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Influence of Nitrogen Foliar Application on Grain Yield and Protein Content of Grain Sorghum

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Abstract: In order to evaluate the effect of urea foliar application of urea on yield and protein content of Kimia cultivar grain sorghum, a factorial experiment was carried out using Randomized Complete Bloke design with 3 replicates and 12 treatments in Saatlo Agricultural Research Center in Uremia, Iran. The factors in this research were foliar application stages (knee stage, tassel emergence, knee stage + tassel emergence) and the foliar application percent (0, 50, 75 and 100%). The results of data analysis showed that foliar application has significant effect on some characteristics such as grain yield, thousand kernel weight, number of grains in a panicle and protein content of grain but no effect on weight of panicle. In treatment stages knee stage has higher result in grain yield as number of grains in a panicle but foliar application in tassel emerges is more effective in thousand kernel weight and grain protein content.

Key words: Grain sorghum, foliar application, nirtogen and yield, influence, protein content

INTRODUCTION

Grain Sorghum (*Sorghum bicolor* L. Moench) is a crop of world-wide importance and is unique in its ability to produce under a wide array of harsh environmental condition (House, 1995; Moghaddam *et al*., 2007). It is considered the forth cereal crops after maize, wheat and rice and Most of grain sorghum grown in Asia and the African tropics is used for human food and also fed to livestock or poultry (Gul *et al*., 2005). Inorganic fertilizers are important inputs in any agricultural production system and Nitrogen is the essential element required for plant growth in relatively large amounts and its deficiency can result reduce in dry matter, crude protein and grain yield (Ashinio *et al*., 2005). One factor that continues to be a problem in farming systems is N fertilizer management (Khosla *et al*., 2000).

Nitrogen is the most nutrient for high grain sorghum productivity. In soils with good aeration nitrate is the dominant available form of nitrogen in higher plants. Great efforts have been made to improve sorghum productivity by new cultivars and increasing the efficiency of added fertilizers (Amal *et al*., 2007). Increasing nitrogen use efficiency in plants is considered as a major way to decrease nitrate accumulation and its leaching in soil (Amal *et al*., 2007). The best method and time of nitrogen fertilizer application will significantly improve both quantity and quality of crops as well as nitrogen use efficiency Foliar application refers to the spraying on leaves of growing plants with suitable fertilizer solutions. In many cases, aerial spray of nutrients is preferred and gives quicker and better results than the soil (Jamal *et al*., 2006). Most of absorption by the leaf takes place by diffusion through the cuticle. Application of N near flowering increased post flowering N uptake, grain protein content and grain protein concentration (Woolfolk *et al*., 2002).

The objectives of this study were: To determine the effective method of N fertilizer application and to evaluate the best time of N fertilizer application.

MATERIALS AND METHODS

This research was been carried out in Saatlo agricultural research center (37°44N, 45°10 altitude 1338 m) during the planting seasons of 2006. Generally, climates are dominant in this region. The average annual temperature is 11.3°C, rain fall is 74.2 mm. The highest humidity was 70%. The soils of experimental area as showed in the table were silt clay loam and chemical analysis showed the PH 8 and EC 0.57 (Table 1).

The experimental design was a factorial using completely randomized block design with 3 replications. The factors in this research were foliar application stages

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Table 1: Physical and chemical analysis of soil

Soil texture	PH	SP (%)	Clay (%)	Silt (%)	Sand (%)	O.C	N (%)	P (ppm)	K (ppm)
Silt clay loam	8	57	33	55	12	1.2	0.12	12.0	800

(knee stage, tassel emergence, knee stage + tassel emergence) and the foliar application percent (0, 50, 75 and 100%). Variety of grain sorghum was Kimia.

Seed was sown by hand in 3-5 cm depth at 166.000 ha in 5-row plots 60 cm apart and 5 m long. Sowing took place on 4th June 2006. The experimental area was fertilized with 100 kg ha Nitrogen (N) and 250 kg ha Phosphorus (P) before planting. After 3 weeks' plants were thinned.

