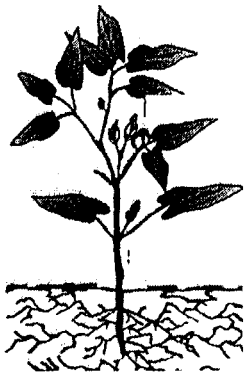

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YIELD AND QUALITY OF TUNIS GRASS AS AFFECTED BY PLANT HEIGHT AT CUTTING AND N FERTILIZER

[13]

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Keywords: Tunis grass, Plant height at cutting, N fertilizer, Yield and chemical composition

ABSTRACT

The present investigation was conducted at Giza Experimental Agricultural Research Station (ARC) to study the effect of plant heights at cutting as well as the rates of N fertilizer on forage yield and quality of the new forage species; Tunis grass (*Sorghum virgatum* Hack.). The experimental design was split plot with three replications. The study included three plant heights of cutting i.e. 60, 90 and 120 cm and three rates of N (20, 30 and 40 kg N/cut/fad. with control treatment (zero N). The trial was conducted in two successive years; 2005 and 2006. Results showed that cutting the plant at the height of 120 cm and fertilized with 40 kg N/cut/fad. caused significant increases in the accumulated fresh and dry forage yields and chemical constituents i.e. fiber, ash and cell wall contents (neutral detergent fiber (NDF) and acid detergent fiber (ADF), while cutting the plant at the height of 60 cm and fertilized with 40 kg N/cut/fad. caused significant increases in protein content, total digestible nutrient (TDN) and digestible crude protein (DCP); and also toxic chemical component i.e. Hydrocyanic acid (HCNμg/100g).

INTRODUCTION

One of the limitations of efficient livestock production in Egypt is the lack of adequate amounts of high-quality forage, especially during the summer. Therefore, great efforts have been directed towards the improvement and introduction of new sources of summer forage crops. The effect of fertilizing summer grasses with N has been received more attention than the additions of other nutrients. Perhaps because of the greater and the more profitable responses obtained with N application.

Many workers have shown that N fertilizer has increased dry matter yield and crude protein content in Sudan grass and forage sorghum. **Bassal *et al* (1997)** found that increasing nitrogen fertilizer levels in sorghum had marked effects on plant height, fresh and dry forage yields, and crude protein percentage. Each increase in nitrogen levels up to30 kg N/ fad. /cut was associated with marked increase in growth, productivity and quality of forage sorghum.

Gheit and Zeadan (2000) found that high levels of nitrogen and phosphorus encouraged plant growth and gave the tallest plants of forage sorghum with thicker stem diameter. Fresh and dry forage yields and protein content were increased with increasing nitrogen level up to 120 kg N/ fad.

Moniker *et al* (1976) found that as the date of the first cut was delayed, the forage yield of sorghum was increased.

Umerov *et al* (1978) obtained the highest yield of Sudan grass when plants were cut four times/ year than three times/year and the highest yield of forage sorghum was obtained when plants were clipped after 40 or 50 days from sowing. Cutting

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frequency was found to be a major factor to influencing dry forage yield.

Desai and Washko (1982) noticed that crude protein content was higher in the first cut than in the late cuts in forage sorghum.

Forage quality is the most important characteristics of feed stuff. Producing and feeding the highest quality forage possibly increases animal performance, reduce feeding costs and ultimately results in an increase return on time and money invested in forage production.

Loyed and Gray (1970) found that the concentration (ppm) of HCN potential in the aboveground plant parts were generally highest in sorghum-Sudan grass hybrid; but intermediate in Sudan grass. Concentration of HCN-P in tillers, leaves, stems, heads and roots generally decreased as maturity advanced.

Easty *et al* (1971) determined the cyanide in some varieties of Sudan grass by continuous electro chemical method. They found that sorghum cv's Tifton contained 315 ppm, commercial 364 ppm, Piper 188 ppm, Sweet 420 ppm , L (109) 145 ppm and corn leaves 12 ppm.

Gorz *et al* (1979) found that Piper, Tifton and Atlas sorghum varieties contained 431± 31, 487 ± 34 and 613 ± 56 and 653 ± 41, 1398 ± 98 and 84 ppm HCN for whole leaf and split leaf, respectively.

Variation in hydrocyanic acid potential was studied in three Sudan grass strains and *Sorghum-almum* Parody by **Gorashi *et al* (1980)** They found that nitrogen application did not result in significant change in HCN but strains and stage of growth when sampled were highly and significantly affected. They also found that HCN was associated with N- level, being lowest at the low N rate.

The present investigation aimed to study the effect of different plant heights at cutting as well as different rates of N fertilizer to identify the suitable plant height at cutting and rate of N fertilizer which result in high forage yield of good quality and low toxic components of the new forage species; Tunis grass (*Sorghum virgatum* Hack.).

MATERIALS AND METHODS

The present study was carried out at the Agricultural Research Station Farm at Giza, ARC. in the two successive years; 2005 and 2006. Physical and chemical analysis of the soil is presented in **Table (1)**.

Table 1. Physical and chemical analysis of the soil before conducting the experiment.

Physical analysis					
Coarse Sand %	Fine Sand %	Silt %	Clay %	Field capacity %	Saturation %
3.9	27.0	26.4	42.7	29.2	49.0
Chemical analysis					
Electrical Conductivity (ds/m)	pH	Organic matter %	Total N %	Available K ppm	Available P ppm
1.35	8.21	1.54	0.15	345	9.5

The experiment was carried out on the new forage crop; **Tunis grass** (*Sorghum virgatum* (Hack.); syn. *Andropogon sorghum* (L.); syn. *Holcus virgatus* (Bailey) Fam.: Poaceae

This new forage crop was identified by the Flora and Phytotaxonomy Research Department, Agricultural Museum, Dokki, Giza, Egypt.

