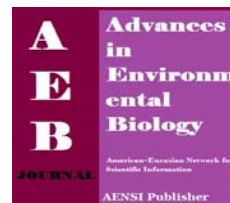




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Effect of Cutting Intervals on Yield and Yield Components of Three Alfalfa (*Medicago sativa* L.) Genotypes

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ABSTRACT

This experiment was conducted at the demonstration farm, College of Agricultural Studies, Sudan University of Science and technology, Shambat during the period From December 2010 to October 2011 to study the effect of cutting intervals in three alfalfa (*Medicago sativa* L.) genotypes under irrigation conditions for some yield and yield components. The experimental design was a Randomized Complete Block design with split plot restrictions for the treatments. The three cutting intervals were assigned as main plots and the three Alfalfa genotypes as sub plots. Seven successive cuts were conducted and from them the plant height (cm), number of leaves/plant and forage fresh yield(T/ha) were measured. The statistical analysis of variance revealed various results of significance for cutting intervals, Alfalfa genotypes and for the interaction between them for the three traits. The results revealed no significant effect of cutting intervals on forage fresh yield for all cuts except the 7th cut. However, the genotype Hegazi scored the highest mean of forage fresh yield (5.13) T/ha for the 25days cutting interval.

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INTRODUCTION

Alfalfa or Lucerne (*Medicago sativa* L.) belongs to the family Fabaceae (Leguminosae). It is a perennial forage crop and considered as the “queen of forages” it has high quality, high yield, stand persistence, wide adaptation, biological nitrogen (N) fixation and soil benefits. Alfalfa providing high energy and protein for dairy cows as well as other types of livestock. It is an “engine of human food production,” eventually transformed into milk, cheese, meat, poultry production, wool, and even honey [15]. It provides a livelihood to thousands of farmers, contributes to wildlife habitat. It is the first choice of many farmers as the premier perennial forage legume grown solely for forage [14]. Alfalfa the oldest crop Today can be found almost anywhere in the world. It is generally agreed that alfalfa comes from south-western Persia. Nowadays it is the territory of Iran. [3]. Alfalfa was one of the earliest domesticated crops and was an important component of early Mediterranean cultures of Europe and the Near East [16].

In the Sudan, Alfalfa grown under irrigation, along the River Nile from Khartoum state northwards, it is sensitive to humidity and Sinnar State is its southern limit. In Sudan, the crop is left to grow for 2 - 4 years giving a cut every three weeks on average. At the end of the third to fourth year, the crop may be left to produce seeds during the hot dry period, from March to May [13].

The production of irrigated alfalfa in Sudan encounters many problems such as scarcity improved seeds, little attention in breeding research of the crop, limited information pertaining to the agronomy of its production, unawareness of seed inoculation techniques, absence of utilizing and preserving methods of the crop, continuous cultivation of the local variety (Hegazi), absence marketing channels and weed infestation [12,1].

In the Sudan the information on cutting intervals are scanty and it depends mostly on alfalfa farmers experiences. However, [8] reported that different cuts could be taken from alfalfa, these cuts range from 12 to 16 cuts / year and 20 to 30 days/cut. The present study, therefore is aimed to study the effect of three cutting intervals in three alfalfa genotypes for some yield and yield components, choose the best cutting interval for the yield of any of three genotypes separately and to choose the most productive genotype of among studied alfalfa genotypes.