Analysis of variance of the data from each attribute was computed using MSTATC program. The Duncan's new multiple range tests at 5% level of probability was used to test among mean values.

RESULTS AND DISCUSSION

The results of data analysis as shown in the following Table 2 indicated that foliar application has significant effect on some characteristics such as grain yield, number of grains in a panicle and grain protein content but no effect on weight of panicle. In treatment stages knee stage has higher resulted as in grain yield as the number of grains in a panicle although foliar application in knee stage + tassel emergence is more effective in thousand kernel weight and grain protein content. Increase in the foliar application percent in ratio to soil application causes better results in grain yield and its components and also in grain protein content.

Grain yield: The effect of foliar application stages and percent showed significant differences in data analysis. Between foliar application stages, Knee stage had better result in improving grain yield, although foliar application in 2 stages was in the same statistical group (Fig. 1). Tassel emerge had the lower effect in grain yield. In foliar application percents 100% was in higher statistical group and 75, 50 and 0% were in the second rank as showed in Fig. 2. The interaction of 2 factors was insignificant.

Yield components and grain protein content: In yield components panicle weight showed insignificant differences to factors but number of grains in panicle showed significant difference in foliar application stages but insignificant respect to foliar application percent. Between stages knee stage had better result in improving grain yield and the other treatments (tassel emerge and knee stage + tassel emerge) were in the 2nd statistical group. Although, foliar percent factor was in significant

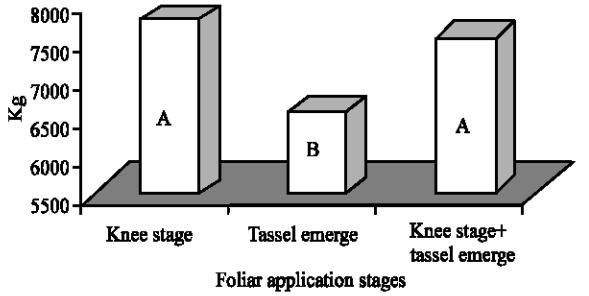

Fig. 1: The effect of foliar application stages on grain yield

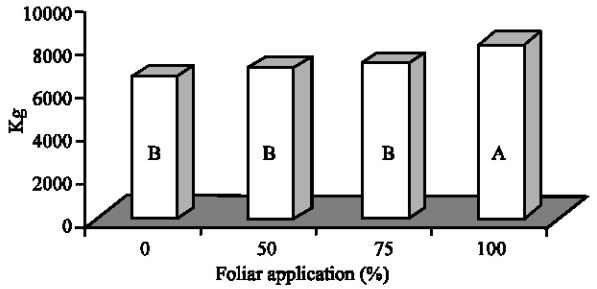

Fig. 2: The effect of foliar application percent ratio soil application on grain yield

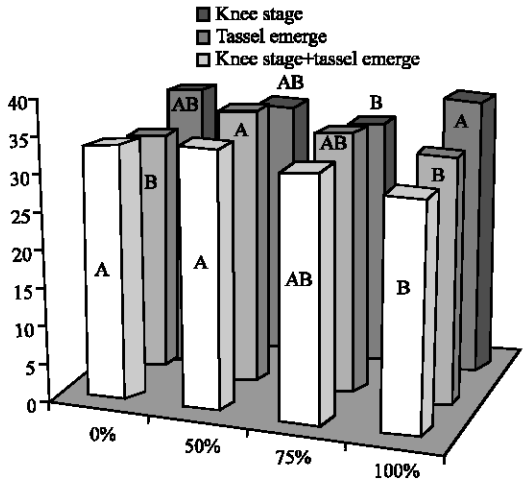

Fig. 3: The interaction effect of foliar application stages and percent on TKW

but showed increase in panicle grain number. The interaction of these factors was shown in Fig. 3. In thousand kernels weight, adverse to grain number of the panicle foliar application in stages was respectively tassel

