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EFFECT OF PLANTING DATE AND APPLICATION OF NITROGEN ON YIELD RELATED TRAITS OF FORAGE SORGHUM CULTIVARS

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Abstract

In order to study the effect of planting date and nitrogen nutrition on yield of two forage sorghum cultivars, a split factorial experiment with four replications was conducted on 2012 growing season in Fariman, Iran. Main factor belonged to planting dates, including June 10, June 26 and July 16. Combination of cultivars, Speedfeed and Jumbo, and nitrogen application, Control, 75 and 150 kg.ha^{-1} net nitrogen, were adjusted as sub plots. Results showed that with delaying of planting date, the total dry matter and fresh forage yield was decreased. The highest fresh and dry forage yield was achieved in June 10 treatment. Leaf area index, leaves number, tillering, and fresh forage yield were affected by nitrogen. Speedfeed was superior to Jumbo in its fresh and dry biomass, specially in the treatment of June 10, that this cultivar produced 87.2 ton.ha^{-1} fresh biomass.

Key words*: forage sorghum, planting date, nitrogen, biomass.*

INTRODUCTION

Sorghum, *Sorghum bicolor* L., is an important fodder crop for both arid and semi-arid regions of the world. This importance is due to its higher water use efficiency, relatively good tolerance to drought and salt stresses, potential for tillering in high amounts, and good competitiveness with weeds in advanced growth stages. Planting date has a key role in establishment the crop specially in mild cold areas, where sorghum is damaged from early or late sowing dates. In such a climatic conditions, proper nitrogen application has an important role for fast growth and green forage production too.

Khalili Mohaleh et al. (2007) showed, the significant differences for Leaf Area Index (LAI) of sorghum hybrids. The highest LAI was belonged to cv. Sugargraze with 9.14 and the lowest one to cv. Jumbo about 7.86. Other experiments in Iran have shown the superiority of cv. Speedfeed sorghum compared to the others in forage yield (Sadeghi & Mohmmedi, 1994 ; Gholami, 1994). Beheshti (1994) has confirmed for the highest forage yield of Speedfeed cultivar in earlier planting dates. Forage sorghum has a great response to nitrogen nutrition (Ram and Singh, 2001). The rate of N fertilizers is varied from 45-224 kg.ha^{-1} related to soil fertility, climate and cultivar (Zhao et al., 2005). Evidences show the more effectiveness of N absorption by sorghum than corn resulted to higher dry matter accumulation (Young & Long, 2000).

MATERIALS AND METHODS

In order to characterize the evolution of planting date and application of nitrogen on related trait and yield of forage sorghum, a split factorial experiment with four replications was conducted on 2012 growing season in Fariman, Iran. Main factor belonged to planting dates, including June 10, June 26 and July 16. Combination of cultivars, i.e. Speedfeed and Jumbo, and nitrogen application, Control, 75 and 150 kg.ha^{-1} net nitrogen, were adjusted as sub plots. Nitrogen was supplied from the source of Urea fertilizer. In control treatment, did not used any kind of nitrogen based fertilizers. Plant density after emergence was adjusted to 360,000 plant.ha^{-1}. LAI was calculated via five different samplings with leaf area meter, in each samples the total shoot dry matter was measured too. At flowering period another traits, i.e. plant height, tiller and leaves numbers, was recorded. At harvest time fresh and dry yield of forage was measured. The data, collected from experimental plots, have

been statistically processed and interpreted. Means of treatments was compared using Duncan's multiple range test.

RESULTS AND DISCUSSIONS

The analysis of variance showed a statistically significant effect of planting date on plant tillers, leaves number and fresh and dry weight of forage per hectare. But the LAI remained statistically unaffected (Table 1). The greatest LAI achieved in earliest planting date (Table 2). It seems that increasing of growing season and greater leaves number in first planting date have led to this superiority (Khalili Mohaleh et al., 2007).

The greatest yield of fresh and dry forage was obtained in first planting date too, that were 81.30 and 19.87 ton.ha^{-1} (Table 2).

