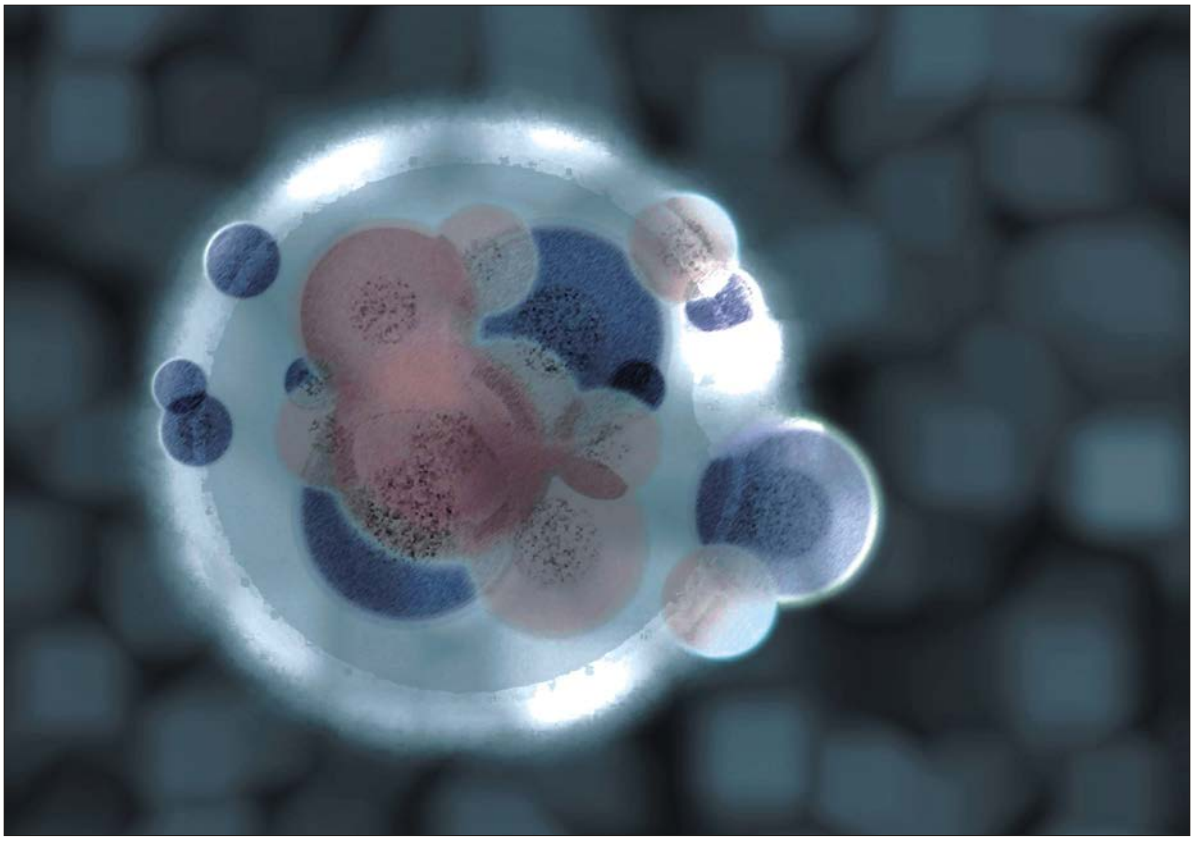

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Effect of Variable Rates of Nitrogen and Phosphorus on Growth and Yield of Maize (Golden)

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Abstract: Plant height was significantly affected by the variable rates of N and T_5 (150-120-60) treatment produced the tallest plants than other treatments. The number of cobs plant^{-1} was significantly different from treatment T_5 (150-120-60). The average grain weight (1000-grain weight) was maximum in T_4 treatment which was at par with treatments T_3 and T_5. Grain yield of maize was significantly enhanced by T_4 treatment than other treatment except for T_5 treatment where it was statistically at par overall, average grain yield of 12.6 t ha^{-1} was obtained under the conditions of this experiment.

