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The Amount and Timing of Foliar Urea Application Effect on Maize and Forage Sorghum Proteins

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Abstract: This study was carried out for investigating the effect of amount and timing of foliar urea in increasing silage yield and protein content of fodder, in a maize field in Neyshabour, Khorasan Razavi Province during 2011 summer crop season. A split plot design with factorial arrangement and three replications were used. Treatments were timing of foliar urea application (a week before tasselling, mid anthesis and early milk stage), urea levels (zero (check), five and 7.5 $g.lit^{-1}$) and two hybrids of corn (Sc 704) and forage sorghum (speed feed). The results indicated that the concentration of nitrogen had significant effect to increase forage protein and silage yield (correcting by 280 $g.kg^{-1}$ of dry matter). The highest forage protein concentrations for both crops and silage yield were achieved with 7.5 $g.lit^{-1}$ of urea application, but the silage yield of sorghum was more than that of corn. The results showed that urea spraying can effectively increase the fodder nitrogen and silage protein, respectively, with the least possible cost, and in this respect it has an important role in providing quality and environmental safe forage for producer and consumer, meanwhile the adverse effects of excessive use of nitrogen fertilizer are reduced.

Keywords: Silage corn and sorghum, time of foliar application, foliar application amount

INTRODUCTION

The grain and silage of maize and sorghum have important roles in feeding livestock and poultry. However, maize is very palatable and its role in animal diets is extremely important, especially their fresh and silage products are of high interest and consumption by the livestock [3]. Increasing the quality and quantity of forages in maize and sorghum has always been discussed. Therefore, the role of nitrogen is important. Nitrogen is the basic element in synthesis and structure of protein molecules, enzymes, co-enzymes, nucleic acids and cytochromes [7]. It is evidence that spraying urea is a simple, low cost method for supplementary soil fertilization with nitrogen. Also, excessive use of nitrogen fertilizer could result in accumulation of nitrates in sub-soil, leaching and polluting the underground water [5]. Koul (1997) reported that the use of nitrogen enhances plant height, stem diameter, fresh and dry weight of silage maize [4]. Cox and Cherny (2000) observed maize silage dry matter increasing as nitrogen consumption was increased [2]. Since the discussion of increasing the forage quality and also dangers of excessive accumulation of nitrate in plant and soil as the results of imprecise use of urea are raised, the purpose of this research was determining the appropriate time and concentration for foliar urea application in order to increase forage quality with the low cost for producer, consumer and decreasing its polluting effects in the soil and the environments.

MATERIALS AND METHODS

An experiment was carried out in a maize field in Neyshabour, Khorasan Razavi Province during 2011 summer crop season. A split plot design with factorial arrangement and three replications were used. Treatments were timing of foliar urea application (a week before tasselling, mid anthesis and early milk stage), urea levels (zero (check), five and 7.5 $g.lit^{-1}$) and two hybrids of corn (Sc 704) and forage sorghum (speed feed). Each plot consisted of four rows of 0.75 × six meters and was separated with one row as corridor. The space between plants within the row was adjusted 15 cm for maize and 8 cm for forage sorghum. There were two planting rows for each hill per plot (eight planted rows in each plot). Soil samples were taken before planting from depth of 0-30 cm. Soil texture, N content and some micro elements such as Zn and Fe were determined. Field operation and using starter fertilizer including phosphorus, potassium, urea and manure have been done by farmer (check plot). Two center rows of each plot (9 m^2), were used for spraying and recording data. Silage yield of both crops was corrected for 280 $g.kg^{-1}$ dry matter which is the suitable moisture for ensiling fresh forages with least effluents in silo. For urea level of zero, un-fertilizer water was used to decrease the error effect of spraying. *Kjeldahl* method was used to measure plant tissue nitrogen and calculate protein content. Testing data for normality, variance analysis and comparison of mean were done by MSTAT-C software and for drawing charts and tables, Excel software was used.

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RESULTS

The results of the ANOVA (table1) indicated that the effects of spraying different nitrogen concentration levels on the protein of forage and silage yield corrected by 280 $g.kg^{-1}$ of dry matter were significant. Differences among time of urea spraying effect were not significant on desirable traits. Maize and sorghum forage proteins at concentrations of five and 7.5 $g.lit^{-1}$ showed significant increase compared to check (fig.1). Highest and lowest protein contents in forage were 13.08% and 11.58% which recorded for 7.5 $g.lit^{-1}$ of urea spraying and check respectively. There were significant differences for silage yield between maize and forage sorghum (p=1%). The highest silage yield of 63.3 ($ton.ha^{-1}$) was achieved at 7.5 $g.lit^{-1}$ of urea application in sorghum (fig.3). The results also indicated that, with increasing nitrogen concentration, the silage yield of both crop has significantly increased in compared to check. The most silage yield has been 64.03 $ton.ha^{-1}$ in 7.5 $g.lit^{-1}$ of urea concentration, which was 18 percent more than check (fig.2).

