EFFECT OF NITROGEN, PHOSPHORUS AND ZINC FERTILIZATION ON YIELD, QUALITY AND NUTRIENTS UPTAKE OF BERSEEM-BARLEY MIXTURE

Awadalla, H.A.; Ismail,S.A. and Abd-El-Hafeez, A.M.
Soil, Water and Environment Res. Inst., A.R. C, Egypt

ABSTRACT

Two field experiments were conducted in clay soil at the Agricultural Farm of Sids Agricultural Research Station, Agricultural Research Center during two seasons 2010/2011 and 2011/2012, consecutively to investigate the effect of three nitrogen levels (0, 15 and 30 kg N/fed), three phosphorus levels, i.e. 6.8, 9.6 and 13.1 kg P/fed and two zinc application levels (0.0, and 10 kg zinc sulphate/fed) on total fresh and dry forage yield, forage quality; namely, N, protein, P and Zn concentration and N, P and Zn uptake by berseem-barley mixture.

Total fresh and dry forage yield significantly increased by N, P and Zn fertilization. Nitrogen and protein percentage positively affected only by nitrogen fertilization. While, phosphorus concentration significantly affected by raising phosphorus levels only. Meanwhile, zinc concentration increased by zinc application and decreased by increasing phosphorus levels. Nitrogen, phosphorus and zinc fertilization increased nitrogen uptake. Whereas, phosphorus or zinc uptake responded only to phosphorus or zinc application, respectively. All studied parameters affected by the interaction between phosphorus and zinc, where added phosphorus at higher rate inhibited the effectiveness of zinc.

Key words: Berseem, barley, forage mixture, nitrogen fertilizer, phosphorus fertilizer, zinc fertilizer, nutrient content and nutrient uptake.

INTRODUCTION

In Egypt, berseem (*Trifolium alexandrium L.*) is the main source of animal feeding. It is grown in pure stand as feed fresh during winter and /or hay in spring and summer seasons. Because of its higher protein content than animal demand, some researches on mixing berseem with cereals such as barley were carried out in order to study the possibility of mrking a balanced feed for the animal requirement and increase the total annual production of the dry matter per unit area. Recently, great attention have been paid in Egypt to increase forage yield and nutritive value of berseem through mixing it with barley. The results of several investigators on berseem-barley mixture indicated that fresh and dry forage of the mixtures were significantly higher than berseem alone **(Kobaissy, *et al.* 1995)**. However, **El-Hattab *et al.* (1985)** reported that berseem-barely mixture was not significantly less than pure stand berseem concerning green and dry yields. On the other hand, many studies emphasized the advantage of mixing grasses with leguminous to improve its quality and yield **(Mostafa *et al,* 1991; Gebra *et al*, 1992; Abd El-Shafy and Ali, 1996,Teasdale *et al,* 2007and Brandaeter *et al* (2012).**

Nitrogen is the nutrient element that most frequently limits yields in the tropics as well as in the temperature region. Many workers stated that, nitrogen fertilization at a rate of 30 kg/fed significantly increased fresh and dry yield or crude protein in the obtained forage of the mixtures **(Tawfik *et al,* 1992)**. Many authors reported the transfer of N from legumes to the unlegane plants mixed with it which found to be up to 50% N in the non-legeme

(Dahlin and Stenberg, 2010). The mechanisms controlling the transfer are nonetheless not clearly understood. A number of pathways have been proposed, e.g. uptake of root deposits either directly by the plant or after transformation by soil microbial biomass and direct interconnections between legume and non-legume roots **(Soussana and Hartwing, 1996 and Rasmussen *et al*, 2007).**

Phosphorus exerts a very important role in energy storage and transfer in the plant. It also plays a fundamental role in large number of enzymatic reactions that depends on phosphorylations. Application of phosphorus to Egyptian clover resulted in an increase in fresh and dry weights **(Abd El-Latif and Salamah, 1982; Abd El-Latif, 1986 and Atia *et al,* 2000).**

Zinc is involved in many enzymatic activators. Zinc is important in the synthesis of tryptophane, a component of some protein and compound needed for the production of growth hormones (auxins) like indole acetic acid. Application of zinc to barley or clover enhanced growth **(Atia *et al.,* 2000)**. The objective of the study were to evaluate the response of yield and quality of berseem – barley mixture to nitrogen , phosphorus and zinc fertilization.

