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RESPONSE OF ALFALFA-BUFFEL GRASS MIXTURE TO ARMYARD MANURE AND SULFUR FERTILIZATION UNDER CALCAREOUS SOIL CONDITIONS

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ABSTRACT

Two field experiments were performed at Mariut Research Station, Desert Research Center (DRC) during 1993 and 1994 growing seasons to study the effect of three cropping patterns i.e. alfalfa pure stand, buffel grass pure stand and alfalfa/buffel grass mixture; three organic manure rates viz., 10, 20 and 30 m^3/fed., in addition to two rates of sulfur i.e. 0.4 and 0.8 ton/fed. on some growth parameters and forage yield. The experiment was arranged in a completely randomized block design with four replications. The results can be summarized as follows:

1. Growing buffel grass with alfalfa decreased plant height and leaf area of buffel grass comparing with sole crop while the reverse was true for alfalfa when mixed with buffel grass. Number of branches/plant for alfalfa were increased by mix cropping than sole cropping. Opposite results were obtained for leaf/stem ratio. Alfalfa-buffel grass mixture had a superiority of fresh or dry yield as well as accumulated yield over that of sole cropping.
2. Increasing organic manure rates from 10 to 30 m^3/fed had no significant effect on plant height and leaf/stem ratio of buffel grass, meanwhile leaf area was significantly increased at 2 cuts out of six.
   Most of alfalfa growth characters were increased according to increasing manure rates. Moreover, dry yield as well as accumulated yields for buffel grass, alfalfa and their mixture were increased due to increase farmyard manure level.
3. Raising sulfur rates from 0.4 to 0.8 ton/fed had no significant effect on growth parameters of either buffel grass or alfalfa at most cuts taken with few exceptions. In addition, no significant responses were detected for forage yield due to sulfur application.
4. Interaction between the main factors had significant effects on some growth and yield characters at some cuts of both seasons.

Keywords: Aflafa, Buffel grass, Mixture, Sulfur, Organic manure, Growth parameters, Forage yield.

INTRODUCTION

Improving animal resources with maximizing land productivity are of great importance, especially in the new reclaimed soils. Legume-grass mixture produce more forage than pure stands of grasses receiving no or moderate amounts of nitrogen fertilizer (Barnett and Posler, 1983). Abd El-Rahim (1975) revealed that mixing alfalfa with either rhodes grass or harding grass or both resulted in an increase in the green forage yield and accumulated dry yield of the pasture as compared to pure stands of the two

perennial grasses. He also showed that mixing alfalfa with rhodes grass or harding grass caused a slight decrease in plant height of alfalfa, slight increase in the height of both perennial grasses. Shulga (1977) found that mixtures of red clover with grasses gave high yields than pure stand.

Abd El-Gawad *et al*. (1985 a,b) showed that plant height, number of branches/plant and number of leaves/plant increased in soybean when intercropped with maize comparing with soybean grown alone. On the other side, intercropping had no significant effect on plant height of maize while leaf area was increased. Jones *et al.* (1988) reported that legumes were taller in mixture than in monoculture at early harvests. Abd El-Gawad *et al*. (1990) found that intercropping patterns increased number of cowpea branches comparing with sole cropping.

Beuselinck *et al*. (1992) concluded that herbage yields of tall fescue-birdsfoot trefoil mixed Culture were greater than tall fescue alone receiving 80 kg/ha nitrogen annually. Mohamed (1992) revealed that intercropping cowpea and sudan grass caused a significant increase in dry forage yield of cowpea, fresh and dry forage yields of sudangrass, the fresh and dry yield of the mixture, she also found that plant height of sudan grass was decreased significantly at the first cut due to intercropping pattern. Moreover, Nassar and Abou-Deya (1995) stated that some growth parameters of alfalfa or buffel grass were enhanced by mix treatment. They also mentioned that the highest forage yield of buffel grass was obtained with pure stand followed by the 1:1 treatment. Meanwhile, alfalfa yields were highest with 1:3 and 1:2 grass : legume treatment.

Manure application to perennial forages improves nitrogen balance, soil properties, permeability, particles aggregation and supplies plants with required nutrients and it is also considered as soil conditioners.