Cultivars also showed a significant effect on all of the traits under consideration (Table 1). Speedfeed was superior to Jumbo in its fresh and dry biomass with 80.43 and 18.42 ton.ha^{-1} respectively. But Jumbo had the greater number of tillers i.e. 2.81 tillers per plant (Table 2).

All traits had a significant trend after using N fertilizer compared to control (Table 1). The more nitrogen application, the more forage yield as fresh and dry biomass, 78.21 and 14.5 ton.ha^{-1} respectively in 150 Kg.ha^{-1} net nitrogen (Table 2). Generally the greatest forage yield was obtained in combination of 150 kg.ha^{-1} net nitrogen×first planting date about 85.41 kg.ha^{-1}. But it was not statistically significant compared to combination of 75 Kg.ha^{-1} net nitrogen × first planting date (Table 2). So it seems that because of environmental precautions we must select the second combination with lower N application in forage sorghum production. This plant can produce more yield in two cuttings per growing season if its nitrogen requirement is balanced. At this conditions the nitrogen use efficiency of the crop is increased too (Seied Sharifi et al., 2009).

Table 1. Analysis of variance for morphological and yield of forage sorghum

		Mean Squres				
Variation sources	**df**	**Tiller number**	**Leaf number**	**LAI**	**Total Fresh Biomass**	**Total Dry Biomass**
Replication	2	0.049$^{n.s}$	178.330*	3.720$^{n.s}$	20.120$^{n.s}$	0.312$^{n.s}$
Planting date	2	0.683*	2053.320**	19.010$^{n.s}$	49.13*	17.120**
Eror$_a$	4	0.103	12.810	12.330	78.129	2.013
Cultivars	1	0.701**	828.320**	41.781**	1072.228**	109.472**
Nitrogen	2	0.263**	668.920**	19.053**	1603.712**	48.132**
PD×C	2	0.321**	72.910$^{n.s}$	127.348**	361.022$^{n.s}$	33.189**
PD×N	4	0.062$^{n.s}$	69.220$^{n.s}$	1.640$^{n.s}$	182.112$^{n.s}$	8.032$^{n.s}$
C × N	2	0.071$^{n.s}$	11.030$^{n.s}$	1.792*	361.372*	11.281*
PD×C×N	4	0.079$^{n.s}$	131.93$^{n.s}$	3.828*	38.118*	1.703*
Eror$_b$	30	0.058	74.81	4.986	155.41	6.413
%C.V	-	16.02	12.38	20.78	16.87	19.02

n.s, *, ** are Non significant and Significant at P≤0.05 and P≤0.01, Respectively.

Table 2. Mean comparison for morphological and yield of forage sorghum

Treatment	**Tiller number**	**Leaf number**	**LAI**	**Total Fresh Biomass(ton/ha)**	**Total Dry Biomass (ton/ha)**
Planting Date					
June 10	2.76a	81.61a	10.61a	81.30a	19.87a
June 26	2.68a	80.92a	9.36b	75.71b	15.23b
July 16	2.25a	68.93b	9.12b	67.42c	14.02b
Cultivars					
Speedfeed	2.63a	73.11a	10.81a	80.43a	18.42a
Jambo	2.81a	68.23b	9.02b	72.68b	14.93b
Nitrogen					
0	2.39b	69.03c	8.40c	63.28c	11.68b
75	2.61a	74.18b	9.28b	69.41b	12.73b
150	2.73a	83.72a	10.8a	78.21a	14.51a

Letters in each columns show significant differences based on Duncan's Test.

CONCLUSIONS

The fall chilling temperatures come soon at this area, so if effective growing period be more available for forage sorghum, its yield is increased undoubtedly. So early planting leads to better land and resources use productivity. Proper use of nitrogen is resulted to increasing of forage yield and lowering the environmental constrains. In this experiment the cv. Speedfeed produced more biomass and had more sensitivity to planting date and nitrogen fertilizers.

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