MATERIALS AND METHODS

The present study was conducted during two successive seasons, namely 2010/2011 and 2011/2012 at Sids Agricultural Research Station, Agricultural Research Center, Egypt. Some physical and chemical properties (according to **Jackson, 1973**) of the experimental soils under study are given in **Table (1)**. The field experiment were carried out to investigate the effect of N, P and Zn fertilization on mixture of Miskawy berseem **(Trifolium alexandrium L., Sakha 4 CV)** with barley **(Hordeum vulgure L., Giza 119 CV)** at seeding rates of 20 kg/fed for each crop. Seeds were sown on 12 and 5th of November in the two studied seasons, respectively. Each experimental plot was 10.5m^2 (1/400 fed). A factorial in completely randomized block design involving the three factors. The phosphorus treatments (B), i.e. 6.8, 9.8 and 13.1 kg P were added before planting. Zinc treatments (0.0 and 10kg zinc sulphate/fed) were added (C) as soil application before planting. Nitrogen fertilization level (0.0, 15 and 30 kg N/fed) was added (A) as ammonium nitrate (33.5% N) before the first irrigation. The other normal cultural practices for growing these crops were followed.

The first cut was taken after 60 days after sowing, then the second cut was after 35 days from the first one, then the following two cuts were taken every 30 days.

Studied traits:-

- Total fresh forage yield for the four cuts (ton/fed): Plots for each cut were hand clipped and weighed in kg/plot, then transferred to ton/fed and calculate the total fresh yield for the four cuts.
- Total dry forage yield (ton/fed): Samples of 100 gm were dried at 75°C to constant weight and dry matter was estimated. The dry forage yield (ton/fed) for each cut was calculated by multiplying fresh forage (ton/fed) with the dry matter percentage and calculate the total dry yield for all cuts.
- Forage quality (nutrient content and protein percentage): Chemical analysis followed the conventional methods recommended by the Association of Official Agricultural Chemists **(A.O.A.C, 1980)** on the dried sample represent the four cuts to determined N, P and Zn concentration. Then nutrient uptake calculated by multiplying dry yield with nutrient

concentration. Whereas, protein content was estimated by multiplying nitrogen concentration by 6.25.

The results were analyzed statically according to the procedure outline by **Snedecor and Cochnan (1980)** using **MSTAT Computer Program V.4 (1986)**. The treatment means were compared by L.S.D test at 5% level of probability in both growing seasons.

Table (1): Some physical and chemical properties of the experimental soil.

Soil properties	First season	Second season
Particle size distribution (%)		
Coarse sand	0.9	0.6
Fine sand	18.1	16.6
Silt	29.3	32.1
Clays	51.7	50.7
Texture grade	Clay	Clay
Chemical analysis		
pH (1:2.5 soil water suspention)	7.96	8.03
EC(dSm^{-1} at 25 °C in soil paste)	0.36	0.39
$CaCO_3$ (%)	2.3	2.6
Organic matter (%)	1.40	1.30
Available N ugg^{-1}	18.2	21.0
Available P ugg^{-1}	12.6	14.1
Available K ugg^{-1}	240	235
Available Zn ugg^{-1}	2.0	2.2

RESULTS AND DISCUSSION

Fresh and dry forage yields:

Green forage yield (fresh and dry) of berseem mixture with barley as affected by nitrogen, phosphorus and zinc fertilization are presented in **Table (2 and 3).**

The data indicated that increasing nitrogen application had a markedly effect on total fresh yield of berssem-barley mixture in the two growing seasons. The increasing nitrogen level up to 30 kg/fed significantly increased the sum fresh forage yields for the four cuts for berseem-barley mixture. In the first season applying nitrogen fertilizer at 15kg/fed increased total fresh green yield by 3.2%, while raising the nitrogen rate to 30 kg N/fed increased it by 5.0% over the non fertilized nitrogen plots. In the second season these increases amounted to 3.2 and 5.3%, respectively.

With respect to total dry forage yield, results showed significant differences between the studied rates of nitrógen fertilizer on dry fresh yield. The treatment of 30 kg N/fed gave the highest value of total dry forage yield (13.08 ton/fed), while without nitrogen treatment gave the lowest value (12.47 ton/fed) in the first season. The corresponding values for the second season were 13.91 and 13.23 ton/fed, respectively.

It is obvious to notice that, although the increasing either fresh or dry yield due to increasing nitrogen levels is significant, but these increments did not so much high. This may be due to the effect nitrogen application is more pronounced on barley than berseem, or it gave negative effect on the later. These results confirm the finding of **Sprage and Garber (1950), Washko and Pannington (1956) and Parson (1958)** who stated that yield increased due to nitrogen has been influenced by the amount of non legume in the mixture. The greater the proportion of non legume, the greater the yield increase from applied nitrogen. Addition of nitrogen usually had increased the competitive ability of the non legume and had decreased the proportion of legume in the mixture. Therefore, nitrogen application has a significant effect on increasing the yield of the mixture, although it reduced the yield of berseem. The reduction in yield of berseem may be due to the fact that nitrogen fixing bacteria trend to decrease nitrogen fixation especially in the presence of large amounts of available nitrogen **(Woodhouse and Chanblese, 1959).**

Table (2): Total fresh forage yield (ton/fed) of berseem-barley mixture as affected by N, P and Zn fertilization.