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MATERIALS AND METHODS

The experiment was conducted at the Experimental Farm, Sudan University of Science and Technology, College of Agricultural Studies, Shambat (Lat. 15° 40' N, Long. 32° 32' E and at of 380 meters above sea level) during the period From December 2010 to October 2011 to study the effect of three cutting intervals in three alfalfa (*Medicago sativa* L.) genotypes for some yield and yield components. The experimental design was a Randomized Complete Block design with four replications. The experiments were conducted by using a split plot restrictions. The three cutting intervals were considered as main plots and the three Alfalfa genotypes as sub-plots. The cutting intervals were conducted every 20, 25, 30 days. The Alfalfa genotypes used in the study were Hegazi (Local variety), Cuf-101 (American variety) and Siriver (Australian hybrid). The Alfalfa genotypes (Cuf-101 and Siriver) were introduced and released by Agricultural Research Corporation (ARC), Sudan. Seed rate applied was 10 kg per hectare for the three alfalfa genotypes. Bacterial inoculation was added before sowing by the ratio of 5 grams from bacterial inoculation to every 54 grams of alfalfa seeds. The experiment was irrigated every 7-10 days according to field capacity (FC) and the cultural operations concerns with Alfalfa were performed as practiced in the area. Nine successive cuts were performed. The first and the second cuts were done for the whole experiment after 70 and 105 days from sowing date, respectively. The data was collected from the third cut to the nine cut for plant height (cm), number of leaves/plant and the forage fresh yield (T/Ha). The collected data were statistically analyzed by using M.STAT computer program packages.

RESULTS AND DISCUSSION

Table 1: Mean Squares of Plant Height, Number of Leaves and Forage Fresh Yield of Three Alfalfa Genotypes as affected by Three Cutting Intervals

S. of Va. Cuts No.	Plant Height (cm)					No. of Leaves/Plant					Forage fresh yield (T/Ha)				
	Cutting Int.	Error Cutting Int.	Gen.	Cutting Int. × Gen.	Error	Cutting Int.	Error Cutting Int.	Gen.	Cutting Int. × Gen.	Error	Cutting Int.	Error Cutting Int.	Gen.	Cutting Int. × Gen.	Error
3 rd Cut	N.S 64.87	56.26	*4.95	N.S45.68	53.87	N.S158.41	65.23	N.S232.33	*142.74	68.15	N.S0.19	1.03	*2.02	* 1.87	0.67
4 th Cut	N.S 85.61	44.75	N.S 28.04	N.S27.57	12.79	N.S7.32	18.82	N.S92.61	*15.09	18.83	N.S0.07	3.83	N.S0.30	N.S 2.87	2.27
5 th Cut	** 513.03	45.61	** 245.88	N.S12.62	28.21	**90.20	6.81	N.S16.16	N.S7.11	12.93	**9.55	0.79	* 2.99	N.S 0.58	0.68
6 th Cut	*75.91	24.01	** 211.57	** 19.00	19.64	N.S25.08	18.54	N.S14.32	N.S4.37	6.31	N.S 2.71	1.67	N.S 6.31	** 0.69	0.74
7 th Cut	**328.31	16.98	** 229.51	* 63.10	25.48	*57.91	9.32	N.S5.76	*71.65	21.06	N.S3.93	1.38	* 1.77	* 2.36	0.55
8 th Cut	*9.62	33.65	N.S 00.27	N.S52.69	47.41	N.S49.53	94.53	N.S114.91	*176.75	48.81	N.S1.87	3.28	* 8.97	N.S 1.45	1.87
9 th Cut	*225.73	35.44	N.S 76.44	N.S14.88	61.29	N.S114.44	59.64	N.S51.73	N.S16.06	37.56	N.S3.55	5.80	N.S0.83	N.S 1.16	4.49

**,* and N.S refer to significant at 0.01,0.05 and non significant respectively. Int.= Intervals, Gen= Genotypes, S. = Source. Va.=Variance

Table 2: Means of Plant Height (cm) of Three Alfalfa Genotypes as Affected by Three Cutting Intervals

