Research Note

RESPONSE OF MAIZE TO DIFFERENT LEVELS OF NITROGEN

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ABSTRACT

An experiment was conducted at the Institute of Agriculture and Animal Sciences, Rampur, Chitwan, Nepal during the summer season of 2003 to evaluate the response of Arun 2 variety of maize to different levels of nitrogen under field conditions. The experiment was conducted using Randomised Complete Block Design (RCBD) with three replications. Results showed a highly significant difference among treatments with respect to yield. Application of 90 kg N per ha gave the highest grain yield (5.46 ton/ha) and 150 kg/ha gave the lowest yield (4.91t/ha). But the non-significant results were found with respect to plant height, cob height, days to 50 % silking, days to maturity and number of plants per plot among treatments. The mean values for number of plants per plot, plant height, cob height, days to 50 % silking after sowing, days to maturity after sowing and yield /ha were found 21.3, 192.3 cm, 94.3 cm, 50.3, 87.5 and 5.18, respectively, Strong correlation of 0.81 and 1 were found between the traits plant height and cob height and days to 50 % silking and days to maturity respectively. In contrast, negative correlation was found between the traits plant height and yield, and cob height and yield.

Key words: Nitrogenous fertiliser, yield component, maize

INTRODUCTION

Maize (*Zea mays* L.) is one of the important cereal crops of Nepal and contributes 6.87% to agricultural gross domestic product (MOAC, 2006). It stands second to paddy in terms of area and production. It occupies about 25.4 % of the total cultivated area and shares about 22.1 % of the cereal production (MOAC, 2005). It is the most staple crop for the hills and the mountains. Due to heterogeneous gene accumulation in this crop; it is widely adapted to different stress environments and is widely grown from the Terai to high mountains in Nepal where it is considered a major food crop and its importance increases with increasing altitudes (Gurung, 1999). It is grown on 851,000 ha of land with a productivity of 2037 kg per ha (MOAC, 2006). Out of the total maize area, 69.9% and 8% belong to mid and high hills with a mean grain yield of 1638 and 1423 kg per ha respectively which is below the national average (2037 kg per ha). The Terai, which is highly potential for winter and spring maize occupies only 20% maize production area (Ojha, 2006). The per capita consumption of maize is 165g per day but per capita consumption is 225g and 80g per day in hills and Terai respectively (Adhikary, 2001).

Over the past 20 years maize yields in Nepal have increased by a total of 2% while area planted and total production have increased by 70-75% ((Adhikary, 2000). But the area planted is increased by 100% in mid hill and high hills (Adhikary, 2001). The future demand for maize in Nepal is expected to grow by 4% per year over the next 20 years driven by increase in demand for food in hills and feeds in Terai. The present yield level of this crop is quite low as compared to other Asian countries, which is mainly due to lack of high yielding varieties, unavailability of improved seeds, low fertility status of the soil, insects (stem borers and white grub) and diseases (leaf blight, rust and cob rot) damage etc (Priyadarshi *et al.*, 1999).

In Nepal, maize production is a part of complex system with extreme environmental variability and hence needs a system based approach, which has been neglected in the past. Maize yield, therefore, is far below the expectation. There is a wide gap between potential yield of open pollinated varieties having 5 ton per ha (on-station experimental yields), attainable yield of about 3.5 ton per ha (on farm yield with improved practices) and actual yield of 2.037 ton per ha (national average). Hence there is large room to capitalise the proportion of unharvested yield and now research has to focus for alternative technological approaches to break this yield barrier.

In the past, limited activities towards response of maize to different levels of nitrogen have been carried out and found different results (Tripathi and Pathak, 1984; Srivastava and Neupane, 1984; KC and Schulte, 1985; Adhikary, 1992; Srivastava and Neupane, 1992; NMRP, 1997; Rijal *et al.*, 1998; Neupane *et al.*, 1998;

Srivastava *et al.,* 1999). From these past studies, no actual finding is put forwarded. To give continuity of the past work and to find an actual level of nitrogen, it was strongly felt a necessary work to conduct a work on response of maize to different levels of nitrogenous fertilisers in Chitwan conditions. Therefore the objective of this research was to know the response of growth parameters and grain yield of maize to different levels of nitrogen.