Mohamed (1992) concluded that adding organic manure at a rate of 20 m^3/fed increased significantly fresh and dry forage yields of cowpea, sudan grass and their mixture. Moreover, she found that some growth parameters of each crop were enhanced by organic manure application. Furthermore, applying different organic manures increased growth rate, yield and its attributes (Abou-Deya and Nassar (1994) on fodder beet, Berner *et al*. (1995) on winter wheat and Innocent *et al*. (1995) on soybean.

Sulfur is an essential nutrient element for plant growth. Salem et al. (1989) mentioned that sulfur had a significant increase on some growth characters of wheat. Kaushik *et al.* (1995) pointed out that sulfur fertilization generally increased brome grass forage production. On the other hand, Helal (1991) recorded insignificant effect on Phalaris plant height, leaf area, green and dry forage yields for sulfur treatments. Razmjoo and Henderlong (1997) showed that sulfur application did not have a marked effect on alfalfa yield.

The main target of the present research is to figure out the influence of sulfur and farmyard manure on growth and forage yields of alfalfa, buffel grass and their mixture under North Western Coast conditions.

MATERIALS AND METHODS

Two field experiments were set up at Mariut Research Station, Desert Research Center (DRC), for the following two successive growing seasons, 1993 and 1994, to study the effect of cropping patterns (Sole and mixed cropping), organic manure and sulfur application on growth and forage yield of alfalfa, buffel grass and thier mixture.

The experiment included 18 treatments which were the combination of three cropping patterns viz, pure stand of alfalfa, buffel grass and buffel grass/alfalfa mixture (50 : 50), three levels of farmyard manure i.e., 10, 20 and 30 m^3/fed. and two rates of sulfur i.e. 0.4 and 0.8 ton/fed.

Organic manure used in this study (sheep dung) contained organic matter of 10.61%, C/N ratio of 10.45 and pH 8.24. The soil of the experiment site was characterized as sandy clay loam soil with pH 8.01 and contained 46.56% $CaCO_3$.

The experiment was laid out with four replicates in a completely randomized block design. Plot size was 10.5 m^2 (3x3.5m).

Alfalfa (*Medicago sativa* L.) c.v. Siwi and buffel grass (*Cenchrus ciliaris* L.). Indian type, as perennial forage crops were grown in sole cropping and in mixture in alternating ridges by 50 cm distances. Seeding rates were 20 and 10 kg/fed for alfalfa, 4 and 2 kg/fed. for buffel grass as a sole crop or in mixture, respectively. The pure stand of alfalfa and buffel grass as well as their mixture were sown in May 21st in 1993.

Organic manure and sulfur were added during land preparation. The pasture were harvested uniformly, after good establishment, at 55 days from sowing date. At the beginning of the second season, the whole experiment was clipped on April 7th to uniform the pasture and subsequently sulfur and organic manure treatments were applied. Three cuts were taken at 45 days interval.

Samples of five guarded plants were taken at every cut from each plot to determine plant height (cm), number of branches/plant for alfalfa, leaf area (cm^2) which measured by using the method described by Montogomery (1911) for buffel grass and using leaf area meter for alfalfa and leaf/stem ratio (on dry weight basis).

The whole plots were harvested to determine total fresh forage yield (ton/fed). Samples of 200 g were dried to calculate dry forage yield. Accumulated fresh or dry forage yields (ton/fed) were determined every season. It should be mentioned that the determined forage yield in this study was based on the forage yield of the three cuts taken during summer season, since winter is considered as dormancy season for buffel grass. Consequently forage yield of alfalfa during winter was not considered.

Data were subjected to the proper statistical analysis of variance of completely randomized block design according to the method reported by Steel and Torrie (1960). Least significant differences (LSD) at 5% level of significance was computed to differentiate between treatment means.

RESULTS AND DISCUSSION

I. Effect of cropping patterns:

I.1. On growth parameters:

A. Buffel grass:

Data presented in Table (1) indicate that plant height of buffel grass was decreased significantly in mixture than sole crop. This trend was fairly true at all cuts of the second season. This may be attributed to the inter and intra specific competition between plants grown in mixture than those grown in sole cropping. These results are in agreement with those obtained by Mohamed (1992) who revealed that plant height of sudan grass was decreased significantly at the first cut as affected by intercropping patterns.