The experiment included 12 treatments, which were the combination of three- plant heights at cutting (60, 90 and 120 cm) and four levels of nitrogen application (no addition (control), 20, 30 and 40 kg N/cut/fad.). The treatments were arranged in a split plot design with three replicates. Plant heights at cutting were arranged at random in the main plots, whereas the levels of nitrogen fertilization were assigned at random in the sub-plots. Each sub plot was 9 m^2 (3 × 3 m) and seeding rate was 20 kg seed/ fad. The trial was sown on in rows 20 - cm apart on 5 May 2005 and continued to November 2006. Phosphorus fertilizer as Super phosphate 15.5% P_2O_5 and potassium fertilizer as k sulphate 48 % K_2O were added in a single dose before sowing at a rate of 200 kg/fad. and 100 kg/fad., respectively. Nitrogen fertilizer was applied as ammonium sulphate (20.6 % N) at three rates of 20, 30 and 40 kg N/fad. The N doses were applied after 21- day of sowing and after every cut during the growing seasons. The trial included 12 cuts, six cuts in every summer season from May to November based on 60 cm plant height at cutting and five cuts based on 90 and 120 cm plant height at cutting, whereas no cuts were taken in the winter seasons of the two years because the plant recovering was very weak. The last cut in the first

year was taken in November 2005. The plant began to flower at the end of February 2006, and gave mature seeds at the end of April 2006. At the beginning of May 2006, the recovering began to be rapidly and economical for cutting, so the first cut in the second year 2006 was taken in May, while the last cut was taken at the first of November 2006. **Table (2)** present plant age and date of cutting for the different treatments of plant height at cutting for all taken cuts in the two years of study.

Studied traits included

1- Forage yield

A- Fresh forage yield (t/fad.): plots were hand clipped and weighed in kg/ plot, then transformed to t/fad.

B- Dry forage yield (t/fad.): Sub samples of 100 g each were dried at 105 ° C till constant weight and dry matter percentage was estimated. The dry forage yield (t/fad.) was calculated by multiplying fresh forage yield (t/fad.) with dry matter percentage (DM %)

2- Chemical composition

Chemical analysis followed the conventional method outlined by the Association of Official Agricultural Chemists **A.O.A.C. (1980)**, on dried samples for the five cuts of the first year, after grinding using Hammer mill kept in labeled plastic bags for chemical analysis, then these samples were analyzed to determine crude protein (CP %), crude fiber (CF %) and ash %. Digestible crude protein (DCP %) was calculated according to the equation of **Church (1979)**,

as: DCP % = CP * 0.929 - 3.48.

Total digestible nutrients (TDN %) calculated according to equation of **Church (1979)**,

as: TDN % =50.41+1.04*CP - 0.07*CF.

Cell wall constituents (acid detergent fiber (ADF) and neutral detergent fiber (NDF) was determined according to the method of **Goering and Van Soest (1970)**. Hydrocyanic acid (µg/100gm) was determined according to the method of **Haskin *et al* (1988)**. Data were statistically analyzed according to the procedures outlined by **Snedecor and Cochran (1980)** using **MSTAT- C computer program Ver.4 (1986).**

RESULTS AND DISCUSSION

1- Forage yield

1-1- Effect of plant height at cutting on forage yield

Results in **Tables (3 and 4)** revealed that fresh, dry and accumulated forage yields (t/fad.) were significantly affected by the studied plant heights at cutting. This was true for all harvested cuts in the two growing years except for the fourth cut in both years for the fresh forage yield and for the fifth cut in the first year for the dry yield. The highest fresh, dry and accumulated forage yields were obtained from the treatment of 120 cm plant height at cutting. Results showed significant differences in fresh and dry forage yield between 60 and 120 cm plant height at cutting.

Table 2. Plant age in days for the plant height at cutting treatments in the first and second years.

Plant height	First year											
	From sowing to 1st cut		From 1st cut to 2nd cut		From 2nd cut to 3rd cut		From 3rd cut to 4th cut		From 4th cut to 5th cut		From 5th cut to 6th cut	
	P.A.*	Date	P.A.	Date	P.A.	Date	P.A.	Date	P.A.	Date	P.A.	Date
60 Cm	31	21/6	20	11/7	22	2/8	20	22/8	30	21/9	35	26/10
90 Cm	38	28/6	25	23/7	26	18/8	30	17/9	37	24/10	-	-
120Cm	44	4/7	30	3/8	31	3/9	38	10/10	45	25/11	-	-
	Second year											
60 Cm	-	21/5	25	15/6	23	6/7	21	27/7	21	17/8	25	11/9
90 Cm	-	28/5	32	30/6	30	30/7	25	24/8	28	21/9	-	-
120Cm	-	6/6	40	16/7	35	20/8	33	22/9	40	2/11	-	-

* P.A. = Plant age

The increases in fresh and dry yields ranged from 78.7 to 14 % and from 73.8 to 5.2 % from the first to the fifth cut in the first year, respectively, while in the second year it ranged from 42.2 to 34.1 % and from 41.7 to 47.4 %. The increases in the accumulated fresh and dry forage yields were 32.2 and 36.0 % in the first year and 21.4 and 24.4 % in the second year. On the other hand, the data presented in **Tables (3 and 4)** showed significant differences in both fresh and dry forage yields between cutting at 90 and 120 cm plant height, but differences were lower if compared with those obtained between cutting at 60 and 120cm plant height. Although, 60 cm plant height at cutting gave six cuts in each of the two years, the accumulated yield of these six cuts was lower as compared with the accumulated yield of the five cuts of 120 cm plant height at cutting in the two years. Thus delaying cutting or grazing to plants to be more mature could lead to higher forage yield.

