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Productivity of Egyptian Clover as Affected by Seeding Rates and Cutting Schedules II-Chemical Dry Matter Analysis

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Abstract: Two field experiments were conducted at the Experimental Station, Faculty of Agriculture, Mansoura University during the two successive seasons of 2000/2001 and 2001/2002. A split-plot design in four replications was used. This investigation aimed to study the effect of seeding rates and cutting schedules parameters on chemical dry matter analysis of Egyptian clover variety Miskawi Giza 6. Crude protein and fiber, ash content, ether extract and nitrogen free-extract percentages in blades and stems and its yields/fed were significantly affected due to cuttings. Highest percentages of CP and ash in blades and stems were produced from the second cut. While highest percentages of CF and EE in blades and stems were produced from the third cut. The fifth cut achieved the highest percentages of NFE in both blades and stems. Moreover, highest crude protein and ash yields per feddan were produced at the second cut. The third cut produced highest averages of CF, EE and NFE yields per feddan. Seeding rates caused significant differences on Crude protein (CP), Crude fiber (CF), ash content, EE and NFE percentages in blades and stems and its yields/fed were significantly affected due to seeding rates. Highest percentages of CP and EE in stems were resulted from sown with 30 kg seed/fed. While, using 45 kg seed/fed was accompanied with the highest percentages of CF and ash content in both blades and stems as well as NFE % in blades only. Moreover, the highest yields of CP, CF, ash, EE and NFE yields per feddan were produced from the medium seeding rate of 30 kg seed/fed. Percentages of CP, CF, ash content, EE and NFE in blades and stems as well as CP, CF, ash content, EE and NFE yields/fed significantly responded as a result of cutting schedules under study. Highest CP % produced from cutting plants at 30 cm height and after 25 days intervals in both blades and stems, respectively. While, highest percentages of CF, ash content and EE in both blades and stems were produced from cutting at 50 cm height. Cutting Egyptian clover plants at 55 days intervals produced highest NFE %. Moreover, highest of CP, CF, ash content, EE and NFE yields/fed were produced from cutting at 30 cm height. There was non significant interactions between seeding rates and cutting schedules treatments on chemical dry matter analysis, this mean that each factor acted separately. It could be summarized that for maximizing forage quality of Egyptian clover Giza 6 cultivar with sowing at seeding rate of 30 kg seed/fed and cutting plants at 30 cm height under the environmental conditions of Dakahlia Governorate.

Key words: Egyptian clover, seeding rates, cutting schedules, chemical analysis

INTRODUCTION

Egyptian clover (*Trifolium alexandrinum* L.) is an annual winter forage crop well adapted to Arab Republic of Egypt. Moreover, it is the mainly and most important fodder crop for animal feeding during winter season for about six months. Both of seeding rates and cutting schedules are factors affecting yield and quality of Egyptian clover. The optimum seeding rates and cutting schedules is very necessary to have a good quality. Each field crop had suitable harvested date such as cotton, flax, maize etc. Berseem which sown for forage must determinate suitable times for cuttings through out schedules cutting which may maximized quality.

Increasing seeding rates from 15, 20 to 25 kg seeds/fed of Egyptian clover caused significant increase in crude protein and fiber and ash percentage in plants[1-4]. Moreover, increasing seeding rates up to 24 kg seeds/fed caused significant decreases in total crude protein and ash but increased total nitrogen free-extract. On the other hand total ether extract and crude fiber were increased by increasing seeding rates up to 24 kg seeds/fedas reported by Kandil and Shalaby[5].

Increasing cutting height of plant from 30, 40, 50 and 60 cm in Egyptian clover followed by increase in protein, ash, crude fiber percentages[6,7]. Moreover, decreasing the period between each cutting followed by increasing in crude protein percentage[8-14].

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The objective of this investigation was aimed for maximizing forage quality of Egyptian clover which could be achieved by the optimum seeding rates and cutting plants at the suitable age or plant height as soon as the crown have enough carbohydrates under the environmental condition of Dakahlia Governorate.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Station, Faculty of Agriculture, Mansoura University during the two seasons of 2000/2001 and 2001/2002. Egyptian clover seeds were sown on 15th and 13th November in the first and second seasons, respectively. Egyptian clover variety Miskawi Giza 6 was used in this study during the two seasons.