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	**10.0**	**Mean**	**0.0**	**10.0**	**Mean**
0.0	6.8	50.26	52.52	51.39	54.88	55.79	55.34
	9.6	52.57	55.49	54.03	56.56	57.98	57.27
	13.1	55.41	56.19	55.80	57.28	57.99	57.64
Mean		**52.75**	**54.73**	**53.74**	**56.07**	**57.25**	**56.66**
15	6.8	54.13	54.99	54.56	56.86	58.71	57.79
	9.6	54.95	55.35	55.15	57.59	58.96	58.28
	13.1	56.19	57.07	56.63	59.85	59.07	59.46
Mean		**55.09**	**55.80**	**55.45**	**58.10**	**58.91**	**58.51**
30	6.8	55.06	56.14	55.60	58.97	59.76	59.37
	9.6	55.83	57.59	56.71	59.43	60.94	60.19
	13.1	56.99	56.88	56.94	59.60	60.74	60.17
Mean		**55.96**	**56.87**	**56.42**	**59.33**	**60.48**	**59.91**
Mean of (B)	6.8	53.15	54.55	53.85	56.90	58.09	57.50
	9.6	54.45	56.14	55.30	57.86	59.29	58.57
	13.1	56.20	56.71	56.46	58.91	59.27	59.09
Mean of (C)		**54.60**	**55.80**	**55.20**	**57.89**	**58.88**	**58.39**
L.S.D at 0.05							
A		0.99			1.01		
B		0.99			1.01		
C		0.72			0.73		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		1.21			1.32		
A×B×C		N.S			N.S		

Table (3): Total dry forage yield (ton/fed) of berseem-barley mixture as affected by N, P and Zn fertilization.

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	10.0	Mean	0.0	10.0	Mean
0.0	6.8	11.72	12.23	11.98	12.73	12.97	12.85
	9.6	12.11	12.87	12.49	13.11	13.51	13.31
	13.1	12.83	13.04	12.94	13.50	13.53	13.52
mean		**12.22**	**12.71**	**12.47**	**13.11**	**13.34**	**13.23**
15	6.8	12.57	12.76	12.67	13.22	13.66	13.44
	9.6	12.93	13.28	13.11	13.52	13.74	13.63
	13.1	13.04	13.27	13.16	13.97	13.76	13.87
mean		**12.85**	**13.01**	**12.98**	**13.57**	**13.72**	**13.65**
30	6.8	12.61	13.09	12.85	13.52	13.88	13.70
	9.6	12.92	13.40	13.16	13.82	14.18	14.00
	13.1	13.27	13.21	13.24	13.91	14.12	14.02
mean		**12.93**	**13.23**	**13.08**	**13.75**	**14.06**	**13.91**
Mean of (B)	6.8	12.30	12.69	12.50	13.16	13.50	13.33
	9.6	12.65	13.18	12.92	13.48	13.81	13.65
	13.1	13.04	13.17	13.11	13.79	13.80	13.80
Mean of (C)		**12.66**	**13.01**	**12.84**	**13.48**	**13.70**	**13.59**
L.S.D at 0.05							
A		0.18			0.21		
B		0.18			0.21		
C		0.14			0.16		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		0.23			0.26		
A×B×C		N.S			N.S		

Regarding phosphorus fertilization it can be notice that raising the phosphorus doses increased total fresh yield in both seasons. The increasing percentage in the first season due to 9.6 and 13.1 kg P treatments reached to 2.7 and 4.9% as compared to 6.8 kg P treatment, respectively. The second season have the same trend.

As for total dry yield, similar to green forage yield, data of dry yield showed a positive and significant relationship between forage dry yield and phosphorus fertilization in both seasons. The increasing in total yield over 6.8 kg P/fed treatment amounted to 3.4 and 4.9% in the first season, while in the second one were 2.4 and 3.5% for phosphorus levels 9.6 and 13.1 kg P/fed, respectively. This increment of yield could be attributed to the increased of the activity of soil bacteria in fixing atmospheric nitrogen due to high supply of phosphorus on one hand and to the important role of phosphorus in physiological processes in berseem and barley plants on the other hand.These findings are in accordance with **Abd El-Latif and Salamah (1982) and Atia *et al* (2000).**

As for the interactions, the data obtained clearly showed that both fresh and dry forage yields were affected only by the interaction between phosphorus and zinc application. Where, the application of zinc at the high phosphorus rate, i.e. 13.1 kg P/fed of phosphorus under 10 kg sulphate zinc did not effect fresh or dry forage yield of berseem-barly mixture in both seasons. This mainly due to the antagonistic effect between phosphorus and zinc. **Stuckenholtz *et al* (1966)** mentioned that higher level of available soil P or applied - P fertilizer induces Zn deficiency in plants. The mobilization of Zn through diffusion is also adversely affected by P fertilization **(Singh *et al*, 1985).**

Forage quality:

Means of nitrogen, protein, phosphorus(%) and zinc (ppm) content of berseem-barley mixture tissues as affected by nitrogen, phosphorus and zinc fertilization are presented in Tables (4-7). The results clearly showed that both nitrogen and protein percentage significantly affected only by nitrogen application in both seasons, while it not affected by either phosphorus or zinc fertilization. It is obvious that the treatment of 30 kg N/fed gave the highest values of N and protein % in berseem-barley mixture, which gave 2.54 and 16.05% in the first season, respectively. The corresponding values in the second season were 2.56 and 16.01%, while the lowest values were recorded for the treatment without nitrogen fertilization (2.26 and 14.03% for the first season and 2.20 and 13.95% for the second one in the above mentioned order. respectively). These results confirm the finding of **Tawfik *et al* (1992).**

The obtained data revealed that phosphorus percentage in berseem-barley mixture was not affected by the studied treatments, except phosphorus fertilization where, phosphorus application had a positive effect on phosphorus content in both seasons. The increase in phosphorus percentage due to 9.6 and 13.1 kg P/fed treatments over 6.8 kg P/fed treatment amounted to 14.3 and 26.2%, respectively in the first season. The increasing percentage for the second season were 6.5 and 15.2% in the same order.

Table (4): Nitrogen content (%) in berseem-barley mixture as affected by N, P and Zn fertilization.

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	10.0	Mean	0.0	10.0	Mean
0.0	6.8	2.22	2.25	2.24	2.21	2.26	2.24
	9.6	2.34	2.30	2.32	2.26	2.14	2.20
	13.1	2.16	2.27	2.22	2.17	2.16	2.17
Mean		**2.24**	**2.27**	**2.26**	**2.21**	**2.19**	**2.20**
15	6.8	2.43	2.39	2.41	2.36	2.45	2.41
	9.6	2.40	2.43	2.42	2.44	2.40	2.42
	13.1	2.43	2.49	2.46	2.44	2.43	2.44
Mean		**2.42**	**2.44**	**2.43**	**2.41**	**2.43**	**2.42**
30	6.8	2.57	2.60	2.59	2.55	2.60	2.58
	9.6	2.51	2.48	2.50	2.53	2.55	2.54
	13.1	2.55	2.50	2.53	2.58	2.53	2.56
Mean		**2.54**	**2.53**	**2.54**	**2.55**	**2.56**	**2.56**
Mean of (B)	6.8	2.41	2.41	2.41	2.37	2.44	2.41
	9.6	2.42	2.40	2.41	2.41	2.36	2.39
	13.1	2.38	2.42	2.40	2.40	2.37	2.39
Mean of (C)		**2.40**	**2.41**	**2.41**	**2.39**	**2.39**	**2.39**
L.S.D at 0.05							
A		0.06			0.08		
B		N.S			N.S		
C		N.S			N.S		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		N.S			N.S		
A×B×C		N.S			N.S		

Table (5): Protein content (%) in berseem-barley mixture as affected by N, P and Zn fertilization.

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	**10.0**	**Mean**	**0.0**	**10.0**	**Mean**
0.0	6.8	13.21	14.16	13.69	13.83	14.43	14.13
	9.6	14.33	14.45	14.39	14.43	13.79	14.11
	13.1	13.62	14.39	14.01	13.66	13.55	13.61
mean		**13.72**	**14.33**	**14.03**	**13.97**	**13.92**	**13.95**
15	6.8	15.29	15.02	15.16	14.62	15.39	15.01
	9.6	15.11	15.33	15.22	15.15	15.12	15.14
	13.1	15.31	15.61	15.45	15.30	15.06	15.18
mean		**15.24**	**15.32**	**15.28**	**15.20**	**15.19**	**15.11**
30	6.8	16.17	16.32	16.25	15.96	16.31	16.14
	9.6	15.64	15.52	15.58	15.85	15.91	15.88
	13.1	15.96	16.67	16.32	16.16	15.84	16.00
mean		**15.92**	**16.17**	**16.05**	**15.99**	**16.02**	**16.01**
Mean of (B)	6.8	14.89	15.17	15.03	14.80	15.38	15.09
	9.6	15.03	15.10	15.07	15.14	14.94	15.04
	13.1	14.96	15.22	15.09	15.04	14.82	14.93
Mean of (C)		**14.96**	**15.16**	**15.06**	**14.99**	**15.05**	**15.02**
L.S.D at 0.05							
A		0.31			0.47		
B		N.S			N.S		
C		N.S			N.S		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		N.S			N.S		
A×B×C		N.S			N.S		

Table (6): Phosphorus content (%) in berseem-barley mixture as affected by N, P and Zn fertilization