1-2- Effect of nitrogen fertilizer rates on forage yield

Results in **Tables (3 and 4)** revealed significant differences on forage yield .This were true for all harvested cuts in the two years with few exceptions. Results also showed that 40 kg N/cut/ fad. gave the highest values of accumulated fresh and dry forage yields, while the control treatment gave the lowest. The increases in the accumulated fresh forage yield amounted 27.9 % in the first year and 27.9 % in the second year, while the increases in the accumulated dry forage yield amounted 22.9 % in the first year and 21 % in the second year as compared with the control.

This increase in fresh and dry forage yields due to the increase of nitrogen fertilizer may be attributed to the good root system and its high efficiency in absorbing soil nutrients, and minimize its loss by leaching. **(Leslie, 1981)**

1-3- Effect of plant height at cutting and N fertilizer rates interaction on forage yield

Data presented in **Tables (3 and 4)** demonstrated the significant effect of the above- interaction on both fresh and dry forage yields in all harvested cuts as well as the accumulated fresh and dry forage yields. The increases in the accumulated fresh and dry forage yields with increasing N rates were not equally the same under the three used plant heights at harvest. The increases in both fresh and dry forage yields due to the increase of N from 20 to 40 kg N did not reach the significant levels with cutting the plant at 60 and 120 cm plant height but it reached the significant level with cutting at 90 cm plant height .

2- Chemical constituents

2-1- Effect of plant height at cutting on chemical constituents

The effect of plant height at cutting on CP, CF and ash contents was significant in all cuts as shown in **Tables (5 and 6)**. Results showed clearly that while increasing plant height at cutting from 60 to 120 cm decreased significantly the crude protein contents it increased greatly both crude fiber and ash contents. This was true with all cuts at different plant height at cutting.

2-2-Effect of N fertilizer rate on chemical constituents

Regarding the effect of N fertilizer rates on chemical constituents (CP, CF and ash contents), the results in **Tables (5 and 6)** indicated significant differences between the different rates of N fertilizer. Results showed that there were significant increases in crude protein, crude fiber and ash contents by increasing the N rate. This finding hold fairly true in all cuts. As an average of all cuts, the increase in the CP, CF and ash contents amounted 42.5, 5.3 and 7.5 % as compared to control.

2-3-Effect of plant height at cutting N fertilizer rates interaction on chemical constituents

The effect of the above interactions on the studied chemical constituents was statistically significant as shown in Tables **(5 and 6)**. The increases in the CP content with increasing of N rates were greatly higher when cutting plants at 60 cm height (11.77 %) if compared with that of cutting at 120 cm height (9.37 %). The increases in both fiber and ash contents due to increases of N levels under 60 cm plant height at cutting were significantly lower (29.88,12.89 %) than that recorded with 120 cm plant height at cutting (33.74, 13.10 %) as average of all cuts.

These results agreed with **Worker and Marble (1968)** who reported that protein content varied significantly by stage of harvest in Sudan grass and the maximum value was recorded at the boot stage and decreased as harvest was delayed.

Table 3. The influence of plant height at cutting, N fertilizer rates and their interaction on fresh forage yield (t /fad.) of Tunis grass.

Treats.	Fresh forage yield (t/ fad.)													
Season	(2005)							(2006)						
Treatment\cuts	Cut $_1$	Cut $_2$	Cut $_3$	Cut $_4$	Cut $_5$	Cut $_6$	AC*	Cut $_1$	Cut $_2$	Cut $_3$	Cut $_4$	Cut $_5$	Cut $_6$	AC*
A- Plant height at cutting (cm)														
60cm	2.44	7.38	4.40	5.16	5.13	4.63	29.15	4.47	5.54	10.09	6.99	7.08	5.37	39.73
90cm	8.21	7.00	6.91	6.19	5.50	-	33. 82	5.64	8.11	8.11	7.58	8.49	-	37.93
120cm	11.44	10.70	8.66	8.30	5.90	-	45. 00	7.78	11.40	9.83	10.82	10.74	-	50.57
LSD 0.05	2.98	2.68	3.10	NS	1.83	-	11.52	0.97	4.02	1.75	NS	2.80	-	10.09
B- Nitrogen application (kg N/ fad.)														
Control	7.10	7.21	4.74	4.67	3.46	1.32	28.52	5.55	7.66	7.47	5.49	6.22	0.97	33.36
20kg N	6.97	8.30	6.18	6.26	3.73	1.32	32.78	5.91	8.67	9.63	8.67	8.62	1.75	43.25
30kg N	7.80	8.75	7.66	7.19	4.47	1.91	37.78	6.26	8.83	10.48	9.70	10.58	2.26	48.10
40kg N	7.59	9.18	8.05	7.94	5.17	1.62	39.54	6.39	8.24	9.80	9.99	9.65	2.18	46.26
LSD 0.05	NS	1.30	1.38	1.20	1.02	0.23	3.85	NS	NS	2.80	1.38	1.90	0.36	5.01
AxB-Interaction														
60 cm+0 N	3.10	5.72	3.50	4.43	4.20	3.97	24.92	4.90	6.53	7.70	4.46	4.67	2.92	31.17
60 cm+20kg N	2.26	6.77	4.20	4.90	4.55	3.97	26.65	4.55	5.83	11.43	8.52	6.83	5.25	42.42
60 cm+30kg N	2.29	7.70	5.02	5.72	5.60	5.72	32.04	4.67	5.60	10.73	7.86	10.03	6.77	45.66
60 cm+40kg N	2.12	9.33	4.90	5.60	6.18	4.85	32.99	4.55	4.20	10.50	7.12	6.77	6.53	39.67
90 cm+0 N	6.77	4.90	4.78	4.69	3.38	-	24.52	4.90	6.07	7.82	4.43	5.48	-	28.70
90 cm+20kg N	7.54	6.77	5.95	5.48	2.80	-	28.54	5.25	8.28	7.35	6.53	7.82	-	35.24
90 cm+ 30kg N	9.33	8.40	8.05	6.88	3.73	-	36.40	5.95	8.75	8.63	8.87	10.03	-	42.23
90 cm+ 40kg N	9.22	7.93	8.87	7.70	4.08	-	37.80	6.45	9.33	8.63	10.50	10.62	-	45.53
120 cm+0 N.	11.43	11.02	5.95	4.90	2.80	-	36.11	6.84	10.38	6.88	7.58	8.52	-	40.21
120 cm+20kg N	11.11	11.38	8.40	8.40	3.85	-	43.14	7.93	11.90	10.09	10.97	11.20	-	52.09
120 cm+30kg N	11.78	10.15	9.92	8.98	4.08	-	44.92	8.17	11.20	10.27	12.37	11.57	-	53.57
120 cm+40kg N	11.43	10.27	10.38	10.51	5.25	-	47.84	8.17	12.13	12.09	12.37	11.67	-	56.42
LSD 0.05	2.36	2.25	2.39	2.07	1.76	-	6.66	1.49	2.06	4.85	2.38	3.29	-	8.67