Cuts No.		3 rd Cut	4 th Cut	5 th Cut	6 th Cut	7 th Cut	8 th Cut	9 th Cut	Means
20 days	H	50.25	45.35	53.20	39.40	47.75	45.15	44.40	46.50
	S	46.20	47.60	42.90	33.25	31.55	41.4	42.50	40.77
	C	52.70	47.90	46.60	36.15	35.35	47.50	39.65	43.69
25 Days	H	48.35	54.00	43.40	44.85	48.95	41.35	38.85	45.68
	S	51.75	52.05	32.30	31.55	45.08	47.80	34.10	42.09
	C	45.15	50.60	39.70	37.50	47.40	40.70	33.95	42.14
30 days	H	46.70	52.10	38.35	36.30	40.35	44.45	47.10	43.62
	S	45.30	53.20	32.35	30.70	33.95	42.25	42.20	40.08
	C	43.60	45.80	34.20	32.05	40.45	42.35	44.45	40.41
Means		47.78	49.84	40.33	35.75	41.20	43.66	40.80	
LSD		7.71	3.76	5.62	4.66	5.34	7.23	8.09	
C.V		1.71	0.80	1.47	1.38	1.37	1.75	2.10	

H,S and C = Hegazi, Siriver and Cuf 101 genotypes, respectively.

Table 3: Means of Number of Leaves/plant of Three Alfalfa Genotypes as affected by Three Cutting Intervals

Cuts No.		3 rd Cut	4 th Cut	5 th Cut	6 th Cut	7 th Cut	8 th Cut	9 th Cut	Means
20 days	H	20.85	23.30	25.70	18.25	15.35	21.65	30.30	23.63
	S	26.30	27.05	23.40	19.60	19.50	27.50	27.70	25.86
	C	37.80	27.25	25.60	20.75	17.40	38.60	23.30	27.24
25 Days	H	24.15	23.35	23.65	15.85	16.20	27.55	23.85	22.09
	S	30.80	26.70	19.45	18.45	23.50	30.65	18.40	23.99
	C	24.05	24.20	23.45	16.55	23.05	27.15	20.85	24.19
30 days	H	27.90	19.80	18.80	16.30	26.10	30.40	26.00	23.61
	S	40.30	29.25	19.65	18.90	18.80	39.30	24.75	27.28
	C	37.95	23.90	19.80	16.15	19.50	27.20	24.20	24.10
Means		29.34	24.97	22.17	17.87	19.93	30.00	24.37	
L.S.D		8.67	4.56	3.78	2.64	4.82	7.34	6.45	
C.V		6.65	1.93	1.80	1.56	2.56	2.59	2.80	

H,S and C = Hegazi, Siriver and Cuf 101 genotypes, respectively.

Table 4: Means of Forage Fresh Yield (T/Ha) of Three Alfalfa Genotypes as affected by Three Cutting Intervals

Cuts No.		3 rd Cut	4 th Cut	5 th Cut	6 th Cut	7 th Cut	8 th Cut	9 th Cut	Means
20 days	H	4.43	6.38	5.31	4.58	2.50	2.50	6.60	4.61
	S	4.85	4.88	4.48	3.50	3.38	1.33	6.11	4.09
	C	5.98	6.50	4.73	3.43	4.43	2.33	7.00	4.91
25 Days	H	4.43	5.78	6.43	5.13	5.13	2.43	6.60	5.13
	S	6.20	6.53	4.75	3.95	3.00	1.25	8.00	4.81
	C	5.23	5.38	5.00	4.78	4.13	0.83	7.15	4.64
30 days	H	5.15	5.93	3.98	5.63	2.63	2.85	5.93	4.59
	S	4.98	6.70	3.63	3.53	3.50	0.30	6.54	4.17
	C	5.03	5.40	3.30	4.93	2.75	0.70	6.08	4.03
Means		5.14	5.94	4.60	4.38	3.53	1.63	6.67	
LSD		0.86	1.61	0.87	0.90	0.78	1.45	2.24	
C.V		1.76	2.87	1.99	2.18	2.29	9.43	3.55	

H,S and C = Hegazi, Siriver and Cuf 101 genotypes, respectively.

