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NUTRITIVE VALUE OF SOME EGYPTIAN CLOVER VARIETIES AS AFFECTED BY VARIOUS LEVELS OF PHOSPHORUS FERTILIZATION.

Seif, A.S. and A.M.Saad
Dept. of Agronomy, Fac. of Agric., Benha Univ.
Corresponding author: Ahmed.Saad@fagr.bu.edu.eg.

ABSTRACT

In order to evaluate nutritive value of some Egyptian clover varieties two field experiments were carried out at the Experimental Research ♀Station, Faculty of Agriculture at Moshtohor, Benha University during the two growing seasons of 2010/2011 and 2011/2012. Chemical constituents potentialities of five Egyptian clover (*Trifolium alexandrinum, L*.) varieties i.e.Gemiza 1, Sakha 4, Helali, Giza 6 and Serw 1 under various phosphorus fertilization levels i.e.0, 22.5 and 45 kg P_2O_5/fed were investigated chemical analysis was conducted for the second and fourth cuts of each of the two growing seasons for the different grown varieties. Combined analysis of the two seasons was done after insuring the validity of partlet test (**Steel and Torrie, 1981).**Results could be concluded as follows:

Results of the combined analysis of the two seasons indicated significant differences in crude protein (CP), crude fiber (CF), Ash, ether extract (EE), nitrogen free extract (NFE), total digestible nutrients (TDN) and digestible protein (DP%) among the studied five Egyptian clover varieties during two cuts. Highest content of CP, CF, P, DP and TDN% were obtained for Gemiza1, whereas, Helali variety recorded highest content of Ash and EE% with significant differences of different magnitudes. Also, highest NFE content was recorded for Giza 6.

Results showed that CP, CF, Ash, EE, P, DP and TDN % were substantially increased as phosphorus fertilization levels increased from 0 to 22.5 and up to 45 kg P_2O_5 /fed. However, reverse trend was observed for NFE content.

It could be concluded that highest forage quality of Egyptian clover was produced from sown Gemiza 1 variety and fertilizing with 45 kg P_2O_5/fed.under North Delta conditions.

INTRODUCTION

Egyptian clover (*Trifolium alexandrinum,L*.) is considered the most important widely grown multi-cut winter forage leguminous crop in Egypt. It is highly nutritive forage contains 15.8-26.7 % crude protein (CP), 14.9-28.3 % crude fiber (CF), 1.4-3.0 % ether extract (EE), 1.4 - 2.58 % calcium and 2.22 - 2.46% phosphorus content (Mohsen *et al*., 2011).In terms of animal production, forage quality is of great importance. Forage quality is determined by the content of different nutrients such as minerals, crude protein and fiber component. The concentration of nutritional and mineral components in the forage varied according to many variables such as fertilization (Türk *et al.* 2007), soil properties and other environmental variables (Kulik,2009).

The contents of DM and NFE tended to decrease with increasing phosphorus fertilization levels, however CP, CF, EE, ash and P increased with increasing phosphorus fertilization levels. Moreover, the contents of DM,

CF, NFE, Ca and P were decreased, but CP, EE and ash tended to be higher in earlier cut as compared with the latest cut of berseem. All nutrients digestibility and nutritive values for berseem clover significantly increased with increasing phosphorus fertilization levels. Moreover, the digestibility of DM, CP, EE and NFE and TDN and DCP values were significantly higher, however, CF digestibility significantly lower for earlier cut as compared to latest cut of berseem clover (Mohsen *et al*., 2011).

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental Research Center, Faculty of Agriculture at Moshtohor, Benha University, Kalubia Governorate during two the growing seasons of 2010/2011 and 2011/2012. The objectives of this investigation was aimed to evaluate the nutritive chemical constituents of some Egyptian clover (*Trifolium alexandrinum, L*.) varieties as affected by various phosphorus fertilization levels. Experiments were designed and layed out in a split plot design, where phosphorus fertilization levels were randomly distributed in the main plots and Berseem varieties in the split plots. The applied treatments were:

A- Common Berseem clover varieties (*Trifolium alexandrinum, L*.): Five varieties were used i.e.Gemiza 1, Sakha 4, Helali, Giza 6 and Serw 1, which were supplied from the Forage Department, Agriculture Research Center, Ministry of Agriculture at Giza, Egypt.

B- Phosphorus fertilization levels: Three phosphorus fertilization levels of 0, 22.5 and 45 kg P_2O_5 /fed., as calcium superphosphate (15 % P_2O_5) were used during the appropriate soil preparation before sowing. Nitrogen (10 kg N /fed) fertilization regime for berseem clover were applied properly. The recommended seeding rates of each of the above berseem varieties were followed. Seeds were sown on October, 24th in 2010/2011 and 2011/2012 seasons, respectively.

Five cuts were obtained during each of the two growing seasons. The first cut was obtained at 50 days from sowing. However, the second cut was obtained after 45 days from the first one. The third cut was taken after 40 days from the second one. Fourth cut was taken at 35 days from the third one, and the fifth cut was taken after 30 days from the fourth one. Ten plants were randomly selected from each experimental unit for each of the obtained two cuts (the 2nd and the 4th cuts) in each of the two seasons for analyzing and determining the following nutritive constituents on dry matter basis: CP, CF, Ash, EE, NFE, TDN, DP and P contents as well.