* AC: Accumulated yield

Table 4. The influence of plant height at cutting, N fertilizer rates and their interaction on dry forage yield (t /fad.) of Tunis grass.

Treats.	Dry forage yield (t /fad.)													
Seasons	(2005)							(2006)						
Treatment\cuts	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Cut 6	AC*	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Cut 6	AC*
A- Plant height at cutting (cm)														
60cm	0.43	0.97	0.72	0.59	0.76	0.68	4.14	0.70	0.97	1.87	1.06	0.82	0.74	6.15
90cm	1.05	0.98	0.81	1.12	0.77	-	4.73	0.86	1.47	1.42	1.19	1.40	0.0	6.33
120cm	1.64	1.62	1.10	1.31	0.80	-	6.47	1.20	2.10	1.46	1.83	1.56	0.0	8.14
LSD 0.05	0.37	0.34	0.49	0.34	NS	-	1.41	0.18	0.98	0.37	0.45	0.35	-	1.59
B-Nitrogen application (kg N /fad.)														
Control	1.03	1.13	0.64	0.70	0.56	0.22	4.28	0.90	1.38	1.35	0.96	0.98	0.15	5.72
20kg N	0.99	1.21	0.84	0.98	0.56	0.20	4.77	0.88	1.59	1.71	1.36	1.21	0.25	7.00
30kg N	1.07	1.17	0.99	1.11	0.69	0.27	5.31	0.93	1.63	1.69	1.53	1.45	0.32	7.54
40kg N	1.06	1.24	1.02	1.23	0.77	0.21	5.55	0.96	1.44	1.58	1.60	1.38	0.28	7.24
LSD 0.05	NS	NS	0.20	0.20	NS	0.04	0.68	0.12	0.25	0.52	0.29	0.26	0.054	0.92
AxB-Interaction														
60 cm+0 N	0.56	0.77	0.55	0.53	0.66	0.65	3.72	0.73	1.17	1.50	0.68	0.58	0.44	5.10
60 cm+20kg N	0.39	0.95	0.74	0.55	0.64	0.59	3.86	0.67	1.02	2.18	1.32	0.79	0.75	6.73
60 cm+30kg N	0.41	1.07	0.82	0.65	0.87	0.82	4.64	0.67	1.01	1.85	1.12	1.14	0.95	6.74
60 cm+40kg N	0.34	1.09	0.76	0.61	0.89	0.64	4.32	0.72	0.68	1.95	1.12	0.74	0.83	6.03
90 cm+0 N	0.85	0.77	0.57	0.81	0.59	-	3.59	0.71	1.11	1.38	0.76	1.0	-	4.95
90 cm+20kg N	0.88	0.90	0.70	0.94	0.46	-	3.89	0.78	1.41	1.43	1.02	1.29	-	5.93
90 cm+ 30kg N	1.20	1.21	0.93	1.30	0.61	-	5.24	0.94	1.59	1.50	1.35	1.61	-	6.99
90 cm+ 40kg N	1.24	1.02	1.04	1.43	0.65	-	5.39	1.00	1.76	1.36	1.65	1.68	-	7.45
120 cm+0 N	1.67	1.85	0.79	0.75	0.45	-	5.52	1.26	1.88	1.19	1.44	1.34	-	7.11
120 cm+20kg N	1.69	1.76	1.10	1.44	0.57	-	6.56	1.19	2.32	1.52	1.74	1.56	-	8.33
120 cm+30kg N	1.60	1.24	1.23	1.39	0.60	-	6.06	1.16	1.89	1.43	2.02	1.72	-	8.23
120 cm+40kg N	1.61	1.62	1.26	1.66	0.78	-	6.93	1.19	2.29	1.71	2.10	1.60	-	8.90
LSD 0.05	0.48	0.45	0.34	0.34	NS	-	1.17	0.21	0.44	0.90	0.50	0.45	-	1.60

* AC: Accumulated yield

Table 5. The influence of plant height at cutting, N fertilizer rates and their interaction on chemical constituents (CP% and CF %) of Tunis grass.