Key words: Nitrogen, phosphorus, yield

Introduction

In Pakistan, maize is cultivated on an area of 880.8 thousand hectares, giving annual production of 1283.4 thousand tones with average yield of 1445 kg per hectare (Anonymous, 1996). Maize occupies a key place in existing cropping system because it is a short duration crop and provides more economic return to the growers.

Fertilizer management is an important attribute of crop yield because it is associated with many factors of the plant environment which influence growth and yield of maize crop. Singh and Dubey (1991) reported that maize crop responds very well to variable rates of nitrogen and phosphorus fertilizers and thus increase grain yield and protein contents. Chaudhry *et al.* (1989) reported maximum yield of about 3.0 t ha^{-1} in maize when 92 kg N and 40 kg P was applied.

In order to achieve maximum attainable yield from the existing corn varieties in a given environment, it is essential to improve crop fertilizer management practices. The present study was, therefore, undertaken with the objective to determine a suitable combination of nitrogen and phosphorus fertilizers for maximizing grain yield of maize under agro-ecological conditions of Faisalabad.

Materials and Methods

A field investigation pertaining to the effect of variable rates of nitrogen and phosphorus application on the growth and grain yield of maize (cv. Golden) at constant rate of potassium was conducted on a sandy clay loam soil at Agronomic Research Area, University of Agriculture, Faisalabad during the year 1997. The experiment was laid out in a Randomized Complete Block Design (RCBD), with four replications. Net plot size was 3 m by 5m. Following treatments were included in the experiment. Treatments T_0, 0-0-0, T_1, 30-40-60, T_2, 60-60-60, T_3, 90-80-60, T_4, 120-100-60, T_5, 150-120-60 Kg NPK ha^{-1}.

The crop was sown on 7 August 1997 with the help of a single row hand drill, using a seed rate of 30 kg ha^{-1} on a well prepared seed bed with a row spacing 60 cm. 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 by band placement. Remaining half of nitrogen fertilizer was applied at tasseling stage. After germination, plant to plant distance was maintained as 23 cm by thinning out the surplus plants. All other agronomic and plant protection practices were kept normal and uniform for all the treatments. Irrigation were given when needed and field was kept weed free throughout the growing season by adopting recommended practices.

Following observations were recorded at different stages of crop growth and development, Number of plants per plot, Plant height at maturity, Number of cobs per plant, Number of grains per cob, 1000-grain weight and Grain yield per plot.

Statistical analysis: The data were analysed using analysis of variance technique and treatments' means were compared by Least Significant Difference (LSD) test at 5% probability level (Steel and Torrie, 1984).

Results and Discussion

Number of plants per plot: The treatment 120-100-60 kg ha^{-1} and T_5 150-120-60 kg ha^{-1} gave the maximum number of plants and significantly increased the stand of the mature plant over control. The plant stand in treatment 60-60-60 kg ha^{-1} was statistically at par with that of treatment 150-120-60. The plant stand in case of treatment 30-40-60 and treatment 90-80-60 kg ha^{-1} was also statistically similar but greater compared to treatment T_1 (30-40-60 kg ha^{-1}). Low plant and in T_0 could be due to deficiency of nutrients (Table 1).

Plant height at maturity (cm): All the treated plots produced plants of more height as compared to treatment T_0 (control). Among treatments, treatment 150-100-60 produced plants of maximum height which were statistically at par with treatment T_4 (120-100-60) which was statistically differ from other treatments. However, treatment T_4 (120-100-60) seems to be best and economical. Therefore, treatment T_4 (120-100-60) can be recommended for soil and climatic conditions similar to that obtained at Agronomic Research Area, University of Agriculture, Faisalabad. Many workers (Samad, 1994) also noted that plant height was significantly increased with increasing application of N and P (Table 1).