Table 2: Mean variance analysis in yield and yield components and grain protein

Source of variation	Freedom degree	Grain yield (Kg ha)	1000 grain weight (g)	No. grain per panicle	Panicle weight (g)	Grain protein content
Rep.	2	36.75	2.707	53007.2	58.865	0.389
A	2	716.266*	23.045*	251620*	403.325*	0.556**
B	3	86.938*	5.637ns	48037.562ns	51.557ns	1.432**
A×B	6	210.703ns	10.946*	141193.653*	192.584ns	0.094ns
E	22	87.125	2.733	30994.475	101.507	0.104
CV		10.63	4.9	6.23	9.23	3.33

A = Foliar application stages (knee stage, tassel emerge and Knee stages tassel emerge), B = foliar application percent (0, 50, 75 and 100%), *significant difference in 5% level probability, **significant difference in 1% level probability, ns = insignificant difference in 5% level probability

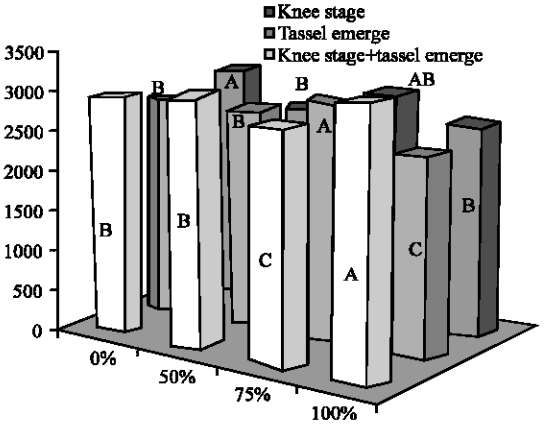

Fig. 4: The interaction effect of foliar application stages and percent on grain number of panicle

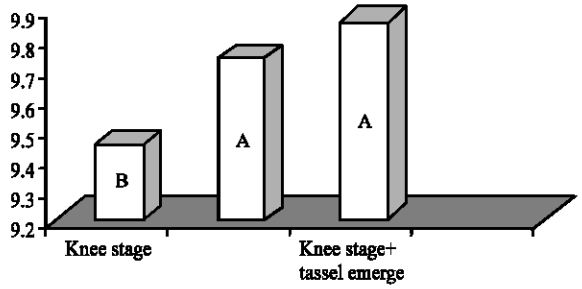

Fig. 5: The effect of foliar application stages on grain protein

emerge, knee stage + tassel emerge and knee stage. The interaction was shown in Fig. 4. Our results are the same as reported by Sarandon and Gianibelli (1990) and Arif *et al.* (2006). In grain protein data analysis showed that urea foliar application had better result in treatment (tassel emerge and knee stage + tassel emerge) and tassel emerge treatment and were in the same statistical group (Fig. 5). Foliar application in knee stage was in the 2nd rank. About 75 and 100% foliar application was in the statistical A group and 0 and 50% in the B group (Fig. 6).

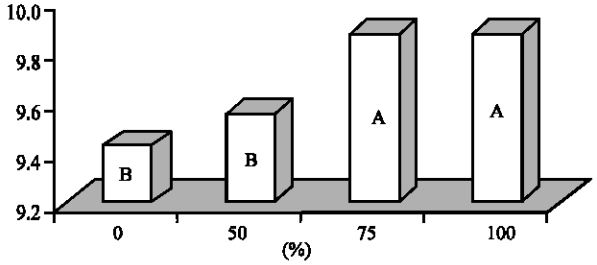

Fig. 6: The effect of foliar application percent ratio soil application on grain protein content

This was in agreement with the researchment done in 2007 by Amal and Hassanein although Seilsepour (2007). The interaction effect of foliar application stages and percent had insignificant difference in 5% level probability.

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