Treats.	Chemical constituents											
	CP %						CF %					
Treatments\cuts	Cut $_1$	Cut $_2$	Cut $_3$	Cut $_4$	Cut $_5$	Mean	Cut $_1$	Cut $_2$	Cut $_3$	Cut $_4$	Cut $_5$	Mean
A-Plant height at cutting (cm)												
60cm	9.83	9.42	10.45	10.00	9.80	9.90	27.56	31.54	28.97	30.06	30.63	29.75
90cm	9.00	10.17	9.79	9.02	8.53	9.30	31.73	31.89	31.36	31.94	31.50	31.68
120cm	8.43	9.30	7.77	7.24	6.98	7.94	33.91	33.59	31.22	32.00	32.38	32.62
LSD 0.05	2.76	0.07	0.09	0.08	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04
B-Nitrogen application (kg N fad^{-1}.)-												
Control	6.87	8.49	7.94	7.37	7.33	7.60	30.83	31.56	29.08	30.16	30.48	30.42
20kg N	8.69	8.90	8.38	7.77	8.69	8.28	30.84	32.67	30.53	30.76	31.02	31.17
30kg N	9.37	9.80	9.83	9.35	8.95	9.46	30.89	32.36	30.97	32.13	32.09	31.69
40kg N	11.41	11.34	11.20	10.51	9.77	10.85	31.71	32.76	31.50	32.27	32.42	32.13
LSD 0.05	0.07	0.06	0.05	0.04	0.03	0.03	0.06	0.03	0.03	0.03	0.03	0.03
AxB- Interaction												
60 cm+0 N	7.75	8.53	9.42	8.34	8.42	8.49	28.69	31.43	27.59	29.06	29.51	29.26
60 cm+20kg N	8.68	8.65	9.62	9.48	9.30	9.18	28.08	32.69	29.81	29.81	30.17	30.11
60 cm+30kg N	10.56	9.43	10.97	10.73	10.60	10.45	26.45	30.52	29.27	31.02	31.55	29.76
60 cm+40kg N	12.14	12.58	11.81	11.46	10.87	11.77	27.02	31.51	29.23	30.35	31.28	29.88
90 cm+0 N	6.91	8.40	7.86	7.11	6.93	7.44	30.43	30.88	30.94	30.07	30.26	30.51
90 cm+20kg N	8.73	9.38	8.78	7.89	7.79	8.51	30.94	31.89	31.38	30.76	30.84	31.16
90 cm+ 30kg N	8.83	10.22	10.11	9.70	8.86	9.54	31.98	32.41	31.22	33.46	32.34	32.28
90 cm+ 40kg N	11.54	12.68	12.40	11.36	10.55	11.70	33.56	32.34	31.90	33.46	32.55	32.77
120 cm+0 N	5.94	8.53	6.55	6.65	6.64	6.86	33.37	32.38	28.72	31.36	31.66	31.50
120 cm+20kg N	8.49	8.66	7.74	5.94	5.97	7.16	33.50	33.44	30.40	31.73	32.06	32.22
120 cm+30kg N	8.73	9.75	8.40	7.64	7.40	8.38	34.26	34.15	32.42	31.93	32.37	33.02
120 cm+40kg N	10.56	10.27	9.40	8.73	7.90	9.37	34.52	34.40	33.37	32.99	33.47	33.74
LSD 0.05	0.12	0,11	0.09	0.08	0.05	0.05	0.11	0.05	0.05	0.05	0.05	0.05

Table 6. The influence of plant height at cutting, N fertilizer rates and their interaction on Ash % of Tunis grass.

Treats.	Chemical constituents					
	ASH %					
Treatments/ cuts	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Mean
A- Plant height at cutting (cm)						
60cm	11.83	11.99	11.70	13.09	13.13	12.33
90cm	12.14	12.39	13.61	12.49	12.63	12.65
120cm	12.30	12.33	13.59	12.43	12.61	12.65
LSD 0.05	0.04	0.04	0.04	0.04	0.04	0.04
B- Nitrogen application (kg N fad^{-1}.)						
Control	11.71	11.52	12.36	12.29	12.36	12.05
20kg N	12.08	12.18	12.90	12.49	12.57	12.45
30kg N	12.25	12.47	13.09	12.75	12.86	12.67
40kg N	12.32	12.75	13.50	13.14	12.85	13.02
LSD 0.05	0.03	0.03	0.03	0.03	0.03	0.03
AxB- Interaction						
60 cm+0 N	11.65	11.60	11.16	12.45	12.51	11.87
60 cm+20kg N	11.74	11.85	11.65	12.85	12.74	12.16
60 cm+30kg N	11.94	12.18	11.89	13.16	13.19	12.40
60 cm+40kg N	12.01	12.35	12.10	13.92	14.07	12.89
90 cm+0 N	11.82	11.58	13.00	12.13	12.23	12.15
90 cm+20kg N	12.11	12.51	13.67	12.27	12.44	12.60
90 cm+ 30kg N	12.26	12.69	13.74	12.61	12.67	12.79
90 cm+ 40kg N	12.37	12.78	14.02	12.93	13.18	13.05
120 cm+0 N.	11.66	11.38	12.92	12.28	12.36	12.12
120 cm+20kgN	12.40	12.19	13.40	12.36	12.54	12.58
120 cm+30kg N	12.56	12.61	13.66	12.48	12.74	12.81
120 cm+40kg N	12.60	13.14	14.39	12.59	12.80	13.10
LSD 0.05	0.05	0.05	0.05	0.05	0.05	0.05