Number of cobs per plant: Among various treatments, 120-100-60 treatment produced maximum number of cobs per plant as compared to control but it did not differ statistically with treatment T_3 (90-80-60) and treatment (150-120-60). The number of cobs per plant was almost increased with increasing level of nitrogen and phosphorus except the highest level treatment T_5 (150-120-60) where

Table 1: Effect of variable rates of nitrogen and phosphorus on growth and yield of maize

Treatment	No.of plants plot^{-1}	Plant height (cm)	No.of cob plant^{-1}	No.of grain cob^{-1}	1000-grain weight (g)	Grain yield
T_0 = 0-0-0	90.00 d	149.80 c	1.25 d	334.20 d	213.13 e	7.80 d
T_1 = 30-40-60	95.25 d	152.53 c	1.43 c	333.76 d	238.67 d	12.28 c
T_2 = 60-60-60	104.75 bc	177.90 b	1.59 bc	365.98 c	239.32 d	21.46 c
T_3 = 90-80-60	101.50 c	192.56 a	1.63 ab	485.31 b	251.42 c	13.28 b
T_4 = 120-100-60	110.75 a	196.23 a	1.70 a	505.53 a	299.94 a	15.27 a
T_5 = 150-120-60	109.25 ab	202.52 a	1.65 a	475.23 a	263.36 b	14.64 a

Any two means not sharing a letter differ significantly at 5% level of probability

the number of cobs per plant was depressed. It may be attributed to balance nutrition and vigorous growth of plants which ultimately showed their maximum inherent potential for the number of cobs per plant. Similar results were reported by Akcin *et al.* (1993).

Number of grains per cob: Treatment 120-100-60 produced maximum number of grains per cob and it significantly differed with rest of all the treatments. Next to follow was the treatment T_3 (90-80-60) which statistically similar with treatment T_5 (150-120-60) but significantly produced higher number of grains than other treatments including control as well. It was concluded from the data that higher levels of nitrogen and phosphorus probably increased the size of individual cobs and thus number of grains per cob. Generally too low or too high N and P levels affect adversely the number of grains. The decreased number of grains per cob in treatment T_1 (30-40-60) and treatment T_0 (control) may be due to deficiency or excess of nitrogen at different growth stages. The decrease in number of grains per cob in treatment T_5 (150-120-60) may be due to excessive of the crop plants. The treatment T_4 (120-100-60) seems to be optimum dose to get maximum number of grains per cob under the existing conditions. These results led to support to the findings of Akcin *et al.* (1993), who also reported similar effects of increasing or decreasing dozes of N application.

1000-grain weight: Different levels of nitrogen and phosphorus markedly affected the 1000-grain weight. When individual treatment means were compared, treatment T_4 (120-100-60) produced the maximum 1000-grain weight and was significantly different from all the other treatments. The treatment T_5 (150-120-60) and treatment T_3 (90-80-60) also gave higher average grain weight over others. However, treatment T_2 (60-60-60) did not differ significantly from treatment T_1 (30-40-60). Whereas minimum 1000-grain weight was obtained in treatment T_0 (control). The results are in agreement with the findings of Akcin *et al.* (1993) and Samad (1994) concluded that effects of increasing rates of application of N and P (upto 112 kg ha^{-1}) on average grain weight.

Grain yield: Maximum grain yield was recorded in T_4 (120-100-60) treatment. However, did not differ significantly from the T_5 (150-120-60) treatment. Next to follow was the T_3 (90-80-60) treatment which also differed significantly from all the treatments. The T_2 (60-60-60) treatment was however statistically similar with treatment T_1. The minimum grain yield was produced in treatment T_0 (control). The results confirmed that higher levels of nitrogen and phosphorus enhanced grain yield on account of increased, number of grains per cob, grain weight per cob, etc. The T_4 (120-100-60) treatment seems to be the optimum and going beyond this level will not bring any economic benefits. Similar results were reported by other workers (Akcin *et al.*, 1993; Samad, 1994).

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