Leaf area of buffel grass tended to decrease in mixture compared to sole crop planting. This effect was merely significant at the 2nd cut of the second season. This may be due to the competition between plants which reflected in reducing leaf width or length.

No clear trend was detected for leaf/stem ratio and there was no significant effect between sole and mixture planting. This finding hold fairly true for all cuts in both seasons.

Table (1): Effect of cropping patterns on some growth parameters of buffel grass in 1993 and 1994 growing seasons.

Growing seasons		**1993**			**1994**	
No. of cuts / Cropping. patterns	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
A:B			**a-plant height (cm).**			
0:1	59.06	82.63	87.59	38.39	56.19	71.19
1:1	57.54	83.34	88.36	30.06	40.46	56.58
L.S.D. (5%)	N.S	N.S	N.S	*	*	*
			b-leaf area (cm^2)			
0:1	5.26	7.72	10.32	5.24	5.11	7.54
1:1	5.06	7.65	11.10	4.97	2.97	7.78
L.S.D. (5%)	N.S	N.S	N.S	N.S	*	N.S.
			c- leaf/stem ratio.			
0:1	0.93	0.51	0.55	0.95	1.09	1.42
1:1	0.88	0.58	0.58	1.28	0.97	1.28
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S

A = Alfalfa B = Buffel grass

B. Alfalfa:

Data in Table (2) illustrate the effect of intercropping patterns on some growth parameters of alfalfa.

Results revealed that planting alfalfa with buffel grass in crop mixture had a positive effect on alfalfa plant height at all cuts of both seasons but the response was only significant at the first and third cuts of the

first season. This could be attributed to the highly competitive ability of alfalfa when mixed with buffel grass in a mixture. These findings are in agreement with those obtained by Abd El-Gawad *et al*. (1985) and Jones *et al*. (1988) who found that legumes were taller and more mature in mixture than in monoculture at early harvests.

Leaf area of alfalfa was slightly affected by mixture than monoculture. It was decreased at two cuts, while the reverse was true at the others but the differences did not reach the level of significance. This finding was in harmony to some extent with those obtained by Nassar and Abou-Deya (1995) as they found that leaf area of alfalfa was enhanced by intercropping alfalfa with buffel grass at 1:1 patterns.

Leaf/stem ratio of alfalfa sole crop was increased when compared with alfalfa in mixture with buffel grass. This effect was noticed at most cuts taken and it reached the level of significance at the second cut of the second season. Similar results were obtained by Mohamed (1992) who found that leaf/stem ratio of cowpea was decreased by intercropping cowpea with sudan grass in different cropping patterns comparing with pure stand.

Number of branches/plant were increased in crop mixture than sole cropping but the differences were only significant at the 2nd cut of the first season. This enhancement may be due to planting alfalfa-buffel grass mixture was able to make use of the above and underground growth resources better than growing alfalfa alone. Such results agreed with the findings of Abd El-Gawad *et al.* (1990).

Table (2): Effect of cropping patterns on some growth parameters of alfalfa in 1993 and 1994 growing seasons.

Growing seasons		**1993**			**1994**	
No. O f cuts / Cropping patterns	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
A:B			**a-plant height (cm).**			
1:0	38.79	63.76	66.36	73.94	71.52	70.40
1:1	43.95	64.21	71.87	75.48	74.21	71.81
L.S.D. (5%)	*	N.S	*	N.S	N.S	N.S
			b-leaf area (cm^2)			
1:0	6.41	5.95	4.15	4.28	4.86	4.81
1:1	6.21	5.47	4.44	4.75	5.65	4.88
L.S.D. (5%)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
			c- leaf/stem ratio.			
1:0	1.41	0.84	1.19	1.69	1.12	1.24
1:1	1.33	0.87	1.13	1.28	0.61	1.28
L.S.D. (5%)	N.S	N.S	N.S	N.S	*	N.S.
			d- number of branches/plant.			
1:0	2.56	3.33	4.54	3.88	4.09	5.77
1:1	2.65	4.07	4.64	4.22	4.37	5.40
L.S.D. (5%)	N.S	0.72	N.S	N.S	N.S	N.S

A = Alfalfa **B = Buffel grass**

.2. On forage yield:

I.2.1. Fresh forage yield:

Data given in Table (3) show the effect of cropping patterns on fresh forage yield for buffel grass, alfalfa and their mixture. Cropping patterns had a significant effect on fresh forage yield of buffel grass at all cuts of both seasons. Similar findings were observed for alfalfa and the differences between means were significant at all cuts of both seasons except for the first cut of the first season.