3- Nutritive values

3.1. Effect of plant height at cutting on TDN and DCP

Results of TDN and DCP contents of Tunis grass as affected by the different plant height at cutting are presented in **Table (7)** Significant differences in TDN and DCP contents were recorded among the different plant height at cutting. As average of all cuts, 60 cm plant height at cutting recorded the highest TDN and DCP contents (58.62 and 5.68 %) and lowest values (51.37 and 3.90 %) were recorded with the120 cm plant height at cutting.

3-2- Effect of N fertilizer rate on TDN and DCP

Results in **Table (7)** revealed that increasing the N rates increased significantly and to different rates the % of TDN and DCP in all taken cuts. As an average of all cuts the treatments of 40 kg N/cut/fad. gave the highest values of TDN and DCP 59.44 and 6.60 % .

3-3- Effect of plant height at cutting and N fertilizer rates interaction on TDN and DCP

The effect of this interaction on TDN and DCP contents was statistically sighificant as shown in **Table (7)**. The highest increases in the TDN and DCP contents with increasing N rates were obtained when plant cutting at 60 cm if compared with that of cutting at plant height of 120 cm and 90 cm as average as an average of all cuts.

4- Cell Wall Contents

4-1- Effect of plant height at cutting on NDF and ADF

The data presented in **Table (8)** showed significant differences due to cutting treatments. Cutting at 120 cm plant height, recorded the highest value of NDF and ADF contents, while cutting at 60 cm height gave lowest values. This finding hold fairly true in all cuts.

4-2- Effect of N fertilizer rate on NDF and ADF contents

The rates of N fertilization presented in **Table (8)** indicated significant differences in NDF and ADF contents. This was true for all harvested cuts. Treatment of 40 kg N/cut/fad. gave the highest values of NDF and ADF. The increases in the NDF and ADF amounted 1.6 and 2.7 % as compared to the control on the level of average cuts.

4.3. Effect of plant height at cutting and N fertilizer rates interaction on NDF and ADF contents

The effects of the above interaction on NDF and ADF contents were statistically significant with few exceptions as shown in **Table (8)**. The increases in the NDF and ADF contents with increasing N rates were not at the same level under the three levels of plant height at cutting. The increases in NDF % due to increases in N rates amounted to 2.78, 1.56 and 0.66 % of the control with 60, 90 and 120 cm plant height at cutting. An opposite trend was noticed with ADF contents, in which the increases in ADF amounted 2.17, 1.28 and 5.05 % of the control with 60, 90 and 120 cm plant height at cutting as an average of all cuts.

Table 7. The influence of plant height at cutting, N fertilization and their interactions on nutritive values (TDN% and DCP %) of Tunis grass.

Treats.	TDN%						DCP (%)					
Treatments\cuts	Cut $_1$	Cut $_2$	Cut $_3$	Cut $_4$	Cut $_5$	Mean	Cut $_1$	Cut $_2$	Cut $_3$	Cut $_4$	Cut $_5$	Mean
A-Plant height at cutting (cm)												
60cm	58.70	58.00	59.25	58.70	58.45	58.62	5.65	5.27	6.23	5.81	5.45	5.68
90cm	57.55	58.75	58.39	57.55	57.08	57.86	4.88	5.97	5.61	4.89	4.45	5.16
120cm	56.80	57.73	56.22	55.70	55.40	51.37	4.35	5.16	3.74	3.24	3.00	3.90
LSD 0.05	0.05	0.08	0.12	0.08	0.04	0.04	0.05	0.06	0.08	0.08	0.39	0.11
B- Nitrogen application (kg N fad^{-1}.)												
Control	55.39	57.02	56.63	55.96	55.90	56.18	2.90	4.40	3.90	3.37	3.10	3.53
20kg N	57.29	57.37	56.99	56.34	56.23	56.84	4.59	4.78	4.31	3.73	3.66	4.22
30kg N	57.99	58.34	58.35	57.89	57.47	58.01	5.22	5.62	5.65	5.21	4.84	5.31
40kg N	60.06	59.91	59.85	59.08	58.30	59.44	7.12	7.06	6.92	6.29	5.60	6.60
LSD 0.05	0.08	0.07	0.19	0.04	0.03	0.05	0.07	0.06	0.04	0.03	0.33	0.06
AxB-Interaction												
60 cm+0 N.	56.46	57.08	58.27	57.05	57.10	57.19	3.71	4.44	5.27	4.27	3.67	4.27
60 cm+20kg N	57.66	57.11	58.32	58.18	57.96	57.85	4.75	4.55	5.45	5.32	5.15	5.05
60 cm+30kg N	59.54	58.08	59.77	59.39	59.22	59.20	6.33	5.27	6.71	6.48	6.37	6.23
60 cm+40kg N	61.14	59.73	60.64	60.20	59.52	60.25	7.80	6.82	7.49	7.16	6.62	7.17
90 cm+0 N	55.47	56.98	56.41	55.70	55.50	56.01	2.94	4.32	3.82	3.13	2.96	3.43
90 cm+20kg N	57.32	57.93	57.34	56.46	56.35	57.08	4.62	5.23	4.68	3.85	3.76	4.42
90 cm+ 30kg N	57.35	58.77	58.74	58.16	57.36	58.08	4.72	6.01	5.92	5.53	4.75	5.39
90 cm+ 40kg N	60.06	61.33	61.07	59.88	59.10	60.29	7.24	8.30	8.03	7.07	6.32	7.39
120 cm+0 N	54.25	57.00	55.21	55.13	55.10	55.34	2.04	4.44	2.60	2.70	2.68	2.89
120 cm+20kg N	56.89	57.07	55.29	54.37	54.37	55.60	4.40	4.57	2.78	2.04	2.07	3.17
120 cm+30kg N	57.09	58.16	56.55	56.12	55.84	56.75	4.62	5.58	4.32	3.61	3.39	4.30
120 cm+40kg N	58.98	58.68	57.85	57.18	56.28	57.79	6.33	6.06	5.25	4.62	3.86	5.22
LSD 0.05	0.13	0.12	0.32	0.08	0.05	0.09	0.12	0.11	0.08	0.05	0.56	0.11