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C) 2010/2011 0.0	10.0	Mean	2011/2012 0.0	10.0	Mean
0.0	6.8	0.42	0.43	0.43	0.46	0.47	0.47
	9.6	0.49	0.49	0.49	0.48	0.49	0.49
	13.1	0.53	0.52	0.53	0.52	0.52	0.52
Mean		**0.48**	**0.48**	**0.48**	**0.49**	**0.49**	**0.49**
15	6.8	0.41	0.40	0.41	0.45	0.44	0.45
	9.6	0.48	0.48	0.48	0.49	0.47	0.48
	13.1	0.54	0.53	0.54	0.54	0.54	0.54
mean		**0.48**	**0.47**	**0.48**	**0.49**	**0.48**	**0.49**
30	6.8	0.41	0.42	0.42	0.47	0.46	0.47
	9.6	0.47	0.46	0.47	0.49	0.48	0.49
	13.1	0.52	0.53	0.53	0.53	0.52	0.53
mean		**0.47**	**0.47**	**0.47**	**0.50**	**0.49**	**0.50**
Mean of (B)	6.8	0.41	0.42	0.42	0.46	0.46	0.46
	9.6	0.48	0.48	0.48	0.49	0.48	0.49
	13.1	0.53	0.53	0.53	0.53	0.53	0.53
Mean of (C)		**0.47**	**0.48**	**0.48**	**0.49**	**0.49**	**0.49**
L.S.D at 0.05							
A		N.S			N.S		
B		0.05			0.04		
C		N.S			N.S		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		N.S			N.S		
A×B×C		N.S			N.S		

Table (7): Zinc content (ppm) in berseem-barley mixture as affected by N, P and Zn fertilization

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C) 2010/2011			2011/2012		
		0.0	10.0	Mean	0.0	10.0	Mean
0.0	6.8	31	42	36.5	39	44	41.5
	9.6	32	40	36.0	38	42	40.0
	13.1	33	34	33.5	37	39	38.0
Mean		**32**	**38.7**	**35.3**	**38**	**41.7**	**39.8**
15	6.8	33	43	38.0	38	45	41.5
	9.6	31	41	36.0	36	40	38.0
	13.1	32	35	33.5	38	39	38.0
Mean		**32**	**39.7**	**35.8**	**37.3**	**41.3**	**39.2**
30	6.8	31	39	35	36	44	40.0
	9.6	34	38	36	37	41	39.0
	13.1	33	33	33	36	37	36.5
Mean		**32.7**	**36.7**	**34.7**	**36.3**	**40.7**	**38.5**
Mean of (B)	6.8	31.7	41.3	36.5	37.7	44.3	41
	9.6	32.3	39.7	36.0	37.0	41.0	39
	13.1	32.7	34.0	33.4	37.0	38.0	37.5
Mean of (C)		**32.2**	**38.3**	**35.3**	**37.2**	**41.1**	**39.1**
L.S.D at 0.05							
A		N.S			N.S		
B		2.10			1.73		
C		1.82			1.61		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		4.37			2.65		
A×B×C		N.S			N.S		

Zinc concentration in berseem-barley mixture was not affected by nitrogen treatments. However, either phosphorus or zinc fertilization had a significant effect on zinc content in berseem-barley mixture in both seasons. Raising phosphorus rates up to 13.1 kg P/fed significantly decreased zinc content. This negative effect of phosphorus fertilization is mainly due to the antagonismatic effect between phosphorus and zinc as mentioned before. On the other hand, addition of zinc significantly increased zinc content in mixture in both seasons. The plants supplied with 10 kg zinc sulphate/fed exceeded that without zinc by about 18.9 and 10.5% in both seasons, respectively.

Concerning the interaction between the studied treatments, the results indicated that zinc concentration in berseem-barley mixture was affected only by the interaction between phosphorus and zinc fertilization. In the presence of zinc, phosphorus application had a negative effect on zinc content, where increasing phosphorus fertilization significantly decreased zinc concentration of the mixture in both seasons. This finding again emphasized the antagonistic effect between phosphorus and zinc.

Nutrient uptake:

Data presented in **Table (8-10)** showed the effect of nitrogen, phosphorus and zinc fertilization on nitrogen, phosphorus and zinc uptake. The results indicated that tested treatments exhibited significant differences regarding nitrogen uptake, except zinc treatment in the second season. It could be noticed that raising both nitrogen or phosphorus significantly increased nitrogen uptake in both seasons, while it responded to added zinc in the first season only. These increments of nitrogen uptake is mainly due to its effect on dry weight of the mixture as mentioned before **(Table, 3)**, since nutrient uptake calculated by multiplying nutrient concentration with dry weight.

Also, the results showed that phosphorus uptake by berseem-barley mixture was positively responded only to phosphorus fertilization. Where, raising phosphorus treatment to 9.6 and 13.1 kg P/fed increased phosphorus uptake by bersem-barley by about 19.8 and 32.5% as compared to 6.8 k P/fed in the first season. The same trend was obtained in the second season.