MATERIALS AND METHODS

The experimental crop (Arun 2 variety) which is familiar in the Chitwan district, was grown in the field of Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan during the summer season of 2003 in a randomized complete block design with three replications. Four levels of nitrogen (60, 90, 120 and 150 kg nitrogen per ha) was applied. The gross experimental field was 14.5 X 6.5 square metre and the plot size was 3 X 1.5 square metre.

In the well prepared field, the seeds were sown in 2nd April 2003 by giving 75 cm row to row and 25 cm plant to plant spacing. Farm yard manure (FYM) was applied @ 10 ton per ha, phosphorous and potash were applied @ 60: 40 kg per ha respectively. The FYM, potash and phosphorous were applied at the time of final land preparation. The nitrogen was given as per mentioned above and in split doses. Half of the nitrogen was applied at the time of final land preparation and the remaining half nitrogen was given at the time of earthing up. Two hoeing were done, the first hoeing was done 25 days after sowing and the second at the time of earthing up. Two irrigations were given with pipe, the first immediately after sowing and the second 10 days after sowing.

Observation on number of plants per plot, grain yield, plant height, cob height, days to 50% silking and days to maturity were recorded. The number of plants per plot was recorded at the time of first weeding by visual counting. The days to 50 % silking was recorded when 50% plants produced flowers. Days to maturity was recorded when the crop reached at its harvesting stage. The plant height was measured from the base of the plant to the flag leaf. Similarly, the cob height was measured from the base of the plant to the node where the first cob come out. The plant height and the cob height were measured at maturity. The grain yield was recorded of seeds having 13% moisture content. The data was taken from 10 central plants of each plot and then the mean figure was presented. The collected data were analysed with the help of Genstat and Minitab software programs and means separation by using LSD. The correlation between the characters was also analysed.

RESULTS AND DISCUSSIONS

Mean values for number of plants per plot, grain yield, plant height, cob height, days to 50% silking and days to maturity of Arun 2 variety of Maize is presented in Table 1 and Table 2. Analysis of variance was performed for the traits days to 50 % silking, days to maturity, cob height, number of plants per plot, plant height and grain yield of maize to different level of nitrogen. Mean squares for treatment was significant for grain yield whereas non-significant for days to 50 % silking, days to maturity, cob height, number of plants per plot and plant height (Table 1). An LSD test at 5 % level of significance was performed to evaluate the performance of grain yield and found significant different among treatments.

A strong positive correlation (0.81) was found between the traits plant height and cob height. With increase in plant height there is increase in cob height. Hence it was seen that plant height and cob height had a positive relationship. No relation was seen between plant height and grain yield as well as cob height and grain yield. So plant height and cob height did not contribute to increase in economic yield. This result supported the previous results of authors (Adhikary, 1992; Gurung, 1999; NMRP, 2002). Plant height varied from 190 cm (90 kg N/ ha) to 195 cm (120 kg N/ha). Similarly, the cob height also varied from 91 cm (90 kg N /ha) to 98 cm (120 kg N/ha). There was no any significant difference among treatments with respect to plant height and cob height at 0.05 probability (Table 1). This result was in agreement with the previous findings of many workers (Srivastava and Neupane, 1984; Adhikary, 1992; NMRP, 1997; Srivastava *et al.*, 1999). The mean cob height and plant height were 94.3 cm and 192.3 cm, respectively.