Samples of the proposed treatments were prepared to be chemically analyzed for each of the earliest and the latest two cuts (on dry matter basis) for each treatment of the two replicates (two composite thoroughly mixed samples were prepared from each of the four replicates) in each of the two growing seasons in the study under investigation. This is to represent the general effect of the imposed treatments.

Soil type of the experimental units was clay with pH 8.0. The physical and chemical properties of the experimental soil units of Moshtohor Exp. Station are recorded in Table (1) for each of the two growing seasons.

Table 1: Physical and chemical properties of the experimental soil units at Moshtohor Agric. Exp. Station during each of the two growing seasons.

Properties	Seasons	
	2010/11	2011/12
Mechanical analysis		
Course sand %	5.90	4.99
Find sand %	18.64	8.02
Silt %	27.19	34.48
Clay %	48.27	52.51
Texture grade	clay	Clay
Chemical analysis		
pH (1: 2.5)	7.9	8.1
E.C. (ds/m) (1:20)	0.16	0.22
O.M (%)	1.91	1.93
$CaCO_3$ (%)	**3.15**	**2.12**
HCO_3 (meq/L)	1.25	1.25
Cl^- (meq/L)	0.54	0.55
Ca^{++} (meq/L)	0.8	0.9
Na^+ (meq/L)	0.77	0.84
K^+ (meq/L)	0.24	0.17
Mg^{++} (meq/L)	0.2	0.2
N available(mg/kg)	241	179
P available (mg/kg)	8.0	12
K available(mg/kg)	1485	1280

Chemical analysis was conducted and presented on dry matter basis after preparing and drying the fresh forage samples which randomly taken (through quadrate of ¼ sq meters) from each experimental unit where leaves of plants were separated to be chemically analyzed. Accurately weighed samples of the separated leaves (about 200 gm) were dried using an air forced drying oven at 75°C till a constant weight. Samples were dried in a labeled Kraft paper bags which were laid in an air forced drying oven all over the drying period. Dried samples were then cooled at room temperature, then ground finely and screened through hummer mill of 40 michs. The screened fine grounded samples were kept in sealed labeled plastic bags and stored in the refrigerator at 5°C till needed for the chemical analysis.

Dried samples of each two replicates for each treatment were thoroughly mixed to form two composite samples out of the 4 replicates. Out of each of the two composite samples, two analyses were done for each treatment, the average results of each analysis in this study were recorded.

The conducted chemical analysis of forage quality components included the following:

1-Crude Protein (CP) Content: Total nitrogen content was determined according to the modified micro kjeldahl method. Crude protein content was estimated by multiplying nitrogen percentage by 6.25 (A.O.A.C., 1995).

2-Crude Fiber (CF) Content: Crude fiber content was determined according to the A.O.A.C. (1995).

3-Ash Content: Accurate weight of 2 g of the dried composite samples which were re-dried for each treatment were put in weighted labeled-crucibles and placed in a muffle furnace at 600°C for about 6 hours, then cooled down to room temperature and weighted till constant weight (A.O.A.C., 1995).

4-Ether Extract (EE) Content: Ether extract content was extracted using petroleum ether (40-60°C boiling point) in a soxhlet apparatus provided with cold water condenser for 9 hours at a rate of 6 siphons/hour (A.O.A.C., 1995).

5-Nitrogen Free Extract (NFE) Content: It was estimated by subtracting the sum of the contents of crude protein, crude fiber, ash and ether extract out of 100.

[NFE % = 100 – (CP% + CF% + EE% + Ash %)]

6- Phosphorus (P) Content: Phosphorus percentage was analyzed and determined according to the A.O.A.C. (1995).

7-Total Digestible Nutrients (TDN): The TDN of the forages was calculated according to Adams *et al.* (1964) using the following equations:

[TDN % = 74.43 + 0.35 CP % – 0.73 CF %]

8- Digestible Protein (DP) Content: The digestible Protein (DP) of the forages was calculated according to Bredon *et al*., (1963): DP % = 0.9596 CP – 3.55.

Statistical analysis: The analyses of variance for each of the contents and the two growing seasons and their combined analysis was conducted to study seasonal behavior of each chemical constituent of the two cuts (the 2nd and the 4th cuts) in each season and, over the combined analysis after insuring the validity of partlet test which was carried out according to the procedure described by Steel and Torrie (1981). The L.S.D. test at 5% level was used in means comparison.