As for zinc uptake by berseem-barley mixture, the data in the same **Tables** revealed that zinc uptake was significantly affected by zinc application and by the interaction between phosphorus and zinc fertilization. The plants received 10 kg zinc sulphate surpassed that without zinc treatment by about 24.8 and 12.8% in the two growing seasons, respectively. The enhancement of zinc application on increasing zinc uptake is mainly due its effect on both dry yield **(Table, 3)** and zinc content **(Table, 7)** as mentioned before. Also, it can be notice from the results that at the higher levels of phosphorus, i.e. 13.1 kg P/fed, zinc application not significantly increased zinc uptake in both seasons, while it significantly responded to zinc application under the two lower phosphorus levels (6.8 and 9.8 kg P/fed) in the two growing seasons. This result is mostly explained by the antagonistic effect between the two nutrients.

Table (8): Nitrogen uptake (kg/fed) by berseem-barley mixture as affected by N, P and Zn fertilization

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	10.0	Mean	0.0	10.0	Mean
0.0	6.8	261.2	274.9	268.1	282.9	291.9	287.4
	9.6	283.9	295.3	289.6	297.7	288.2	293.0
	13.1	276.5	296.1	286.3	293.2	293.3	293.3
Mean		**273.9**	**288.8**	**281.4**	**291.3**	**291.1**	**291.2**
15	6.8	304.1	303.2	303.7	313.2	334.2	323.7
	9.6	311.6	321.5	316.6	330.5	331.2	330.9
	13.1	317.2	331.2	324.2	341.4	332.9	337.2
Mean		**311.0**	**318.6**	**314.8**	**328.4**	**332.8**	**330.6**
30	6.8	323.3	339.7	331.5	345.2	361.1	353.2
	9.6	325.6	333.5	329.6	349.1	362.6	355.9
	13.1	337.1	331.6	334.4	359.6	358.4	359.0
Mean		**328.7**	**334.9**	**331.8**	**351.3**	**360.7**	**356.0**
Mean of (B)	6.8	296.2	305.9	301.1	313.8	329.1	321.4
	9.6	307.0	316.8	311.9	325.8	327.3	326.6
	13.1	310.3	319.6	315.0	331.4	328.2	329.8
Mean of (C)		**304.5**	**314.1**	**309.3**	**323.7**	**328.2**	**326.0**
L.S.D at 0.05							
A		9.12			11.27		
B		9.12			11.27		
C		7.36			N.S		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		N.S			14.13		
A×B×C		N.S			N.S		

Table (9): Phosphorus uptake (kg/fed) by berseem-barley mixture as affected by N, P and Zn fertilization.

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	10.0	Mean	0.0	10.0	Mean
0.0	6.8	48.6	51.6	50.1	56.9	60.1	58.5
	9.6	59.3	63.7	61.5	63.2	67.6	65.4
	13.1	67.2	67.2	67.2	69.7	71.3	70.5
Mean		**58.4**	**60.8**	**59.6**	**63.3**	**66.3**	**64.8**
15	6.8	51.2	50.5	50.9	58.4	61.2	59.8
	9.6	62.2	62.9	62.6	65.1	63.2	64.2
	13.1	64.6	71.7	68.2	75.7	74.9	75.3
Mean		**59.3**	**61.7**	**60.5**	**66.4**	**66.4**	**66.1**
30	6.8	52.2	55.8	54.0	64.4	64.1	64.3
	9.6	61.3	62.2	61.8	68.5	69.5	69.0
	13.1	68.5	71.4	70.0	73.4	74.6	74.0
Mean		**60.7**	**63.1**	**61.9**	**68.8**	**69.4**	**69.1**
Mean of (B)	6.8	50.7	52.6	51.7	59.9	61.8	60.9
	9.6	50.9	62.9	61.9	65.6	66.1	65.9
	13.1	66.8	70.1	68.5	72.9	73.6	73.3
Mean of (C)		**59.5**	**61.9**	**60.7**	**66.1**	**67.2**	**66.7**
L.S.D at 0.05							
A		N.S			N.S		
B		4.32			4.96		
C		N.S			N.S		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		N.S			N.S		
A×B×C		N.S			N.S		

Table (10): Zn uptake (g/fed) by berseem-barley mixture as affected by N, P and Zn fertilization.