Concerning the forage yield of the mixture, it could be noticed that the cropping patterns had a significant effect on forage yield at all cuts of both seasons and the mixture yield exceeded that of sole cropping of each crop at most all obtained cuts.

The accumulated fresh forage yield varied significantly for buffel grass at both seasons. Meanwhile, the differences were only significant at the first season for alfalfa. For mixture's accumulated forage yield, it exceeded that of sole buffel grass by 25.07% and 219.21% and exceeded aflalfa by 35.48 and 7.60% at the first and second seasons, respectively. This increment may be due to the ability of both plants to make use of climatic and edaphic factors and this reflect in more photosynthates which produce more forage for the mixture than sole crop. This last findings is in a close agreement with the findings of Abd El-Rahim (1975), Shulga (1977), Beuselinck *et al*. (1992) and Mohamed (1992).

I.2.2. Dry forage yield:

Data given in Table (4) showed that dry forage yield of buffel grass, alfalfa and their mixture followed the same trend of fresh forage yield. Accumulated dry forage yield of the mixture outyielded significantly both buffel grass or alfalfa monoculture at both seasons. These findings are in agreement with those obtained by Abd El-Rahim (1975), Mohamed (1992) and Nassar and Abou-Deya (1995).

II. Effect of farmyard manure:

II.1. On growth parameters:

A. Buffel grass:

Data in Table (5) indicated that increasing organic manure rates from 10 up to 30 m^3/fed showed no significant effect on buffel grass plant height at all cuts of both seasons.

Significant differences in leaf area due to organic manure application were only noticed in the second and third cuts of the first and second seasons, consequently. This increment might be owe to the effect of manure in offering nutrients for plants which reflect in expanding both leaf length or width of buffel grass.

Leaf/stem ratio of buffel grass was not significantly affected by manure application. This was fairly true at all cuts taken of both seasons.

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Table (5): Effect of organic manure on some growth parameters of buffel grass in 1993 and 1994 growing seasons.

Growing seasons		1993			1994	
No. of cuts	1st	2nd	3rd	1st	2nd	3rd
Organic manure (m^3/fad.)	cut	cut	cut	cut	cut	cut
			a-plant height (cm).			
10	58.00	81.23	86.47	33.03	49.13	62.53
20	56.48	81.23	87.07	34.45	48.65	63.58
30	60.42	86.50	90.38	35.18	47.18	65.53
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S
			b-leaf area (cm^2)			
10	4.64	7.88	11.37	5.37	4.19	7.37
20	5.35	6.81	10.11	5.03	4.33	6.37
30	5.48	8.37	10.65	4.93	3.59	8.69
L.S.D. (5%)	N.S	1.21	N.S	N.S	N.S	0.88
			c- leaf/stem ratio.			
10	0.84	0.58	0.51	1.22	0.85	1.41
20	1.00	0.50	0.57	0.89	1.21	1.41
30	0.86	0.54	0.62	1.23	1.03	1.24
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S

B. Alfalfa:

Results in Table (6) showed the effect of manure rates on some growth parameter of alfalfa.

No significant differences were observed for the influence of manure application on plant height, leaf area and number of branches/plant. Meanwhile, leaf/stem ratio was affected significantly only at the third cut of the first season.

In spite of the insignificant effect of manure on most of alfalfa growth characters, the enhancement role of manure was noticed under the condition of this investigation. This may be attributed to the role of organic matter in the preservation of soil fertility and improvement the physical properties of the soil. These results are in accordance with the findings of Mohamed (1992), Abou-Deya and Nassar (1994), Berner *et al*. (1995) and Innocent *et al.* (1995).