RESULTS AND DISCUSSION

It should be noticed that chemical analysis was conducted for the second and fourth cuts of each of the two growing seasons. Also, the chemical constituents for leaves of the obtained Egyptian clover materials (of the various varieties) were analyzed and presented on dry matter basis as follows:

Crude Protein (CP) Content:

Over the applied phosphorus fertilization levels, combined analysis (Table,2) indicated significant variations in CP content between the five varieties inspite of the very narrow range in between. The descending ranking order for CP content was 14.97, 14.90, 14.73, 14.37 and 14.31% for Gemiza 1, Sakha 4, Helali, Giza 6 and Serw 1, respectively. So, it is noticed that each of the 5 varieties varied in their CP content in their leaves with slight significant differences. So, it is noticed that Gemiza 1 of Egyptian clover was of the highest leaf-CP content (14.97%), whereas, Serw 1 variety was lowest CP level (14.31%) in leaves with slight significant magnitudes. Results showed that crude protein content was relatively higher for the first

growing season than the second one having ranking order of Helali (16.09) > Serw 1 (16.06) > Giza 6 (15.12) > Sakha 4 (15.08) > Gemiza 1 (15.07), with no significant differences during the first season being Gemiza 1 (14.87) > Sakha 4 (14.72) > Giza 6 (13.96) > Helali (13.36) > Serw 1 (12.56) with significant differences for the second season. It is generally noticed that CP content of leaves for the five berseem varieties was relatively higher in the first growing season than the second one. Such variations in CP contents may be due to the slight differences in their specific genetical makeup and/or their interaction with the prevailing environmental seasonal conditions between the first and the second growing seasons (Table 1). Regarding CP content of berseem leaves for the earlier than the later cuts, results clarified that the second cut was relatively higher in CP content than the fourth cut in each of the 5 berseem varieties for their leaves as compared with the fourth cut (Table, 2).Such results are more likely due to more leafy plants and shorter stems of higher biophysiological activities forming more CP content for the earlier than the later cuts of season. Moreover, the later cuts of the end of winter season and its relatively more wormer environment and its limited functions in its assimilation rates which reflect decreases in CP content. Also, Gemiza 1, Sakha 4, Serw 1, Giza 6 and Helali were of 17.40, 16.82, 15.72, 15.58 and 15.51% CP content in the 2nd cut, respectively. Whereas, varietal CP contents in the later 4th cut were in the descending order Helali, Giza 6, Sakha 4, Serw 1 and Gemiza 1were of 13.96, 13.17, 12.99, 12.91 and 12.55% with significant differences. Similar results were reported by Kulik (2009) on grass-legumes sward. Meanwhile, Gemaiza 1 variety was of the highest CP content in the 2nd cut (17.40%) and the lowest content in the 4th cut (12.55%) and Helali variety was in an opposite trend of lowest CP content in the 2nd cut (15.51%) and highest CP content in the 4th cut (13.96%). This particular results may prove the differential behavior of CP assimilation rates for Gemiza 1 and Helali varieties, which was higher in the early cut than in the later one in the first variety and highest in the later cuts than the first one for the second variety. These different assimilation rates of CP formation is more likely due to their specific genetical makeup which interacted with the prevailing environmental seasonal conditions

Regarding phosphorus fertilization levels, combined analysis revealed significant differences in CP content (over the grown 5 varieties) according to the assigned phosphorus fertilization levels (Table, 2). Over the grown varieties of berseem, combined analysis revealed significant increase in CP content of leaves by increasing phosphorus levels from the control to 22.5 and up to 45kg P_2O_5/fed., having respective CP content of 13.29, 14.47 and 16.21% in leaves, respectively. This trend of the presented increasing order of CP content as phosphorus levels increase was recorded for each of the two growing seasons and during each of the obtained cuts with significant differences of various magnitudes (Table 2). It is also noticed that there was a relative increase in CP content in berseem leaves for the first seasons than the second one and for the 2nd cut than the 4th cuts. Similar results were reported by Turk *et al.* (2007) on Narbon vetch and Mohsen *et al.* (2011) on berseem.

Table 2: Crude protein (CP) and Crude fiber (CF) contents for leaves of some Berseem clover (*Trifolium alexandrinum, L*.) varieties as affected by various phosphorus levels for early and late cuts (Combined over two seasons).

Phosphorus Fertilization Levels (P) (Kg $_2O_5$/fed.)	Variety (V)	Crude protein (CP) content			Crude fiber (CF) content		
		2nd cut	4th cut	Mean	2nd cut	4th cut	Mean
……(% on dry matter basis) ……							
Control	Gemaiza 1	15.84	11.33	13.58	27.90	30.69	29.29
	Sakha 4	15.31	12.16	13.73	27.91	31.11	29.51
	Helali	13.70	12.48	13.09	26.88	30.09	28.48
	Giza 6	14.66	10.94	12.8	27.69	29.70	28.69
	Serw 1	14.55	12.00	13.27	28.68	30.04	29.36
Mean		14.81	11.78	13.29	27.81	30.33	29.07
22.5	Gemaiza 1	16.92	11.88	14.40	28.70	31.80	30.25
	Sakha 4	16.52	12.92	14.72	28.26	32.19	30.22
	Helali	15.33	14.00	14.66	27.81	32.22	30.01
	Giza 6	15.46	13.68	14.57	28.27	29.17	28.72
	Serw 1	15.54	12.49	14.01	29.15	31.11	30.13
Mean		15.95	12.99	14.47	28.44	31.30	29.87
45	Gemaiza 1	19.45	14.43	16.94	30.52	32.32	31.42
	Sakha 4	18.62	13.89	16.25	29.37	32.35	30.86
	Helali	17.49	15.39	16.44	28.04	31.15	29.59
	Giza 6	16.64	14.91	15.77	29.34	29.86	29.60
	Serw 1	17.07	14.24	15.65	30.86	30.86	30.86
Mean		17.85	14.57	16.21	29.63	31.31	30.47
Gemaiza 1		17.40	12.55	14.97	29.04	31.60	30.32
Sakha 4		16.82	12.99	14.90	28.51	31.88	30.19
Helali		15.51	13.96	14.73	27.58	31.15	29.36
Giza 6		15.58	13.17	14.37	28.43	29.58	29.00
Serw 1		15.72	12.91	14.31	29.56	30.67	30.11
Mean		16.21	13.12	14.66	28.624	30.976	29.80
L.S.D at 5% for:		P= 0.077 V=0.11 Py=0.11 Vy= 0.16 Pv=0.19 Pvy=0.27	P= 0.0018 V=0.002 Py=0.0025 Vy= 0.0028 Pv=0.0034 Pvy=0.0048		P= 0.50 V=0.33 Py=0.71 Vy= 0.46 Pvy=0.80	P= 0.32 V=0.21 Py=0.45 Vy= 0.30 Pv=0.37 Pvy=0.52	

