Response of Maize Fodder to Different Nitrogen Levels and Harvesting Times
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Abstract
A field experiment was conducted at Faisalabad, Pakistan, during 2000, to study the effect of 50, 100 and 150 kg N ha\(^{-1}\) on maize (Zea mays L.) cultivar ‘Golden’ harvested 40, 50 and 60 days after sowing. The green fodder yield was significantly increased with increasing nitrogen levels and maximum (43.62 t ha\(^{-1}\)) was obtained when the crop was fertilized at the rate of 150 kg N ha\(^{-1}\). The increase in yield was mainly due to greater plant height (144.92 cm), stem diameter (1.78 cm), leaf number (12.22) and leaf area (207.0 cm\(^2\)) per plant. The crop harvested 60 days after sowing owing to greater plant height (172.99 cm), stem diameter (1.68 cm), leaf number (12.29) and leaf area (207.1 cm\(^2\)) per plant, produced significantly higher yield (44.44 t ha\(^{-1}\)) than the crop harvested earlier. The crop harvested 60 days after sowing and fertilized at the rate of 150 N kg ha\(^{-1}\) seems to be the best combination for getting higher green fodder yield of maize under agro-ecological conditions of Faisalabad.

Key words: Nitrogen, harvesting time, maize fodder, green fodder yield

Introduction
Maize in addition to providing grains for animals and human consumption is also being used as fodder for animals or for conservation by drying or ensilage. Maize fodder is very much liked by animals due to being succulent and palatable. Fodder scarcity is considered a major limiting factor for a prosperous livestock industry in Pakistan. The fodder production is approximately 52-54% less than the actual requirement for animals (Bhatti, 1988). It is therefore, imperative to make efforts to increase production of fodder in the country. The horizontal expansion in fodder is not possible due to human population pressure. So the only solution is to increase yield on per unit area basis.

One way of doing so is to determine its fertilizer requirement. The plant nutrition not only affect the forage production but also improve the quality of forage from view point of its protein content (Ayub et al., 2002b). Harvesting time is another important factor affecting the yield of forage crops. Optimum harvest time increased yield with increased nitrogen rates (Siddique et al., 1989). Delaying harvest increased yield but decreased quality parameters (Agath et al., 1997 and Ayub et al., 2002a). The information on the interactive effects of nitrogen application and harvesting time on green fodder yield of fodder maize is lacking in Pakistan. The present study was therefore, designed to determine the optimum nitrogen rate and harvesting time for obtaining higher green fodder yield of maize.

Materials and Methods
A field experiment to evaluate the response of fodder maize to nitrogen levels of 50, 100 and 150 kg ha\(^{-1}\) when harvested 40, 50 and 60 days after sowing was conducted at Agronomic Research Area, University of Agriculture, Faisalabad, Pakistan. The experiment was laid down in randomized complete block design with factorial arrangement having three replications and measuring a net plot size of 2.4 m x 9 m. The crop was sown with single row hand drill in 30 cm spaced rows on April 10, 2000. Prescribed doses of nitrogen and basal dose of phosphorus at the rate of 60 kg ha\(^{-1}\) were applied at the time of seedbed preparation in the form of urea and single super phosphate, respectively. All other practices were kept normal and uniform for all the treatments. The data regarding growth and yield parameters were recorded following standard procedures. The data collected was analyzed statistically by using Fisher’s analysis of variance technique and differences among treatment means were compared using least significant difference test at 5% probability level. (Steel and Torrie, 1984).

Results and Discussion
The data regarding yield and yield components are presented in table 1. The effect of nitrogen levels and harvesting times on plant density was not significant. These non-significant results can be attributed to the use of uniform seed rate having same viability in all the plots. Rafiq et al. (1996) had also reported that nitrogen application did not affect the plant density.
Plant height was affected significantly by nitrogen application. The plant height was increased significantly with each increased nitrogen level. The plots receiving 150 kg N ha\(^{-1}\) produced the tallest plants against the minimum plant height at nitrogen level of 50 kg ha\(^{-1}\). Significant increase in plant height with nitrogen application has also been reported by Ayub et al. (2002b). Harvesting time also significantly affected the plant height. The plots harvested 60 days after sowing produced significantly taller plants as compared to those harvested on 40 and 50 days after sowing. An increase in plant height with delayed harvesting has also been reported by Musa et al. (1993) and Ayub et al. (2002a).

A significant increase in stem diameter was observed at each increased rate of nitrogen fertilizer. The plots fertilized at the rate of 150 kg N ha\(^{-1}\) produced significantly thicker stems than all other nitrogen levels. These results are supported by Ahmad (1999) and Ayub et al. (2002a,b). Among the harvesting times, plots harvested 60 days after sowing produced significantly thicker stem than other treatments. The minimum stem thickness was obtained in plots harvested 40 days after sowing. Increase in stem diameter with delayed harvesting has also been reported by Siddique et al. (1989) and Ayub et al. (2002a).

Nitrogen application significantly increased the number of leaves plant\(^{-1}\) and all nitrogen levels differed significantly from each other. The maximum leaves plant\(^{-1}\) were observed in plots receiving nitrogen at the rate of 150 kg ha\(^{-1}\). Safdar (1997) has also reported that nitrogen application increased number of leaves plant\(^{-1}\). The crop harvested 50 and 60 days after sowing produced statistically similar number of leaves per plant but both these treatments have significantly higher number of leaves plant\(^{-1}\) than crop harvested 40 days after sowing. These results confirm the findings of Ashraf (1976).

Increase in nitrogen rates significantly increased the leaf area plant\(^{-1}\). The maximum and minimum leaf area plant\(^{-1}\) was recorded at nitrogen levels of 150 and 50 kg ha\(^{-1}\), respectively. Significant increase in leaf area with nitrogen application can be attributed to more number of leaves per plant. These results are quite in line with those of El-Hattab et al. (1980) and Ayub et al. (2002a). Harvesting time also significantly affected the leaf area plant\(^{-1}\). The plots harvested 60 days after sowing produced significantly more leaf area plant\(^{-1}\) than earlier harvesting times. Minimum leaf area was observed when crop was harvested 40 days after sowing. Musa et al. (1993) had also reported a significant increase in the leaf area plant\(^{-1}\) with delaying the harvest.

Green fodder yield was increased with increased nitrogen rate and increase was significant at each increased nitrogen rate. The minimum green fodder yield was recorded in plots receiving 50 kg N ha\(^{-1}\). The increase in yield was mainly due to more number of leaves and leaf area plant\(^{-1}\), stem diameter and plant height. Similar results have also been reported by Safdar (1997) and Ayub et al. (2002a,b). Plots harvested 60 days after sowing produced more number of leaves and leaf area plant\(^{-1}\), stem diameter and plant height produced significantly higher green fodder yield than plots harvested earlier. Plots harvested 40 days after sowing gave minimum green fodder yield. Increase in green fodder yield with delayed harvesting has also been reported by Genter et al. (1970) and Ayub et al. (2002a). Interaction between nitrogen levels and harvesting times for all the parameters discussed was not significant.

**References**


