7c	62.2c

Any two means not sharing a letter in common differ significantly at 0.05 probability level

It is clear that treatment 150-100-100 kg NPK ha^{-1} resulted in more 1000-grain weight (303.4 g). Next to follow was treatment 200100-100 kg NPK ha^{-1} which out yielded all the rest of the treatments. Theses treatments were followed by the treatments 250-100-100 kg NPK ha^{-1} and treatment 300-100-100 kg NPK ha^{-1} which again did not differ significantly when compared with each other. Whereas, the minimum 1000-grain weight was obtained in control treatment. Rather a higher level of NPK, i.e. seems to be most suitable level under the conditions. The levels lower than this, that is, in 150-100-100 kg NPK ha^{-1} may have not produced the optimum grain weight due to want of nitrogen. Whereas, the decrease in 1000-grain weight obtained in higher levels of NPK may be attributable to the physiological disorder on account of excessive nitrogen. The results are partly in agreement with Tveitnes and McPhillips (1989).

It is revealed from the data that the maximum grain yield (68.4 g ha^{-1}) was recorded in treatment 250-100-100 kg NPK ha^{-1}, which did not statistically differ from treatment 200-100-100 kg NPK ha^{-1}, Treatment 200-100-100 kg NPK ha^{-1}, was further found at be at par with 150-100-100 kg NPK ha^{-1}. Next to follow were treatments 300-100-100 kg NPK ha^{-1}, 100-100-100 kg NPK ha^{-1} and control in a descending order. It is again confirmed that rather higher NPK levels will help increase grain yield per ha on account of increased number of grain per cob, Treatment 200-100-100 kg NPK ha^{-1} seems to be the best level and going beyond this level will not bring any economical benefits. This may partly be due to increased nitrogen use efficiency in treatment 200-100-100 kg NPK ha^{-1} and treatment 250-100-100 kg NPK ha^{-1}. Similar results were reported by Gardner *et al*. (1990).

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