Results indicated significant interaction effect for berseem varieties and the applied phosphorus fertilization levels on CP content of leaves. Gemiza 1 variety fertilized at highest phosphorus levels (45 kg P_2O_5/fed) produced highest leaf-CP content (19.45%) of the second cut. Meanwhile, Giza 6 variety produced the lowest CP content (10.94%) without phosphorus fertilization levels (control) for the fourth cut. Such results indicated the effect of phosphorus in enhancing the CP content of berseem leaves as a main source of energy transfer in all of the biophysiological activities and metabolism functions.

Crude Fiber (CF) Content:

Over phosphorus fertilization levels, combined analysis (Table, 2) indicated that crude fiber (CF) content varied significantly among the grown berseem varieties. The obtained CF content could be ranked in the following

descending order: Gemiza 1 (30.32%), Sakha 4 (30.19%), Serw 1 (30.11%), Helali (29.36%) and Giza 6(29%) with significant differences in both seasons. Crude fiber contents were relatively higher for the first growing season than the second one and having the descending ranking order of Gemiza 1 (30.84%) > Serw 1 (30.70%) > Sakha 4 (29.90%) > Giza 6 (29.32%) > Helali (29.01%), with significant differences during the first season, being Sakha 4 (30.51%) > Gemiza 1 (29.80%) > Helali (29.72%) > Serw 1 (29.53%) > Giza 6 (28.68%),with significant difference for the first and the second seasons. In generally it could noticed that CF content of leaves for the 5 berseem varieties was relatively higher in the first growing season than the second one. Such variations in CF contents may be due to the slight differences in their genetical specific and/or their interaction with environmental seasonal condition within each of the first and second growing seasons. Combined analysis clarified that, the fourth cut was relatively higher in CF content than the second cut in each of the 5 berseem varieties for their leaves (Table, 2). Also, Serw 1, Gemiza 1, Sakha 4, Giza 6 and Helali were of 29.56, 29.04, 28.51, 28.43 and 27.58% CF content in the 2^{nd} cut, respectively. Meanwhile, in the 4^{th} cut CF contents were in the following descending order: Sakha 4, Gemiza1, Helali, Serw1 and Giza 6 which was of 31.88, 31.60, 31.15, 30.67 and 29.58% with slight ignorable significant differences. Similar results were reported by Kulik (2009) on grass-legumes sward.

From the combined analysis (over berseem varieties), data cleared that increasing phosphorus application levels caused slight ignorable significant increased in CF of the obtained forage legumes in both seasons especially when comparing between the effect of the lowest (control) and highest (45 kgP_2O_5/fed) phosphorus levels. The obtained CF content was 29.07, 29.87 and 30.47% when applying control, 22.5 and 45 kg P_2O_5/fed., respectively. The obtained results matches with those of Turk *et al.*(2007) on Narbon vetch and Mohsen *et al.* (2011) on berseem.

Combined analysis indicated significant interaction effect of the imposed factors under study (berseem varieties x phosphorus levels) on CF content of the obtained forage. These results indicated that each of the berseem variety was differently affected by the applied phosphorus levels to its CF content (Table, 2) which increased by increasing phosphorus levels. Sakha 4 variety fertilized with highest phosphorus level (45 kg P_2O_5/fed) produced the highest leaf-CF content (32.35%) of the fourth cut, and Helali produced the lowest CF content (26.88%), fertilized with the lowest phosphorus level (0kg P_2O_5/fed.) for the second cut.

Ash Content:

As it is clear from the combined analysis (Table, 3) and over the different phosphorus fertilization levels, ash-contents of leaves for berseem varieties were of slight significant differences with slight ignorable variable. However, the descending respective leaves-ash values were for Helali (13.35%), Sakha 4 (13.26%), Serw 1 (12.91%), Giza 6 (12.84%) and Gemiza 1 (12.55%).

It is also noticed that leaf-ash content of Helali berseem variety was the highest significant value in the first season and each of the two cuts. But,

leaf-ash content of Sakha 4 berseem variety was the highest significant value during the second season and for each of the two cuts. Whereas, Gemaiza 1 was always of the lowest significant value in each of the two seasons and their two early and late cuts. Moreover, other varieties were in very narrow range of no specific trend and behaved in a similar way for each growing season and for each cut. Similar results were reported by Kulik (2009) on grass-legumes sward.