Nitrogen kg/fed (A)	Phosphorus kg/fed (B)	Zn kg $ZnSO_4$/fed (C)					
		2010/2011			2011/2012		
		0.0	10.0	Mean	0.0	10.0	Mean
0.0	6.8	363.1	515.7	439.4	495.3	579.3	537.3
	9.6	386.5	514.9	450.7	499.1	568.4	533.8
	13.1	424.7	445.7	435.2	498.2	527.1	466.7
Mean		**391.4**	**492.1**	**441.8**	**497.5**	**558.3**	**527.9**
15	6.8	415.5	546.2	480.9	501.1	613.1	557.1
	9.6	401.9	543.2	472.6	487.7	548.6	518.2
	13.1	417.7	563.5	490.6	532.1	538.2	535.2
Mean		**411.7**	**551.0**	**481.4**	**507.0**	**566.6**	**536.8**
30	6.8	391.2	512.3	451.8	487.2	610.1	548.7
	9.6	438.1	507.6	472.9	510.2	583.0	546.6
	13.1	436.5	437.2	436.9	501.3	523,4	512.4
Mean		**421.9**	**485.7**	**453.8**	**499.6**	**572.2**	**535.9**
Mean of (B)	6.8	389.9	524.7	457.3	494.5	600.8	547.7
	9.6	408.8	521.9	465.4	499.0	566.7	532.9
	13.1	426.6	482.1	454.4	510.5	529.6	502.1
Mean of (C)		**408.4**	**509.6**	**459.0**	**501.3**	**565.7**	**533.5**
L.S.D at 0.05							
A		N.S			N.S		
B		N.S			N.S		
C		62.51			46.13		
A×B		N.S			N.S		
A×C		N.S			N.S		
B×C		80.19			66.52		
A×B×C		N.S			N.S		

CONCLUSION

It could be recommended that fertilized berseem-barley mixture with 30 kg N, 13.1 kg P and 10 kg zinc sulphate/fed can be give best yield and quality of forage under the condition of clay alluvial soils.

REFERENCES

Abd El-Latif, L.I. (1986). Effect of phosphorus fertilization levels and molybdenum on green fodder, dry matter and seed yield of berseem (*Trifolium alexandrium* L.). Annals Agric. Sci., Fac. Agric., Ain Shams Univ., Cairo, Egypt, 31(1): 207-218.

Abd El-Latif, L.I. and Salamah, G.G.D. (1982). Effect of cutting intervals and phosphorus fertilization on green fodder, dry matter and seed yield of berseem (*Trifolium alexandrium* L.). Research, Fac. of Agric., Ain Shams University, 2105 : 9-12.

Abd El-Shafy, A.S. and Ali, A.M. (1996). Forage yield and quality of berseem Fahl and ryegrass mixtures at different seeding rates. Annals of Agric. Sci. Moshtohor, 34(4): 1405-1414.

A.O.A.C. (1980). Association of Official Agriculural Chemists, Official Method of Analysis. 11th ED. Washington DC.,U.S.A.

Atia, A.A.M.; Mossi, F.M.; Sarhan, G.M.A. and Meawed, N.S. (2000). Study of the effect of phosphorus fertilizer levels and some micro elements on Egyptian clover. Egypt. J.Appl. Sci., 15(6):70-77.

Brandaeter, M., Goul Thomsen, M., Waernhus, K. and Fykse, H. (2012). Effects of repeated clover undersowing in spring cereals and stubble treatments in autumn on Elymus repens, Sonchus arvensis and Cirsium arvense. Crop Protection. 32: 104-110.

Dahlin, A.S. and Stenberg, M. (2010). Transfer of N from red clover to perennial ryegrass in mixed stands under different cutting strategies. Europ. J.Agronomy, 33: 149-156.

El-Hattab, A.H.; Abou-Raya, A.K.; Abd El-Raouf, M.S.; Kandil, A. and Khalil, N.A. (1985). Forage yield and quality of berseem grass mixtures as affected by seeding rates and time of cutting. Bull. Fac. Agric. Cairo Univ., 36(1):23.

Gebra, M.A.; Mostafa, M.R.M. and Khinizy, A.E.M. (1992). Nutritional studies on interceding barley with some leguminous winger forage sown on North Western Coast. J. Agric. Sci. Mansoura, Univ. 17:3132-3139.

Kobaissy, M.; Marei, Z.M.; El-Shahewy, A.S. and Ali, G.M. (1995). Effect of growing Egyptian clover in pure stand and in mixture with some grasses on forage yield and nutritive value. Egypt. J. Appl. Sci., 10(9): 510-531.

Jackson, M.L. (1973). Soil Chemical Analysis. Prentice-Hall of India, Private and LTD. New Delhi, 2nd Indian Rep.

Mostafa, M.R.M.; Ghanem, H.M.; El-Kholy, S.; Gabra, M.A. and Abd El-Malek, W.H. (1991). Effect of seeding berseem with barley with or without minerals supplement on growth and feed efficiency of growing lambs. J. Agric. Sci. Mansoura, Univ., 16:2802-2806.

MSTAT, V4 (1984). A micro computer program for design and analysis of agronomic research experiments. Michigan State Univ., USA.

Parson, J.L. (1958). Nitrogen fertilization of alfalfa-grass mixture. Agron. J. 50:593-594.

