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Effect of Nitrogen and Sulphur on Growth, Yield and Quality of Hybrid Maize (*Zea mays* L.)

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Abstract

The experiment was laid out in randomized complete block design (RCBD) with three replications keeping a net plot size of 3.5 x 7.5 m to evaluate the effect of nitrogen and sulphur on growth, yield and quality of hybrid maize (cargill-707). Application of fertilizer at 150 ± 30 and 150 + 20 kg N and S per hectare, respectively greatly increased dry weight per plant, No. of grains per cob and grain weight per cob over other treatments, Similarly, highest grain yield of 8.59 tones per hectare was recorded from plot fertilized at 150 kg N and 30 kg S per hectare. While maximum grain oil and crude protein contents were recorded from plot fertilized at 150 + 30 and 150 20 kg N and S per hectare, respectively.

Introduction

Maize (*Zea mays* L.) is the third most important cereal crop in the woad after wheat and rice in respect of area and production. In Pakistan it is cultivated on an area of 872.3 thousand hectares with annual production of 1260.6 thousand tones giving an average grain yield of 1460 kg per hectare (Anonymous, 1997). Though the yield potential of our present maize varieties is high enough but it has not been explored fully due to some production constraints. Among the limiting factors nitrogen and sulphur are of prime importance. Nitrogen is a component of proteins and nucleic acids and when N is sub-optimal, growth is reduced. Similarly the nutritive value of cereal is determined by the proportion of S-Containing amino acids (Katyal *et al*., 1987). Besides, S contributes to the assimilation of other nutrients and stimulates root and plant growth. Like nitrogen, S imparts dark green colour to leaves which guarantees optimal chlorophyll activity (Belger *et al*., 1978). By contrast, lack of S slows down plant development because of reduced protein synthesis (Buttrey *et al*., 1987). Consequently the present study was planned to see the effect of nitrogen and sulphur on growth, yield and quality of hybrid maize grown under Faisalabad conditions.

Materials and Methods

The experiment was conducted under field conditions at the University of Agriculture, Faisalabad during 1997. The experiment was laid out in randomized complete block design with three replications using net plot size of 3.5 x 7.5 m. Fertilizer levels i.e. 0, 100 and 150 Kg N and 0,10,20 and 30 Kg S ha^{-1}, respectively were used. Hybrid maize Cargill 707 was used as a test crop. Crop was sown on a well prepared seed bed with the help of dibbler. Full dose of phosphorus, potash, sulphur and half of N was applied at the time of sowing while remaining half of N was applied at first irrigation. The crop was thinned at 3-4 leaf stage in order to maintain the required plant population. First irrigation was given 12 days after sowing while the subsequent irrigation was adjusted according to the need of the crop strictly avoiding over irrigation. All the agronomic practices were kept normal and uniform for all treatments. The crop was harvested on maturity and observations recorded were dry weight per plant at tasseling, number of grains per cob, grain weight per cob (g), grain yield (t ha^{-1}), stover yield (t ha^{-1}), grain oil content and grain crude protein content (%). The grain yield was recorded after shelling the cobs at a moisture level of about 14 percent. To determine significant difference among the treatment's means, LSD test at 5 percent probability was applied (Steel and Torrie, 1984).

Results and Discussion

The data regarding dry wt. per plant at tasseling indicated that nitrogen and sulphur application significantly increased dry weight per plant at tasseling over control. Maximum dry weight (87.42) per plant was recorded from plot fertilized at 150 and 30 kg N and S ha^{-1}, respectively over that fertilized at 100 arid 20 kg N and 5 per ha^{-1} but the difference among T7, T6, T5 and T4 were found to be nonsignificant. While significantly lowest dry wt. (43.50 g) per plant was obtained from control plot. The increase in dry weight per plant at tasseling due to increase in nitrogen and sulphur application is ascribed to its positive effects, though non-significant, on plant height, stern diameter and leaf number per plant (Data not shown). Greater dry weight per plant with sulphur application was also reported by Kochar *et al*. (1990).