Table 3: Ash and Ether Extract (EE) contents for leaves of some Berseem clover (*Trifolium alexandrinum, L*.) varieties as affected by various phosphorus levels for early and late cuts (Combined over two seasons).

Phosphorus Fertilization Levels(P)(Kg P_2O_5/fed.)	Variety (V)	Ash content			Ether Extract (EE) content		
		2nd cut	4th cut	Mean	2nd cut	4th cut	Mean
(%on dry matter basis)							
Control	Gemaiza 1	13.90	10.37	12.13	2.51	2.66	2.58
	Sakha 4	14.32	10.87	12.59	2.96	2.61	2.78
	Helali	14.30	10.85	12.57	2.38	2.87	2.62
	Giza 6	13.60	10.55	12.07	2.53	2.32	2.42
	Serw 1	13.40	10.45	11.92	2.31	2.92	2.61
Mean		13.90	10.17	12.03	2.54	2.68	2.61
22.5	Gemaiza 1	14.15	10.85	12.50	3.33	2.71	3.02
	Sakha 4	15.35	11.40	13.37	3.28	2.99	3.13
	Helali	15.27	11.40	13.33	3.69	2.81	3.25
	Giza 6	14.95	11.10	13.02	2.56	3.12	2.84
	Serw 1	15.20	10.95	13.07	2.86	2.49	2.67
Mean		14.98	11.14	13.06	3.15	2.83	2.99
45	Gemaiza 1	14.93	11.10	13.01	3.37	2.59	2.98
	Sakha 4	15.48	12.15	13.81	3.42	2.45	2.93
	Helali	15.95	12.35	14.15	3.80	3.45	3.62
	Giza 6	15.05	11.80	13.42	3.42	2.80	3.11
	Serw 1	15.50	12.00	13.75	3.48	3.13	3.30
Mean		15.38	11.88	13.63	3.50	2.88	3.19
Gemaiza 1		14.33	10.77	12.55	3.07	2.65	2.86
Sakha 4		15.05	11.47	13.26	3.22	2.69	2.95
Helali		15.17	11.53	13.35	3.29	3.04	3.16
Giza 6		14.53	11.15	12.84	2.84	2.75	2.79
Serw 1		14.70	11.13	12.91	2.88	2.85	2.86
Mean		14.75	11.21	12.98	3.06	2.80	2.92
L.S.D at 5% for:		P= 0.15 V=0.28 Vy= 0.39 Pvy= 0.68	P= 0.19 V=0.10 Py=0.23 Vy= 0.14 Pv=0.17 Pvy=0.23		V= 0.25 Pvy=0.61	P= 0.03 V=0.06 Py=0.05 Vy= 0.08 Pv=0.10 Pvy=0.13	

Combined analysis clarified that, the second cut was relatively higher in ash content than the fourth cut in each of the five berseem varieties for their leaves as compared with the fourth cut (Table, 2). Also, Helali, Sakha 4, Serw 1, Giza 6 and Gemiza 1 were of 15.17, 15.05, 14.70, 14.53 and 14.33% ash content in the 2nd cut, respectively. Meanwhile, in the 4th cut, ash contents were in the following descending order Helali, Sakha 4, Giza 6,

Serw 1 and Gemiza 1 were of 11.53, 11.47, 11.15, 11.13 and 10.77% with slight ignorable significant differences. Over berseem varieties, combined analysis indicated significant increase in ash content of their leaves by increasing phosphorus levels from 0 to 22.5 and up to 45kg P_2O_5/fed., having respective ash content of 12.03, 13.06 and 13.63% in leaves. This trend of increasing ash content as phosphorus levels increase was recorded for each of the two growing seasons and during each of the obtained cuts with significant differences of various magnitudes as it is clear from Table (3).

It is generally noticed that (Over berseem varieties), increasing phosphorus levels caused very slightly increasing in leaf-ash contents within quite ignorable levels. Increasing phosphorus levels i.e. 0, 22.5 and 45 kg P_2O_5/fed. did not exert appreciable differences in ash contents of berseem clover varieties. The obtained results matches with those of Turk *et al.* (2007) on narbon vetch and Mohsen *et al.* (2011) on berseem.

Results indicated significant interaction effect of berseem clover varieties and phosphorus levels on ash content of leaves, where Helali variety fertilized at the highest phosphorus levels produced the highest leaf-ash content of the second cut, whereas, Serw 1 variety produced the lowest ash content, fertilized by lowest phosphorus levels(0 kg P_2O_5/fed) for the fourth cut.

Ether Extract (EE) Content:

From the combined analysis (Table, 3) results showed that (over the applied fertilization treatments), there was appreciable differences among the grown forage legumes in their ether extract (EE) with variable significant magnitudes. Ether extract (EE) content could be ranked in the following descending order: Helali (3.16%), then Sakha 4 (2.95%) followed by Gemiza 1= Serw 1 (2.86%) followed Giza 6 (2.79%). It could be pointed out that highest EE content was for Helali variety whereas; the lowest content was for Giza 6 variety with significant difference.