Table1. Analysis of variance for effects of amount and time of foliar urea application on protein and forage yield of maize and sorghum.

S.O.V	df	Mean of squares	
		Forage yield(t/h)	Forage protein%
Replication	2	1.755	0.647
Plant(A)	1	737.042*	0.282^{ns}
Error1	2	16.752	1.145
Time(B)	2	2.385^{ns}	0.694^{ns}
A×B	2	0.711	0.169
Concentration(C)	2	485.264**	12.366**
A×C	2	22.357	0.004
B×C	4	41.891	0.435
A×B×C	4	14.058	0.262
Error	32	24.965	0.394
CV%		8.38%	5.01%

ns,* and**:non-significant, significant at 5% and 1% levels respectively

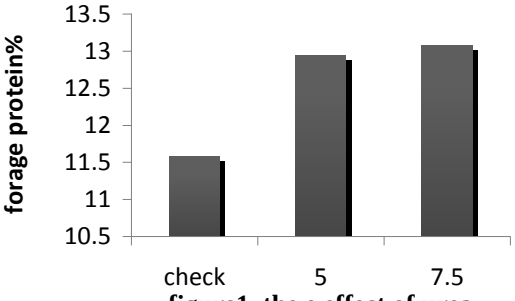

figure1. the e effect of urea concentration on forage protein

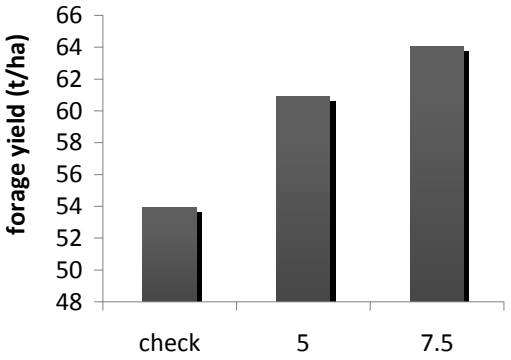

figure2. the effect of urea concentration on forage yield corrected for 280g/kg DM

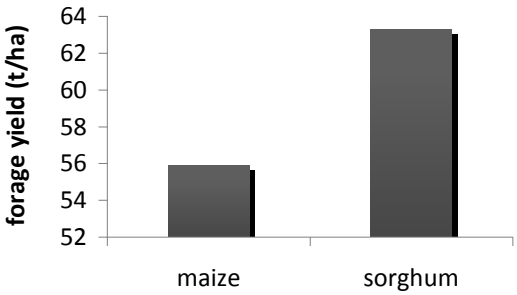

figure3. means comparison of forage yield among maize and sorghum

DISCUSSION AND CONCLUSION

For proper development of plants, their nitrogen supply is essential in each of the growth stages. Just giving too much or enough fertilizer is not sufficient, instead steadily preparing of nitrogen for plant is of more importance. According to Mason (1972) increased nitrogen fertilizer during the planting, probably has small effects on enhancing grain protein because they believed that nitrogen at the planting time in some cases may be removed from availability of plant by leaching [6]. Bah and his colleagues (1998) stated that nitrogen deficiency, limits more crop growth and productions relative to other elements. Nitrogen can increase the yield and yield components (the number of spikes, Grain number per spikes and grain weight) in sorghum. Although, the different sorghum cultivars respond different to nitrogen concentration, but mostly, this is a positive impact and grain and biological yield increases as nitrogen level increase [1]. In general, it could be concluded that foliar urea application in appropriate concentration and time can have positive impact on both quantitative and qualitative factors of maize and sorghum especially, the forage protein. It plays an important role in livestock feeding and therefore farmers and ranchers are

concerned to it. Also, this method of providing nitrogen for plants could reduce the problems caused by excessive use of chemical fertilizers, such as urea. According to ANOVA, however differences among the phonological growth stage for spraying of nitrogen were not significant, but the results indicated that spraying of urea in the mid anthesis and early milk stage is better than one week before tasselling.

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