Number of grains per cob was significantly affected by nitrogen and sulphur application. Maize crop fertilized at 150 and 20 Kg N and S ha^{-1}, respectively produced significantly maximum number of grains (349.7) per cob but was statistically at par with T3, T4, T5 and T6. While significantly minimum no, of grains (271.7) per cob was recorded in case of control plot. The increase in number of grains per cob by increasing nitrogen and sulphur level was mainly due to more number of grains per row and cob length (data not shown).

Maize crop fertilized at 150 and 20 Kg N and S ha^{-1} respectively took significantly maximum grain weight

Table 1: Growth, yield and quality characteristics of hybrid maize as affected by N and S application

Treatments (Kg ha^{-1}) N + S		Dry wt. (g) per plant at tasselling	No. of grain per cob	Grain weight per cob (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Grain oil content (%)	Grain crude protein content (%)
T1	0 + 0	43.50c	271.7c	96.86d	3.76d	9.65d	4.20b	8.21c
T2	100 + 10	66.66b	280.8bc	118.3cd	6.62c	16.21c	4.64a	8.57bc
13	100 + 20	69.43b	31 5.3abc	126.3bc	6.68c	16.60c	4.78a	8.63bc
T4	100 + 30	78.23ab	329.0ab	141 .lab	7.65b	17.37bc	4.80a	8.86b
T5	150 + 10	75.61ab	328.0ab	135.2abc	8.18a	17.04c	4.78a	8.73b
T6	150 + 20	86.72a	347.60	153.1a	8.38a	19.29a	4.88a	9.93a
T7	150 + 30	87.42a	349.7a	151.7a	8.59a	19.23ab	4.90a	9.77a
LSD		12.19	32.34	21.62	0.50	1.91	0.33	0.45

Means followed by different letters are significantly different at p = 0.05

(153.2 g) per cob than that fertilized at 100 + 20 Kg N and S ha^{-1}, respectively but was on a par with that of T7, T5 and T4. While significantly minimum grain weight (96.86) per cob was recorded from control plot which is also statistically at par with T2 in which 100 and 10 Kg N and S ha^{-1}, respectively was applied. The increase in grain weight per cob was due to more number of grains per cob and cob length (data not shown).

Significantly maximum grain yield (8.59 t ha^{-1}) of maize was obtained from T7 plot fertilized at 150 + 30 kg N + S ha^{-1}, respectively followed by plot fertilized at 100 + 30 kg N and S ha^{-1} but was statistically at par with T5 and T6. While significantly minimum grain yield (3.76 t ha^{-1}) was obtained from control. The increase in grain yield per hectare as a result of increasing nitrogen and sulphur application is attributed to enhanced crop growth rate, net assimilation rate (data not shown) and dry weight per plant, which ultimately increase number of grains per cob and grain weight per cob (Table 1). Higher grain yield in response to nitrogen and sulphur application was also stated by Balko and Russell (1980).

Significantly maximum stover yield (19.29 t ha^{-1}) was recorded in case of 150 and 20 kg N and S ha^{-1}, respectively followed by 100 + 30 kg N and S ha^{-1} but differences in stover yield between T6 and T7 and T7 and T4 were statistically at par with each other, respectively. The increase in stover yield with successive increase in N and S was due to the more leaf area (data not shown) and dry weight per plant (Table 1).

The successive increasing in nitrogen and sulphur fertilizer increased the grain oil content. This increase in grain oil content (%) by the application of S was due to requirement for disulphide bond formation between polypeptide chains sulphur is required for the synthesis of various metabolize e.g. co-enzyme A which is involved in the oxidation and synthesis of fatty acids (Tisdale *et al*., 1990).

Maximum grain crude protein contents (9.93%) was obtained from T6 which is statistically at par with T7. While significantly minimum grain crude protein contents (8.21) was recorded in case of control plot (Table 1). The increase in grain crude protein content may be due to the fact that nitrogen is an integral constituent of amino acids which are the basic units of the proteins. Hybrid maize (cargill-707) should be fertilized at 150 + 30 kg N and S per hectare to maximize its grain yield per unit area as well as to improve the quality of oil and protein under the agro-ecological conditions at Faisalabad.

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