Table 8. The influence of plant height at cutting, N fertilizer rates and their interaction on cell wall contents (NDF % and ADF %) of Tunis grass

Treats.	NDF %						ADF %					
Treatments\cuts	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Mean	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	Mean
A-Plant height at cutting (cm)												
60cm	66.91	68.71	65.32	66.53	66.29	66.75	34.28	39.65	41.65	40.69	39.36	39.13
90cm	69.68	70.60	62.70	68.87	70.08	68.39	39.74	38.65	42.49	39.74	40.17	40.16
120cm	71.27	73.52	65.78	69.46	66.24	69.26	42.26	43.47	44.58	43.48	40.80	42.92
LSD 0.05	0.52	0.59	0.57	0.62	0.41	0.17	0.28	0.51	0.71	0.48	0.39	0.24
B- Nitrogen application (kg N fad^{-1}.)												
Control	68.86	71.68	64.19	67.39	66.37	67.70	37.85	41.71	42.03	40.86	38.82	40.25
20kg N	67.78	70.63	65.59	68.41	69.05	68.29	39.12	40.61	41.87	40.70	40.49	40.56
30kg N	70.00	69.69	62.86	68.60	67.50	67.73	38.16	39.74	43.36	42.77	39.82	40.77
40kg N	70.52	71.78	65.77	68.74	67.24	68.81	39.91	40.32	44.36	40.90	41.31	41.36
LSD 0.05	0.84	0.79	0.59	0.60	0.88	0.33	0.58	0.51	0.51	0.42	0.44	0.69
AxB- Interaction												
60 cm+0 N	65.61	69.59	64.03	65.25	63.38	65.57	33.64	40.55	38.37	41.22	39.40	38.64
60 cm+20kg N	63.49	69.56	67.13	66.97	67.31	66.89	35.24	39.80	39.88	40.17	40.32	39.08
60 cm+30kg N	69.14	68.41	64.54	67.58	66.15	67.16	32.90	39.37	44.90	41.64	38.58	39.31
60 cm+40kg N	69.44	67.29	65.59	66.32	68.32	67.39	35.33	38.89	43.43	39.72	39.16	39.48
90 cm+0 N	68.58	71.72	64.18	66.49	69.29	68.05	37.93	39.96	43.53	38.40	39.09	39.78
90 cm+20kg N	69.19	70.00	62.06	69.53	71.75	68.51	39.70	40.12	40.84	38.73	40.77	40.03
90 cm+ 30kg N	70.37	67.82	61.92	69.29	69.96	67.87	40.31	36.66	43.30	42.47	39.95	40.54
90 cm+ 40kg N	70.59	72.84	62.63	70.14	69.34	69.11	41.03	37.87	42.28	39.37	40.88	40.29
120 cm+0 N.	72.38	73.73	64.35	70.42	66.44	69.46	41.98	44.60	44.17	42.94	37.98	42.34
120 cm+20kg N	70.71	72.32	67.58	68.73	68.09	69.49	42.41	41.91	44.91	43.19	40.38	42.56
120 cm+30kg N	70.48	72.85	62.12	68.92	66.39	68.15	41.27	43.18	41.86	44.19	40.93	42.29
120 cm+40kg N	71.52	75.20	69.09	69.76	64.05	69.92	43.36	44.19	47.37	43.61	43.89	44.48
LSD 0.05	1.46	1.38	1.02	1.05	1.53	0.58	1.00	0.89	0.89	0.72	0.77	1.19

5- HCN content

5.1. Effect of plant height at cutting on Hydrocyanic acid content (HCN)

Results in **Table (9)** indicated significant differences in content of HCN µg/100 gm due to cutting Tunis grass at different plant height. The decreases in HCN content due to the increases of plant height at cutting reached the significant level in all cuts with the exception of the first two cuts in which these increases did not reach the significant level. The results in **Table (9)** showed that cutting at 60 cm plant height gave the highest value of HCN (0.9 µg/100g), while cutting at 120 cm plant height gave the lowest value (0.72 µg/100g) as an average of all cuts.

5-2- Effect of N fertilizer rates on HCN content

The effect of N rates on HCN content was significant except between 30 and 40kg N/cut/fad. As an average of all cuts the treatment of 40 kg N/cut/fad. gave the highest value of HCN (1.00µg/100g). The increases of HCN amounted 33.0 % as compared to the control.

Table 9. The influence of plant height at cutting, N fertilizer rates and their interaction on HCN (µg/100g) of Tunis grass.

