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Influence of Different Nitrogen Levels and Harvesting Times on Dry Matter Yield and Quality of Fodder Maize

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Abstract

In field experiment at Faisalabad, Pakistan conducted during 2000, the effect of 50,100 and 150 kg N ha^{-1} and harvesting times i.e. 40, 50 and 60 days after sowing on dry matter yield and quality of fodder maize (*Zea mays* L.) was investigated. The dry matter yield, dry matter contents and crude fibre contents were significantly increased by both increased nitrogen level and delaying the harvest. Whereas, the content of crude protein and ash were increased with increased nitrogen level and were decreased with delayed harvest. Ether extractable fat contents were significantly decreased by increased nitrogen level and delayed harvest. The crop fertilized at the rate of 150 kg N ha^{-1} and harvested 60 days after sowing proved to be the best combination for getting higher dry matter yield (20.63 t ha^{-1}) of maize cultivar 'Golden' under Faisalabad conditions.

Key words: Nitrogen levels, harvesting time, crude protein, crude fibre, dry matter

Introduction

Maize (Zea mays L.) is grown as food, feed and fodder crop in Pakistan and plays a key role in both human and animal diet. Maize fodder in spite of low protein contents is relished by the animals due to being succulent and palatable. Although the soils and climatic conditions of Pakistan are favourable for maize production but it's per hectare yield is very low as compared to other maize growing countries of the world. Low yield of maize is due to many constrains but fertilizer application is one of the major factor, which can increase the fodder production on per unit area basis. The plant nutrition not only affects the forage production but also improve the quality of forage from view point of its protein content (Ayub *et al*., 2002b).

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Similarly Baran (1987) reported that the application of nitrogen to maize increased the fodder nutritive value by increasing the crude protein and by reducing the ash and fibre concentration. Harvesting time is another important factor affecting both yield and quality of forage crops. Optimum harvest time increased the yield and crude protein content with increased nitrogen rates while delayed harvesting deceased the crude protein contents (Siddique *et al*., 1989). The effect of harvesting time on the chemical composition of fodder are greater than cultivars (Firdous *et al*., 1996). Delaying the 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 quality of maize fodder is lacking in Pakistan. The present study was therefore designed to determine the optimum nitrogen rate and harvesting time for obtaining higher maize fodder yield of good quality under Faisalabad, conditions.

Materials and Methods

A field experiment to evaluate the effect of different nitrogen levels and harvesting times on dry matter yield and quality of maize fodder 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 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. The nitrogen fertilizer was applied at the rate of 50, 100 and 150 kg ha^{-1} through urea and 60 kg P ha^{-1} was applied as single super phosphate.. Both phosphorus and prescribed levels of nitrogen were applied at sowing. All other agronomic practices were kept normal and uniform for all the treatments. Quality parameters like crude protein, crude fibre, ether extractable fat and total ash percentage were determined using the methods recommended by AOAC (1984). The data collected was analysed 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

Dry mater per cent was increased with increased nitrogen rate but the increase in dry matter contents could not reach to a significant level from 50 to 100 kg N ha^{-1} (Table 1). Maximum dry matter percentage was obtained when nitrogen was applied at the rate of 150 kg ha^{-1}. An increase in dry matter percentage with nitrogen application has also been reported by Ahmad (1999) and Ayub *et al*. (2002b). Dry matter percentage was also increased significantly with the advancement in maturity and all harvesting times differed significantly from each other. These results are quite in line with those of Ayub *et al*. (2002a). Interaction between nitrogen levels and harvesting times was not significant.

Crude fibre contents were influenced significant by nitrogen application. Plots receiving nitrogen at the rate of 150 kg ha^{-1} gave significantly higher crude fibre percentage than all other nitrogen levels. The minimum crude fibre percentage was recorded in plots fertilized at the rate of 50 kg N ha^{-1}. Safdar (1997), Ahmad (1999) and Ayub *et al*. (2002b) had also reported that crude fibre contents were increased significantly by nitrogen application. The crude fibre contents were increased significantly with delaying the harvest. Maximum and minimum fibre contents were recorded when crop was harvested 60 and 40 days after sowing, respectively. An increase in crude fibre contents with delaying harvest has also been reported by Firdous *et al*. (1996) and Agath *et al*. (1997). Interaction between fertilizer and harvesting times was not significant.

The application of nitrogen significantly affected the crude protein contents. The application of nitrogen at the rate of 150 and 100 kg N ha^{-1} produced significantly higher crude protein content than 50 kg ha^{-1}. Nitrogen being a basal component of amino acid might have enhanced protein contents. The increase in crude protein content of maize fodder with nitrogen application has been reported by many workers before like Safdar (1997), Ahmad (1999) and Ayub *et al*. (2002a&b). Crude protein contents were decreased with delaying the harvest and all harvests differed significantly from one another. Maximum and minimum crude protein contents were noted when crop was harvested 40 and 60 days after sowing, respectively. A significant decrease in protein contents with advanced maturity has also been reported by Agath *et al*. (1997) and Ayub *et al*. (2002a). Interaction between nitrogen levels and harvesting times was not significant.