Combined analysis clarified that, the second cut was relatively higher in EE content than the fourth cut in each of the 5 berseem varieties for their leaves as compared with the fourth cut (Table, 2). Also, Helali, Sakha 4, Gemiza 1, Serw 1 and Giza 6 were of 3.29, 3.22, 3.07, 2.88 and 2.84% EE content in the 2nd cut, respectively. Whereas, in the 4^{th} cut EE contents were in the following descending order: Helali, Serw 1, Giza 6, Sakha 4 and Gemaiza 1 were of 3.04, 2.85, 2.75, 2.69 and 2.65% with slight ignorable significant differences. These results were in good agreement with those reported by Kulik (2009) on grass-legumes sward.

Results of the combined analysis (over berseem varieties), cleared that increasing phosphorus application levels caused significant increase in EE of the obtained forage legumes in both seasons especially when comparing between the effect of the lowest (0 kgP_2O_5/fed) and highest (45 kgP_2O_5/fed) phosphorus levels. The obtained EE content were 2.61, 2.99 and 3.19% when applying 0, 22.5 and 45 kg P_2O_5/fed, respectively. The obtained results were similary with reported by Turk *et al.*(2007) on Narbon vetch and Mohsen *et al.* (2011) in berseem.

Over combined analysis, results evedentiated significant interaction effect of the imposed factors (Berseem clover varieties and phosphorus fertilization levels) on EE content of the obtained forage. This indicate that each of the berseem varieties was affected differently by the applied phosphorus levels in their response to EE content (Table, 3) which increased with increasing phosphorus levels, where Helali variety fertilized with highest lowest phosphorus level (45 kg P_2O_5/fed) and produced highest leaf-EE content (3.80%) of the second cut, whereas, Serw 1 produced the lowest EE content (2.31%), and without fertilization with phosphorus level (0 kg P_2O_5/fed.) for the second cut.

Nitrogen Free Extract (NFE) Content:

Results in Table (4) present the combined analysis for the studied berseem clover varieties fertilized with various phosphorus levels. Over phosphorus levels, berseem varieties varied significantly within relatively narrow range values in their leaf -NFE content. Results indicated that highest and lowest-NFE values for leaves and noticed that Giza 6 and Sakha 4 varieties of berseem clover, respectively. Leaf-NFE contents were 40.98, 39.79, 39.38, 39.29 and 38.68% for Giza 6, Serw 1, Helali, Gemiza 1 and Sakha 4, respectively. Such variations could be of a specific identity of these studied varieties as affectedly with the prevailing conditions under the circumstances of this study.

Combined analysis clarified that, the fourth cut was relatively higher in NFE content than the second cut in each of the five berseem varieties for their leaves as compared with the second cut (Table, 4). Also, Giza 6, Helali, Serw 1, Sakha 4 and Gemiza 1 were of 38.61, 38.45, 37.14, 36.40 and 36.16% NFE content in the 2nd cut, respectively. While, in the 4th cut NFE content was in the following descending order: Giza 6, Serw 1, Gemiza 1, Sakha4 and Helali were of 43.35, 42.44, 42.42, 40.97 and 40.32%, respectively with slight ignorable significant differences magnitudes. Similar results were reported by Kulik (2009) on grass-legumes sward.

Over varieties, combined analysis revealed significant increase in nitrogen free extract (NFE) content of their leaves by increasing phosphorus levels from 0 to 22.5 and up to 45kg P_2O_5/fed., having respective NFE content of 37.97, 39.61 and 41.29% in leaves, respectively. This trend of increasing NFE content as phosphorus levels increase was recorded for each of the two growing seasons and during each of the obtained cuts with significant differences of narrow magnitudes as it is clear from Table (4). Such obtained results matches with those of Turk *et al.*(2007) on narbon vetch and Mohsen
et al. (2011) on berseem.

Results indicated significant interaction effect of berseem varieties and phosphorus fertilization levels for NFE content of leaves. Where, Giza 6 variety fertilized with highest phosphorus level (45 kg P_2O_5/fed) produced highest leaf-NFE content (44.77%) of the fourth cut, whereas, Gemiza 1 produced the lowest NFE content (32.77%) fertilized with the lowest phosphorus level (0 kg P_2O_5/fed.) for the second cut. Others interactions were observed in Table (4).

Table 4: Nitrogen free extract (NFE) and Phosphorus (P) contents for leaves of some Berseem clover (*Trifolium alexandrinum, L.*) varieties as affected by various phosphorus levels for early and late cuts (Combined over two seasons).