Rasmussen, J.;Eriksen, J.;Jensen, E.S., Esbensen, K.H. and Hegh-Jensen, H. (2007). In situcarbon and nitrogen dynamics in ryegrass- clover mixtures;transfer, deposition and ; leaching. Soil Biology and Biochemistry. 39 : 804-815.

Singh, N.; Deb, D.L. and Srivasta, P.C. (1985). Effect of zinc and phosphorus application on self-diffusion of zinc phosphorus in a sandy loam soil under varying temperature. J. Nucl. Biol. 14: 145-148.

Snedecor, G.W. and W.G. Cochran (1980). Statistical Methods, 7th Edin. Iowa State. Univ. Press, Iowa, U.S.A.

Soussana, J.F. and Hartwing, U.A., (1996). The effects of elevated CO2 on symbiotic N-2 fixation, a link between the carbon and nitrogen cycles in grassland ecosystems. Plant and Soil .187: 321-332.

Spargue, V.G. and Garber, R.J. (1950). Effect of time and height of cutting and nitrogen fertilization on the persistence of the legume and production of orchard grass- ladino and brome grass-ladino association Agron. J. 42: 586-593.

Stuckenholtz, D.D.; Olsen, R.J.; Gogan, G. and Olson, R.A. (1966). Studies on the mechanism of phosphorus-zinc interaction in corn nutrition. Soil Sci. Soc. Amer. Proc.30: 759-763.

Tawfik, M.A.; El-Harriri, D.M. and El-Neklawy, A.S. (1992). Effect of nitrogen fertilizers on yield and protein content of Egyotian clever and its mixture with some ryegrass varieties. Zagazig J. Agric. Res. 19(1): 617-625.

Teasdale, J.R.; Brandsaeter, L.D.; Calegari, A.and Skora, N, F., (2007). Cover crops and Weed Management.CAB International. pp. 49-64.

Washko, J.B. and Pannington, P.I. (1956). Forage and protein production of nitrogen fertilized grasses compared with grass-legume association. Pennsylvania Agric. Exp. St. Bull. 611.

Woodhouse, W.W. and Chamblese, D.S. (1959). Nitrogen in forage production. N.C. Agric. Exp. St. Bull. 383.

اثر التسميد النيتروجينى والفوسفورى والزنك على محصول العلف ونوعيته وامتصاص العناصر فى مخلوط البرسيم والشعير

حامد على عوض الله ، صفوت أحمد إسماعيل و أحمد محمد عبد الحفيظ

معهد بحوث الاراضى والمياه والبيئة - مركز البحوث الزراعية

أجريت تجربتان حقليتان لمدة موسمين متتاليين ٢٠١٠/٢٠١١ و ٢٠١١/٢٠١٢ فى المزرعه البحثية بمحطه البحوث الزراعيه بسدس لدراسه اثر اضافه ثلاث معدلات من التسميد النيتروجينى (صفر ، ١٥، ٣٠ كجم ن/فدان) وثلاث مستويات من التسميد الفوسفاتى (٦,٨ ، ٩,٦، ١٣,١ كجم فو/فدان) ومستويان من الزنك (١٠ كجم سلفات زنك للفدان وبدون إضافة) على المحصول الكلى الغض والجاف ومحتوى النيتروجين والبروتين والفوسفور والزنك وكذلك امتصاص النيتروجين والفوسفور والزنك لمحصول البرسيم المصرى مخلوطا مع الشعير.

النتائج المتحصل عليها تشير الى الاتى:

١- ازداد المحصول الكلى الغض والجاف معنويا بالتسميد النيتروجينى والفوسفاتى والزنك.

٢- محتوى مخلوط البرسيم مع الشعير من النيتروجين والبروتين ازداد زيادة معنوية بالتسميد النيتروجينى فقط، بينما محتوى المخلوط من الفوسفور تأثر ايجابيا بزيادة التسميد الفوسفاتى فقط، وقد ازداد محتوى مخلوط البرسيم مع الشعير معنويا باضافه الزنك ولكنه انخفض بزيادة معدلات التسميد الفوسفاتى.

٣- ادى التسميد النيتروجينى والفوسفاتى والزنك الى زيادة فى امتصاص عنصر النيتروجين، بينما ادى التسميد الفوسفاتى الى زيادة امتصاص الفوسفور، وكذلك ادى اضافه الزنك الى زيادة معنوية فى امتصاص الزنك.

٤- تأثرت كل الصفات المدروسه بالتفاعل بين الفوسفور والزنك حيث ادى زيادة التسميد الفوسفاتى الى تقليل تأثير اضافه الزنك مما يعرف بعمليه التضاد بين الفوسفور والزنك.

وبصفه عامه يمكن التوصيه بتسميد مخلوط البرسيم مع الشعير بـ ٣٠ كجم ن للفدان، ١٣,١ كجم فو وإضافة ١٠كجم سلفات زنك للفدان للحصول على افضل محصول علف كما ونوعا تحت ظروف الاراضى الطينية الرسوبية.