Table 1: Effect of nitrogen levels and harvesting times on drymatter, crude fibre and crude protein contents of maize fodder.

	Nitrogen levels (kg ha^{-1})			Harvesting times (days after sowing)		
	50	100	150	40	50	60
Dry Matter (%)	30.24 b	31.07 b	31.93 a	24.71 c	30.59 b	37.94 a
Crude fibre (%)	27.61 c	29.03 b	30.25 a	27.64 c	28.50 b	30.75 a
Crude protein (%)	8.76 b	11.09 a	11.50 a	11.66 a	10.62 b	9.07 c

Means having same letter in a column did not differ significantly at 5% probability level.

Table 2: Effect of different nitrogen levels and harvesting times on ether extractable fat contents of fodder maize.

Nitrogen levels (kg ha^{-1})	Harvesting times (days after Sowing)			
	40	50	60	Means
50	3.05 a	1.91 e	2.34 c	2.45 a
100	2.52 b	2.09 d	1.91 e	2.17 b
150	1.78 f	2.52 b	1.23 g	1.83 c
Means	2.43 a	2.17 b	1.84 c	

Means having same letter in a column did not differ significantly at 5% probability level.

Table 3: Effect of different nitrogen levels and harvesting times on ash contents of fodder maize.

Nitrogen levels(kg ha^{-1})	Harvesting times (days after Sowing)			
	40	50	60	Means
50	10.52 e	9.41 g	8.76 h	9.56 c
100	11.33 c	10.70 d	9.85 f	10.63 b
150	12.92 a	11.63 b	10.75 d	11.77 a
Means	11.59 a	10.58 b	9.79 c	

Means having same letter in a column did not differ significantly at 5% probability level.

Table 4: Effect of different nitrogen levels and harvesting times on dry matter yield of fodder maize.

Nitrogen levels (kg ha^{-1})	Harvesting times (days after Sowing)			
	40	50	60	Means
50	6.10 g	8.92 e	13.90 c	9.64 c
100	7.37 f	11.11 d	16.23 b	11.57 b
150	9.18 e	13.12 c	20.63 a	14.31 a
Means	7.55 c	11.05 b	16.92 a	

Means having same letter in a column did not differ significantly at 5% probability level

Ether extractable fat percentage was decreased significantly with increased rate of nitrogen application and all nitrogen levels differed significantly from one another. The maximum extractable fat percentage was recorded in plots fertilized at the rate of 50 kg N ha^{-1}. Similar results have been reported by Ahmad (1999) and Ayub *et al*., (2002 a & b). The extractable fat contents were decreased significantly with the advancement in maturity and all harvests differed significantly form one another. Maximum and minimum extractable fat contents were noted when crop was harvested 40 and 60 days after sowing, respectively. A decrease in extractable fat contents with delaying harvest has also been reported by Ayub *et al*. (2002a). Interaction between fertilizer and harvesting times was also significant. The maximum ether extractable fat percentage was observed when crop was fertilized at the rate of 50 kg N ha^{-1} and harvested 40 days after sowing. The crop fertilized at the rate of 150 kg N ha^{-1} and harvested 60 days after sowing produced the minimum ether extractable fat contents.

The ash percentage was increased significantly by each increased nitrogen level. Plots receiving nitrogen at the rate of 150 kg ha^{-1} gave significantly higher ash percentage than all other nitrogen levels. The results are in accordance with those of Safdar (1997), Ahmad (1999) and Ayub *et al*. (2002b). The ash contents were decreased significantly with the advancement in maturity and the decrease was significant at each advanced maturity stage. Maximum and minimum ash contents were noted when crop was harvested 40 and 60 days after sowing, respectively. A decrease in ash contents with delayed harvesting has also been reported by Ayub *et al*. (2002a). Interaction between fertilizer and harvesting times was also significant. The maximum ash percentage was observed when crop was harvested 40 days after sowing and fertilized at the rate of 150 kg N ha^{-1} and the minimum ash percentage was observed when crop was given 50 kg N ha^{-1} and harvested 60 days after sowing.

Dry matter yield was increased significantly at each increased rate of nitrogen fertilizer (Table 4). The maximum dry matter yield was obtained from plots fertilized at the rate of 150 kg N ha^{-1}. A significant increase in dry matter yield with nitrogen application has also been reported by Ahmad (1999) and Ayub *et al*. (2002a&b). Dry matter yield was also affected significantly by harvesting times and all differed significantly from each other. The maximum dry matter yield was recorded in plots harvested 60 days after sowing. These results are in agreement with those of Ayub *et al*. (2002a). The interaction between nitrogen levels and harvesting times was also significant. The plots fertilized at the rate of 150 kg N ha^{-1} and harvested 60 days after sowing gave significantly higher dry matter yield than all other combinations and minimum dry matter yield was obtained from plots receiving 50 kg N ha^{-1} and harvested 40 days after sowing.

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