The preceding crop was maize (*Zea mays* L.) in the two seasons. Soil samples were taken at random from the experimental field area at depth of 15 and 30 cm from soil surface before seedbed preparation and mixed thoroughly for soil homogeneity to determine the important mechanical and chemical soil properties. The experimental soil was clay in texture, the pH was 7.6, 8.1 and available nitrogen was 25.5, 27.0 ppm and available potassium was 295, 303 ppm in the first and second seasons, respectively. The treatments were arranged in a split-plot design in four replications. The three seeding rates 15, 30 and 45 kg seeds/fed occupied the main plots. Whereas the seven cutting schedules were included three plant height i.e. 30, 40 and 50 cm and four cutting times, i.e., 25, 35, 45 and 55 days intervals were applied in the sub-plots. The sub-plots area was 10.5 m^2 (3.0×3.5 meter which is equal 1/400 feddan). In both seasons the first cut was taken after 60 days from sowing date to insure the enough carbohydrates in the roots. For chemical analysis the similar treatments in each replicate resulted from the first cut were mixed using the same amount of dry matter of blades and stems + petioles plus sheathes and then mixed thoroughly to obtain three samples in case of 1st cut. Whereas, the 2nd, 3rd, 4th and 5th cuts the similar treatments were mixed using same technique to obtained 21 treatments which were the combinations of three plant density × seven cutting schedules using the same amount of dry matter of blades and stems + petioles plus sheathes. The mixing samples were ground into very fine powder and stored a way from air moisture for the following chemical determinations:

- Crude protein percentage (CP%) and crude protein yield (kg/fed): according to Kock and McMeekin[15] and Bolton[16].
- Crude fiber percentage (CF%) and crude fiber yield (kg/fed): according to AOAC[17].
- Ether extract percentage (EE%) and ether extract yield (kg/fed): Soxhelt apparatus was used for determination of ether extract percent according to AOAC[17].
- Ash content percentage and ash yield (kg/fed).
- Nitrogen free-extract percentage (NFE%) and nitrogen free-extract yield (kg/fed). It was calculated by using the following equation NFE = 100 – (crude protein percent + crude fiber percent + ether extract percent + ash percent). Moreover, nitrogen free-extract in kg/fed/cut was calculated by multiplying nitrogen free-extract percent × yield of dry matter in ton/fed in each blades and stems.

Calculated relative yield of both protein, fiber, ashether extract and nitrogen free-extract (kg/fed/cut) were modified according to full maturity (200 days).

All data were statistically analyzed according to the technique of analysis of variance for the split-plot design as described by Gomez and Gomez[18].

RESULTS AND DISCUSSION

Cuttings: The results in Table 1-3 showed that cuttings excreted significant effect on crude protein and fiber, ash content, ether extract and nitrogen free-extract percentages in blades and stems as well as its yields/fed were significantly affected due to cuttings. Highest percentages of crude protein and ash in blades and stems were produced from the second cut. The highest percentages of crude fiber and ether extract in blades and stems produced from the third cut. The fifth cut achieved highest percentage of nitrogen free-extract in both blades and stems. Moreover, highest crude protein yield and ash in yield/fed were produced at the second cut. The third cut produced the highest percentages of crude fiber, ether extract and nitrogen free-extract yields per feddan. Moreover, the lowest percentages of crude protein and fiber, ash content and ether extract in yields/fed were recorded at the fifth cut. On the other hand, the lowest percentages of crude protein and fiber, ash content and ether extract in both blades and stems were resulted from the fifth cut. In addition, the lowest percentage of nitrogen free-extract percentages in blades and stems were obtained from the third cut. The same conclusion were reported by Legel[7] and Tomar *et al.*[12].