Plant height (cm):

The analysis of variance for the three cutting intervals (20,25 and 30days) of the plant height revealed that, there were high significant ($P \leq 0.01$) variances for the 5th and 7th cuts, significant ($P \leq 0.05$) for the 6th and 9th cuts and non significant for the 3rd, 4th and 8th cuts. (Table,1). These significant findings illustrate the effect of cutting intervals on the three genotypes of Alfalfa for this trait. Increasing of plant height as a yield component of Alfalfa forage yield is a direct way to increase the yield of Alfalfa as reported by [8]. Table,1 also revealed high significant between the three Alfalfa genotypes in the 5th, 6th and 7th cuts, significant in the 3rd cut, this significance could be attributed to genetic variability between the three Alfalfa genotypes for this trait as indicated by [12] and [7]. The significant in the interaction between the cutting intervals and the genotypes for plant height revealed for the 7th cut (Table,1) could be attributed to the effect of the environment or the genotypes or to their interaction. Similar findings were reported by [2].

Table, 2 showed that the genotype Cuf101 scored the highest plant height (52.7) for 20 days cutting interval whereas the genotype Siriver attained the lowest plant height (31.55) for 20 and 25 days cutting intervals. Different results were obtained by [6] who reported that minimum and medium cutting intervals scored the highest shoot in three Alfalfa genotypes.

Number of Leaves/Plant:

The analysis of variance for the three cutting intervals (20,25 and 30days) for the number of leaves/plant revealed that, there were high significant ($P \leq 0.01$) in the 5th cut and significant ($P \leq 0.05$) for the 7th cut (Table,1).

These significant results could be of a great value for obtaining high yield through this trait, this is due to the fact that number of leaves is the most important yield component in order to obtain high quality and high yield from Alfalfa genotypes as reported by many investigators [12,8,1]. The results of the genotypes and the interaction between cutting intervals and the genotypes for number of leaves as shown in (table,1) were not significant for all cuts except the interactions of the 7th and 8th cuts. These findings for the genotypes indicate that these genotypes are similar in their pedigree for this trait. However, the significant of the interaction for the 7th and 8th cuts could be attributed to the effect of the environment.

Table,3 showed that the cutting interval (30 days) attained the highest (40.30) and the lowest (16.15) number of leaves for Siriver and Cuf 101 genotypes, respectively.

Forage Fresh Yield (T/Ha):

The analysis of variance for the three cutting intervals (20,25 and 30 days) revealed that, there were no significant differences between the three cuttings intervals for forage fresh yield for all cuts except the 5th cut. These results reflect the similar effect of the three cutting intervals on forage fresh yield of the Alfalfa genotypes (Table,1). These results could be useful for Alfalfa farmers at Sudan to select the appropriate economic period to harvest Alfalfa in order to gain high yield or to apply the market demands without affecting the forage quality. However, in contrast [9,17,5] obtained significant results for the effect of cuttings frequency on yield. In addition, [6] has recommended for the medium cutting interval due to its characterization by high forage yield and quality. Table (1) also revealed significant variances between the genotypes in the 3th, 5th, 7th and 8th cuts. These results could be of a great benefit to select the most productive genotype. Similar findings were reported by [7] and [6]. The interaction between the cutting intervals and the genotypes was significant for 1st, 6th, 7th and 9th cuts. This significant could be attributed to the environment effects or the genotypes or to the interaction between them. The effect of cutting intervals or environment factors on yield of Alfalfa had been studied by many researches [4,2,6,10,11]. Generally, as shown in (Table,4), the genotype Hegazi scored the highest mean of forage fresh yield (5.13 T/Ha) for the 25 days cutting interval.

Conclusions:

In conclusion, this study showed various results of significance for cutting intervals, Alfalfa genotypes and for their interaction for yield and yield components. The non significant effect of cutting intervals on forage fresh yield for all cuts except the 7th cut could be of a benefit for Alfalfa farmers in the Sudan to choose the appropriate time for cutting and to apply market demands. Therefore, more experiment should be done at different locations of Sudan to obtain high yield and good quality through the best cutting interval. However, the genotype Hegazi scored the highest mean for forage fresh yield (5.13) T/Ha for the 25days cutting interval.

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