Phosphorus Fertilization Levels (P) (Kg P_2O_5/fed.)	Variety (V)	Nitrogen free extract content			Phosphorus content		
		2nd cut	4th cut	Mean	2nd cut	4th cut	Mean
(%on dry matter basis)							
Control	Gemaiza 1	39.85	45.02	42.45	2.13	0.81	1.47
	Sakha 4	39.50	43.41	41.47	1.81	0.99	1.40
	Helali	42.74	43.13	42.95	2.11	1.02	1.57
	Giza 6	41.52	46.01	43.78	1.73	0.90	1.32
	Serw 1	41.06	44.38	42.73	1.70	0.85	1.27
Mean		40.94	44.84	42.90	1.90	0.92	1.41
22.5	Gemaiza 1	36.90	42.76	39.83	1.25	1.35	1.30
	Sakha 4	36.59	40.50	38.56	2.54	1.15	1.85
	Helali	37.90	39.57	38.75	2.70	1.06	1.88
	Giza 6	38.76	42.93	40.85	2.26	1.26	1.76
	Serw 1	37.25	42.96	40.12	2.08	0.94	1.51
Mean		37.48	41.74	39.61	2.37	1.15	1.76
45	Gemaiza 1	31.73	39.49	35.62	3.62	1.51	2.56
	Sakha 4	33.11	39.00	36.07	2.90	1.27	2.09
	Helali	34.72	38.24	36.49	3.26	0.94	2.10
	Giza 6	35.55	41.11	38.34	2.68	1.32	2.00
	Serw 1	33.09	39.98	36.54	2.40	1.34	1.87
Mean		33.64	39.56	36.60	2.97	1.28	2.13
Gemaiza 1		36.16	42.42	39.29	2.67	1.23	1.95
Sakha 4		36.40	40.97	38.68	2.42	1.14	1.78
Helali		38.45	40.32	39.38	2.69	1.01	1.85
Giza 6		38.61	43.35	40.98	2.23	1.16	1.69
Serw 1		37.14	42.44	39.79	2.06	1.04	1.55
Mean		37.35	41.90	39.63	2.41	1.12	1.76
L.S.D at 5% for:		P= 0.83 V=0.52 Py=1.18 Vy= 0.74 Pv=0.90 Pvy=1.28	P= 0.44 V=0.26 Py=0.63 Vy= 0.36 Pv=0.44 Pvy=0.62		P= 0.006 V= 0.006 Py= 0.008 Vy= 0.008 Pv=0.01 Pvy=0.01	P= 0.04 V= 0.05 Py= 0.08 Vy= 0.07 Pvy= 0.12	

Phosphorus (P) content:

Combined analysis in Table (4) presents P- content of leaves for the five varieties of Berseem clover during each of the two growing seasons and cuts.

Each of the five berseem varieties, showed significant differences in their P content over the different phosphorus fertilization levels. Leaf-P content was in the following descending order: Gemiza 1(1.95%), Helali (1.85%), Sakha 4 (1.78%), Giza 6 (1.69%) and Serw 1 (1.55%) with significant differences.

Combined analysis clarified that, the second cut was relatively higher in P content than the fourth cut in each of the five berseem varieties for their

leaves as compared with the fourth cut (Table, 4). Also, Helali, Gemiza 1, Sakha 4, Giza 6 and Serw 1were of 2.69, 2.67, 2.42, 2.23 and 2.06% P content in the 2nd cut, respectively. While, in the 4th cut P-content were in the following descending order: Gemiza 1, Giza 6, Sakha4, Serw 1 and Helali were of 1.23, 1.16, 1.14, 1.04 and 1.01% with slight ignorable significant differences in magnitudes. Similar results were reported by Kulik (2009) on grass-legumes sward.

Over berseem varieties, combined analysis indicated significant increase in P content of their leaves by increasing phosphorus levels from 0 to 22.5 and up to 45kg P_2O_5/fed., having respective P content of 1.41, 1.76 and 2.13% in leaves, respectively. This trend of increasing P content as phosphorus levels increase was recorded for each of the two growing seasons and during each of the obtained cuts with significant slight differences of various magnitudes as it is clear from Table (4).

Total Digestible Nutrients (TDN) Content:

Results presented in Table (5) showed the total digestible nutrients (TDN) of berseem varieties as affected by different phosphorus levels. Results over the phosphorus levels, the combined analysis indicated that Gemiza 1 variety was significantly higher in the TDN as compared with other varieties Serw 1 in leaves. Similar results were reported by Kulik (2009) on grass-legumes sward.

Regarding phosphorus levels, it is obviously clear from the combined analysis that the TDN of leaves of berseem variety (over the varieties) increased as phosphorus levels increased from 0 to 22.5 and up to 45kg P_2O_5/fed respectively. The respective TDN values were 77.12, 77.48 and 78.04%, respectively.

Significant interaction effect of berseem varieties and phosphorus fertilization levels for TDN content was noticed, where Gemiza 1variety fertilized at the highest phosphorus levels produced the highest leaf-TDN content of the second cut, whereas, the Giza 6 variety produced lowest TDN content fertilized at the lowest phosphorus levels for the fourth cut with slight significant differences (Table 5). This trend was noticed during each of the two cuts of the two growing season, where the respect TDN was 77.77, 77.60, 77.60, 77.50 and 77.40% for Gemiza 1, Sakha 4, Helali, Giza 6 and Serw 1, respectively. It could be concluded that the lowest values of TDN were for (Sakha 4, Helali, Giza 6 and Serw 1).

Digestible Protein (DP) Content:

The response of digestible protein content of berseem clover varieties as an inorganic native herbaceous legumes fertilized at various phosphorus fertilization levels are presented in Table (5). Results showed parallel behaviors trend almost similar to CP content previously presented and discussed.

Table 5: Total Digestible Nutrients (TDN) and Digestible Protein (DP) Contents for leaves of some Berseem clover (*Trifolium alexandrinum, L.*) varieties as affected by various phosphorus levels for early and late cuts (Combined over two seasons).