Seeding rates: Regarding the effect of seeding rates, the results in Tables 1-3 showed significant differences on

Table 1: Percentages of crude protein and fiber in blades and stems and crude pratein and fiber yields content (kg/fed) and their calculated relative yield (kg/fed) as affected by seeding rates and cutting schedules

Treatments	Crude protein (%)		Protein yield (kg/fed)	Calculated relative protein yield (kg/fed)	Crude fiber (%)		Fiber yield (kg/fed)	Calculated relative fiber yield (Kg/fed)
	Blades	Stems			Blades	Stems		
A : cuttings								
1st	24.52	11.12	142.57		8.29	16.22	135.56	
2nd	29.00	09.83	210.94		9.40	21.92	256.32	
3rd	24.55	08.46	181.11		10.19	25.31	299.26	
4th	19.77	06.67	138.53		9.35	23.14	268.67	
5th	12.98	05.23	100.06		8.36	20.64	244.27	
LSD 5%	01.45	00.82	22.31		0.24	0.62	23.24	
LSD 1%	02.19	01.25	33.79		0.36	0.94	35.20	
B: seeding rates (kg/fed)								
15	22.20	07.80	140.72		9.02	22.10	223.73	
30	22.36	07.72	185.44		9.33	22.70	303.99	
45	20.16	07.12	146.810		9.61	23.46	273.67	
LSD 5%	01.00	NS	19.34		0.16	0.45	20.13	
LSD 1%	01.35	NS	29.29		0.22	0.60	30.49	
C: cutting schedules								
30 cm height	26.86	08.92	210.89	249.57	10.21	24.56	326.07	385.98
40 cm height	23.66	08.33	175.47	189.70	10.61	25.79	303.03	327.60
50 cm height	21.86	08.02	170.36	172.08	11.09	26.55	319.59	322.82
25 days intervals	26.25	09.16	180.50	225.62	9.51	23.90	258.16	322.70
35 days intervals	23.22	08.34	165.12	165.12	10.65	26.23	302.29	302.29
45 days intervals	17.66	05.97	122.92	126.07	7.94	19.48	228.07	233.91
55 days intervals	11.51	04.02	78.35	92.18	5.25	12.77	132.69	156.11
LSD 5%	03.83	01.43	40.41	-	2.73	6.79	92.66	-
LSD 1%	05.11	01.91	53.94	-	3.65	9.07	123.70	-

Table 2: Percentages of ash and ether extract in blades and stems and ash and ether extract yields content (kg/fed) and their calculated yield (kg/fed) as affected by seeding rates and cutting schedules

Treatments	Ash (%)		Ash yield (kg/fed)	Calculated relative ash yield (kg/fed)	Ether extract (%)		Ether extract yield (kg/fed)	Calculated relative ether extract yield (Kg/fed)
	Blades	Stems			Blades	Stems		
A: cuttings								
1st	12.81	16.91	152.31		3.49	2.05	23.56	
2nd	12.52	18.68	235.41		2.65	2.14	31.42	
3rd	10.81	17.24	218.82		3.21	2.24	35.52	
4th	07.98	12.86	159.53		3.03	1.95	30.74	
5th	05.55	09.98	123.31		2.29	1.52	23.89	
LSD 5%	00.27	00.41	020.65		0.21	0.06	03.21	
LSD 1%	00.41	00.62	031.28		0.31	0.10	04.86	
B: seeding rates (kg/ fed)								
15	09.29	14.34	157.80		2.86	2.04	27.18	
30	08.88	14.84	210.71		2.91	2.06	36.59	
45	09.48	14.90	184.30		2.55	1.79	27.41	
LSD 5%	00.19	00.28	017.89		0.14	0.02	02.79	
LSD 1%	00.26	-	027.09		0.18	0.03	04.23	
C: cutting schedules								
30 cm height	09.70	15.81	220.64	261.11	3.13	2.11	36.71	43.45
40 cm height	10.13	16.25	205.30	221.95	3.23	2.18	34.51	37.30
50 cm height	10.52	16.71	219.02	221.23	3.32	2.28	36.46	36.83
25 days intervals	09.37	15.16	179.55	223.19	2.90	2.08	29.73	37.16
35 days intervals	10.13	16.00	195.75	195.75	3.02	2.14	32.11	32.11
45 days intervals	08.45	13.41	163.90	168.10	2.31	1.76	26.92	27.61
55 days intervals	06.21	09.50	106.72	125.55	1.49	1.18	16.31	19.19
LSD 5%	02.05	03.49	053.22 -		0.76	0.53	09.95	-
LSD 1%	02.74	04.66	071.05 -		1.01	0.71	13.28	-

crude protein, crude fiber, ash content, ether extract and nitrogen-free extract percentages in blades and stems as well as its yields/fed, except crude protein percentage in stems only which did not reach the level of significant. Highest percentages of crude protein and ether extract in stems were resulted from sown with rate of 30 kg seed/fed . While, increasing seeding rate to 45 kg seed/fed was accompanied with the highest percentage of crude fiber and ash content in both blades and stems as well as percentages of nitrogen free-extract in blades only. The