Table 1. Mean grain yield, days to 50 % silking, plant height, cob height and days to maturity of Arun 2 variety of maize as influenced by different level of nitrogen at Rampur, Chitwan, Nepal in the summer seasons, 2003

Treatments	Grain yield (t/ha)	Days to 50 % silking (das)	Days to maturity (das)	Number of plants per plot	Plant height (cm)	Cob height (cm)
60 kg N/ha	5.39[a]	50[ns]	88 [ns]	21[ns]	192 [ns]	95 [ns]
90 kg N/ha	5.46[a]	50 [ns]	88 [ns]	21.3 [ns]	190 [ns]	91 [ns]
120 kg N/ha	4.96[b]	50 [ns]	85 [ns]	22 [ns]	195 [ns]	98 [ns]
150 kg N/ha	4.91 [b]	51 [ns]	89 [ns]	21 [ns]	192 [ns]	93 [ns]
Grand mean	5.18	50.3	87.5	21.3	192.3	94.3
LSD	0.23	2.7	5.7	1.5	9.0	7.89
Probablity (0.05)	18.69**	0.62 [ns]	0.62 [ns]	1.14 [ns]	0.72 [ns]	1.67 [ns]

Where, T/ha = ton per hactare, das = days after sowing, N/ha = nitrogen. per hactare, LSD = least significant difference; ** indicates significant at 0.01 probability level, and [ns] indicates non significant. Means followed by the same letter within a column are non significantly different at 0.05 level by LSD

Very strong positive correlation (1) was found between the traits days to 50 % silking and days to maturity. An increment in days to 50 % silking increased the number of days to maturity. Those plants that flowered earlier matured first. Late flowering plants matured later. This finding was similar to the findings of Tripathi and Pathak, 1984; Adhikary, 1992 and NMRP, 2002. Days to 50 % silking varied from 50 (60, 90 and 120 kg N/ha) to 51 days after sowing (150 kg N/ha). Likewise days to maturity also varied from 85 days after sowing (120 kg N/ha) to 89 days after sowing (150 kg N/ha). There was no any significant difference among treatments with respect to 50 % silking and days to maturity at 0.05 probability (Table 1). The mean days to 50 % silking and days to maturity were 50.3 and 87.5, respectively.

Number of plants per plot did not vary significantly. Several researchers (Adhikary, 1992; NMRP, 1997; Rijal *et al.,* 1998; Srivastava *et al.,* 1999) also reported similar findings. Negative correlation (-0.81) was found between the treatments and grain yield of maize. Increment in nitrogen after certain level decreased grain yield. Yield ranged from 4.91 ton/ha (150 kg N/ha) to 5.46 ton/ha (90 kg N/ha). This research showed that the highest yield was achieved by applying medium dose of nitrogen and reduction in yield was found in lower as well as higher doses of nitrogen. This finding was similar to the findings of other workers (Adhikary, 1992; Srivastava and Neupane, 1992; Srivastava *et al*, 1999). It can be explained that plants cannot achieve required amount of nutrients from the soil because of under dose of fertilization. On the other hand, plants cannot utilize the nutrients over than the required dose therefore the higher dose of fertilization sometimes may be injurious to plants. In contrast, this result was contrary to the results of Srivastava and Neupane (1984), Tripathi and Pathak (1984), NMRP (1997), Rijal *et al.* (1998) and Neupane *et al.* (1998). They all found that higher yield was obtained by applying higher doses of nitrogen. This could be due to leaching and or washing away unwanted nutrients over than the normal dose so that the harmful effects of higher doses of fertilizers would be minimized. According to LSD test at 5 % level of significance, a significant result was found and the treatments can be categorised into two groups. There was no significant yield difference between the treaments 60 kg N and 90 kg N /ha as well as between 120 and 150 kg N/ha.

CONCLUSIONS

Significant different results among levels of nitrogen with respect to plant height, cob height, days to flowering, days to maturity and number of plants per plot were not found. The correlation between plant height and cob height, and days to 50 % silking and days to maturity was found positive. The yield governing component, number of plants per plot was not affected by the levels of nitrogen. Significant result among the levels of nitrogen for yield was obtained and showed a negative correlation between levels of nitrogen and grain yield. Application of 60 kg nitrogen/ha and 90 kg nitrogen/ha gave the same result. Similarly, differences between 120 kg nitrogen/ha and 150 kg nitrogen/ha were not found for grain yield. The mean values for number of plants per plot, plant height, cob height, days to 50 % silking after sowing, days to maturity after sowing and yield /ha were 21.3, 192.3 cm, 94.3 cm, 50.3, 87.5 and 5.18 t/ha, respectively.

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