Phosphorus Fertilization Levels (P) (Kg P_2O_5/fed.)	Variety (V)	Total Digestible Nutrients Content			Digestible Protein Content		
		2nd cut	4th cut	Mean	2nd cut	4th cut	Mean
(% on dry matter basis)							
Control	Gemaiza 1	78.17	76.25	77.21	11.65	7.32	9.48
	Sakha 4	77.99	76.51	77.25	11.14	8.11	9.62
	Helali	77.49	76.69	77.09	9.59	8.43	9.01
	Giza 6	77.77	76.18	76.97	10.51	6.94	8.72
	Serw 1	77.66	76.53	77.09	10.41	7.96	9.18
Mean		77.82	76.43	77.12	10.66	7.75	9.20
22.5	Gemaiza 1	78.49	76.36	77.42	12.69	7.85	10.27
	Sakha 4	78.38	76.70	77.54	12.30	8.85	10.57
	Helali	78.00	77.07	77.53	11.16	9.88	10.52
	Giza 6	78.01	77.17	77.59	11.28	9.57	10.42
	Serw 1	77.98	76.62	77.30	11.36	8.43	9.89
Mean		78.17	76.79	77.48	11.76	8.92	10.34
45	Gemaiza 1	79.25	77.21	78.23	15.11	10.29	12.70
	Sakha 4	79.04	77.02	78.03	14.32	9.78	12.05
	Helali	78.74	77.63	78.18	13.23	11.21	12.22
	Giza 6	78.35	77.56	77.95	12.41	10.76	11.58
	Serw 1	78.39	77.25	77.82	12.83	10.11	11.47
Mean		78.75	77.34	78.04	13.58	10.43	12.00
Gemaiza 1		78.64	76.91	77.77	13.15	8.49	10.82
Sakha 4		78.47	76.74	77.60	12.59	8.91	10.75
Helali		78.08	77.13	77.60	11.33	9.84	10.58
Giza 6		78.04	76.97	77.50	11.40	9.09	10.24
Serw 1		78.01	76.80	77.40	11.53	8.83	10.18
Mean		78.25	76.91	77.58	12.00	9.03	10.52
L.S.D at 5% for:		P= 0.04 V=0.045 Py=0.06 Vy= 0.06 Pv=0.08 Pvy=0.11	P= 0.022 V=0.015 Py=0.031 Vy= 0.021 Pv=0.026 Pvy=0.036		P= 0.07 V=0.11 Py=0.10 Vy= 0.15 Pv=0.19 Pvy=0.26	P= 0.0016 V=0.002 Py=0.0023 Vy= 0.0026 Pv=0.0034 Pvy=0.0046	

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القيمة الغذائية لبعض أصناف البرسيم المصرى تحت مستويات مختلفة من الفوسفور

سيف الدين عطاالله سيف و أحمد محمد سعد إبراهيم
قسم المحاصيل – كلية الزراعة – جامعة بنها

أجريت تجربتان حقليتان بمزرعة مركز البحوث والتجارب الزراعية بكلية الزراعة بمشتهر – جامعة بنها وذلك خلال موسمي الزراعة الشتوى 2011/2010 ، 2012/2011 م بهدف تقييم التركيب الكيماوى (البروتين الخام – الالياف الخام – الرماد – مستخلص الاثير – الكربوهيدرات الذائبة الكلية – المركبات الكلية المهضومة – البروتين المهضوم – الفوسفور على أساس المادة الجافة) لخمسة أصناف من البرسيم المصرى (جميزة 1– سخا 4- هلالى- جيزة 6- سرو 1) تحت ثلاث مستويات من السماد الفوسفاتى (صفر- 22.5- 45 كجم فو$_2$أ$_5$/ف) وقد استخدم تصميم القطع المنشقة مرة واحدة بأربعة مكررات. ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :

1 - أوضحت النتائج ان الصنف جميزة 1 كان اعلى الأصناف الخمسة فى محتواه من (البروتين الخام – الالياف الخام – المركبات الكلية المهضومة – البروتين المهضوم – الفوسفور) بينما تفوق الصنف هلالى فى محتواه من (الرماد – مستخلص الاثير) و صنف جيزة 6 فى الكربوهيدرات الذائبة الكلية.

2 - أدت إضافة السماد الفوسفاتى بمعدل 45 كجم فو$_2$أ$_5$/ف الى الحصول على أكبر محتوى من (البروتين الخام – الالياف الخام – الرماد – مستخلص الاثير –المركبات الكلية المهضومة – البروتين المهضوم – الفوسفور) بينما انخفضت نسبة الكربوهيدرات الذائبة الكلية بزيادة إضافة معدل السماد الفوسفاتى.

3 - كان للتفاعل بين اصناف البرسيم المصرى ومعدلات النسميد الفوسفاتى تأثير معنوى على نسبة البروتين الخام ، الالياف الخام ، الرماد ، مستخلص الاثير ، الكربوهيدرات الذائبة الكلية ، المركبات الغذائية الكلية المهضومة ، البروتين المهضوم ، الفوسفور لمتوسط الحشة الثانية والرابعة.

توصى الدراسة بزراعة البرسيم المصرى صنف جميزة 1 مع التسميد بمعدل 45 كجم فو $_2$أ$_5$/ فدان للحصول على اعلى جودة لمحصول العلف تحت ظروف جنوب الدلتا.