Table 3: Percentages of nitrogen free-extract in blades and stems and nitrogen free-extract yield (kg/fed) as affected by seeding rates and cutting schedules

Treatments	Nitrogen free extract (%)		Nitrogen free extract yield (kg/fed)	Calculated relative (NFE) yield (kg/fed)
	Blades	Stems		
A: Cuttings				
1st	50.89	53.70	510.61	
2nd	49.89	47.43	652.60	
3rd	46.43	46.75	675.69	
4th	51.24	55.38	580.56	
5th	59.87	62.63	501.41	
LSD 5%	01.21	00.65	053.13	
LSD 1%	01.83	00.99	080.45	
B: Seeding rates (kg/fed)				
15	56.63	53.72	525.09	
30	56.52	52.68	683.85	
45	58.20	52.73	598.76	
LSD 5%	00.84	00.47	046.01	
LSD 1%	-	00.63	069.67	
C: Cutting schedules				
30 cm height	50.19	48.60	755.50	894.08
40 cm height	52.37	47.45	678.83	733.87
50 cm height	53.21	46.37	687.46	694.41
25 days interval	51.97	49.70	652.05	815.06
35 days intervals	52.98	47.29	662.88	662.88
45 days intervals	63.64	59.38	490.17	612.72
55 days intervals	75.54	72.53	291.07	342.44
LSD 5%	09.22	12.21	185.58	-
LSD 1%	12.31	16.30	247.75	-

lowest percentages of crude fiber and ether extract in blades and stems were obtained due to using highest seeding rate of 45 kg seed/fed. While, using 30 kg seed/ fed produced the lowest percentages of ash in blades and nitrogen free-extract in both blades and stems. Moreover, reducing seeding rate to 15 kg seed/fed produced the lowest percentages of crude fiber in both blades and stems and ash in stems only. Moreover, highest protein, crude fiber, ash, ether extract and nitrogen free extract yields per feddan were produced from sown with seeding rate of 30 kg seed/fed. While, the lowest yields of all dry matter analysis per feddan were produced from reducing seeding rate to 15 kg seed/fed. These results are in agreement with those obtained by Zeiton[1], Hassaballa[3], Kandil and S halaby[5] and Younis *et al*[4].

Cutting schedules: The results in Tables 1-3 showed that percentages of crude protein, and fiber, ash content, ether extract and nitrogen-free extract in blades and stems as well as its yields/fed significantly responded as a result of cutting schedules under study. Highest percentages of crude protein produced from cutting plants at 30 cm height and after 25 days intervals in both blades and stems, respectively. While, highest percentages of crude fiber, ash content and ether extract were produced from cutting at 50 cm height in both blades and stems. But cutting plants at 55 days intervals produced the highest percentage of nitrogen free-extract. On contrary, the lowest percentages of crude protein, crude fiber, ash and ether extract were produced from cutting plants at 55 days intervals. On the other hand, cutting at 30 or 50 cm height were produced the lowest percentage of nitrogen free-extract in blades and stems, respectively. Moreover, highest yields of crude protein and fiber, ash content, ether extract and nitrogen free-extract per feddan were produced from cutting at 30 cm height. The lowest yields of crude protein and fiber, ash content, ether extract and nitrogen free-extract per feddan were produced from cutting at 55 days intervals. The same conclusions were reported by Abd-El-Raouf *et al.*[6], Legel[7], El-Sarangawy *et al.*[8], Abd-El-Gawad [10], Tomar *et al.* [12]and Pea and Bin[14].

There was non significant interactions between cuttings, seeding rates and cutting schedules treatments on chemical analysis of dry matter, this mean that each factor acted separately.

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