Treatments\cuts	Cut_1	Cut_2	Cut_3	Cut_4	Cut_5	Mean
A- Plant height at cutting (cm)						
60cm	0.72	0.70	0.84	1.02	1.28	0.91
90cm	0.69	0.67	0.76	0.87	1.01	0.80
120cm	0.57	0.56	0.68	0.81	0.98	0.72
LSD 0.05	0.21	0.16	0.12	0.035	0.08	0.06
B- Nitrogen application (kg N fad^{-1}.)						
Control	0.54	0.52	0.65	0.78	0.88	0.67
20kg N	0.59	0.60	0.70	0.83	0.93	0.73
30kg N	0.69	0.69	0.80	0.90	1.12	0.84
40kg N	0.83	0.77	0.89	1.09	1.43	1.00
LSD 0.05	0.27	0.16	0.15	0.16	0.16	0.08
AXB- Interaction						
60 cm+0 N	0.64	0.64	0.72	0.83	0.95	0.76
60 cm+20kg N	0.69	0.65	0.79	0.89	0.99	0.80
60 cm+30kg N	0.71	0.72	0.85	0.97	1.36	0.92
60 cm+40kg N	0.84	0.80	0.98	1.40	1.80	1.17
90 cm+0 N	0.57	0.50	0.67	0.77	0.83	0.67
90 cm+20kg N	0.62	0.62	0.69	0.81	0.89	0.72
90 cm+ 30kg N	0.71	0.74	0.80	0.90	1.00	0.83
90 cm+ 40kg N	0.85	0.81	0.89	0.98	1.30	0.97
120 cm+0 N	0.41	0.43	0.55	0.74	0.85	0.60
120 cm+20kg N	0.47	0.53	0.63	0.78	0.91	0.66
120 cm+30kg N	0.64	0.60	0.74	0.83	0.99	0.76
120 cm+40kg N	0.77	0.69	0.80	0.88	1.18	0.86
LSD 0.05	0.47	0.27	0.26	0.28	0.28	0.13

5-3- Effect of plant height at cutting and N fertilizer rates interaction on HCN content

The effect of the above interaction on HCN (µg/100gm) was significant. In spite of the significant increases in HCN content by the increases in N rates under the three studied plant heights at cutting, the values of increases were not the same. These increases amounted 53. 94, 44.77 and 43.33 % of the control with cutting at 60, 90 and 120 cm plant height as an average of all cuts.

6- Seed yield (kg/fad.)

6-1- Effect of plant height at cutting and N fertilizer rates interaction on seed production

Results in **Table (10)** reveal that no significant differences were detected in the interaction between plant height at cutting and N fertilizer rates in seed yield, and the treatment of 120 cm plant height at cutting with 40 kg N/cut/fad. gave the heights yield of seed yield (281.9 kg/fad.).

Table 10. The influence of plant height at cutting, N fertilizer rates and their interactions on seed yield (Kg /fad.) of Tunis grass

Plant height at cutting (A)	N –rates (B) 0	20	30	40	Mean
60 Cm	206.4	244.2	254.3	262.7	241.9
90 Cm	194.7	212.5	195.6	268.3	217.8
120 Cm	209.8	224.2	239.4	281.9	238.8
Mean	203.6	227.0	229.7	271.0	-
LSD0.05	A = 51.56				
	B = 25.85				
	A x B= 11.21				

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حوليات العلوم الزراعية
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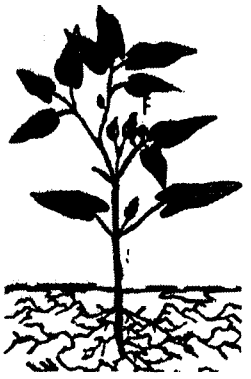

حاصل العلف و جودته في حشيشة الفرس وتأثره بالتسميد النتروجيني وارتفاع النبات عند الحش

[١٣]

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أجريت هذه الدراسة بمزرعة محطة البحوث الزراعية بالجيزة (مركز البحوث الزراعية) وذلك لدراسة تأثير الأرتفاع عند الحش وكذا معدلات التسميد النتروجيني على حاصل العلف وجودته لحشيشة الفرس.

اتبع تصميم القطاعات المنشقة في ثلاثة مكررات حيث رتبت ارتفاعات ألنبات عند الحش في القطع الرئيسية ومعدلات التسميد الأزوتي في القطع الشقية.

أشتملت ألدراسة على ثلاثة أرتفاعات للنبات عند الحش ٦٠، ٩٠ و١٢٠ سم وثلاثة معدلات من ألتسميد ألنتروجيني ٢٠، ٣٠، ٤٠ كجم/ فدان في وجود معاملة المقارنة بدون إضافة سماد وقد أقيمت ألتجربة خلال العامين ٢٠٠٥ و٢٠٠٦.

أظهرت النتائج أن الحش عند أرتفاع ١٢٠ سم وبأضافة ٤٠ كجم نتروجين/حشة/ فدان تسبب في زيادة معنوية في حاصل العلف الأخضر والجاف الكلي وكذلك زيادة معنوية في المكونات الكيميائية (محتوى الألياف والرماد) ومكونات جدار الخلية (الألياف المتعادلة والألياف الحامضية).

بينما أظهرت النتائج أن الحش عند أرتفاع ٦٠ سم وبإضافة ٤٠ كجم نتروجين/حشة/ فدان تسبب في زيادة معنوية في محتوى البروتين والمواد المهضومة الكلية والبروتين المهضوم وايضا المواد الكيميائية السامة (حامض الهيدروسيانيك).

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