II.2. On forage yield:

II.2.1. Fresh forage yield:

Data in Table (7) exhibited the response of fresh forage yield of buffel grass, alfalfa and their mixture to organic manure at different rates in 1993 and 1994 growing seasons.Fresh forage yield seemed to be increased insignificantly with increasing organic manure up to 30 m^3/fed. This was true for sole crops (alfalfa, buffel grass) and their mixture at all cuts of both seasons with few exceptions in which differences were significant, i.e. buffel grass yield at the second and third cuts as well as the accumulated yield in 1994 growing season. Similar results were obtained by Mohamed (1992), Abou-Deya and Nassar (1994) and Berner *et al*. (1995).

Table (6): Effect of organic manure on some growth parameters of alfalfa in 1993 and 1994 growing seasons.

Growing seasons	1993			1994		
No. pfcuts / Organic manure(m^3/fad.)	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
			a-plant height (cm).			
10	39.60	63.50	69.23	75.90	77.07	74.70
20	41.70	61.78	66.10	73.78	72.22	66.88
30	42.81	66.67	72.00	74.45	69.32	71.73
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S
			b-leaf area (cm^2)			
10	5.91	5.92	4.11	4.36	4.83	4.35
20	6.42	5.14	4.14	4.43	5.23	4.71
30	6.59	6.08	4.64	4.77	5.71	5.47
L.S.D. (5%)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
			c- leaf/stem ratio.			
10	1.44	0.88	1.25	1.14	0.79	1.28
20	1.28	0.82	1.14	2.07	1.03	1.38
30	1.39	0.88	1.09	1.27	0.77	1.13
L.S.D. (5%)	N.S	N.S	0.13	N.S	N.S	N.S.
			d- number of branches/plant.			
10	2.55	4.19	4.72	3.86	4.21	5.78
20	2.72	3.33	4.78	4.44	4.22	5.23
30	2.53	3.58	4.28	3.84	4.28	5.74
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S

II.2.2. Dry forage yield:

Results in Table (8) indicated that dry forage yield of buffel grass, alfalfa and their mixture followed the same trend of fresh forage yield as affected by organic manure application. This effect was only significant for buffel grass at the second and third cuts and accumulated dry yield in the second season.

It could be concluded from these results that adding farmyard manure at the rate of 30 m^3/fed. helped in offering more available nutrients for plant which in turn resulted in more growth activities, building up more synthates and ultimately producing more dry matter accumulation. These findings are in harmony with those obtained by Mohamed (1992), Innocent et al. (1995) and Abou-Deya and Nassar (1994).

III. Effect of sulfur:

III.1. On growth parameters:

A. Buffel grass:

Data subjected in Table (9) showed the influence of two sulfur rates on some growth parameters of buffel grass under Mariut region conditions in 1993 and 1994 growing seasons.

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Table (9): Effect of sulfur on some growth parameters of buffel grass in 1993 and 1994 growing seasons.

Growing seasons	1993			1994		
No. of cuts / Sulfur (ton/fed.)	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
a-plant height (cm).						
0.4	59.07	84.24	87.52	33.57	47.24	61.77
0.8	57.53	81.73	88.42	34.88	49.40	66.00
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S
b-leaf area (cm^2)						
0.4	5.18	8.08	10.34	5.12	4.05	8.49
0.8	5.14	7.29	11.08	5.09	4.03	6.83
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	0.72
c- leaf/stem ratio.						
0.4	0.97	0.54	0.49	0.99	1.09	1.29
0.8	0.84	0.54	0.63	1.23	0.97	1.41
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S

Insignificant differences were noticed for plant height and leaf/stem ratio of buffel grass due to sulfur application. Meanwhile no clear trend was observed for leaf area by increasing sulfur rates from 0.4 to 0.8 t/fed and the only significant effect was noticed at the third cut of the second season. These results are in accordance with those obtained by Helal (1991), who recorded that increasing sulfur did not affect significantly phalaris plant height and leaf area.

B. Alfalfa:

The effect of sulfur rates on some growth parameters of alfalfa is illustrated in Table (10).

Plant height was increased insignificantly by raising sulfur rates from 0.4 to 0.8 t/fed. This was fairly true for all cuts except the first cut of the second season. This augmentation may be due to the availability of the essential elements and decreasing soil pH by applying sulfur to calcareous soils.

Leaf area as well as the number of branches/plant showed no significant response to sulfur application, meanwhile, leaf/ stem ratio exhibit neither significant nor consistent trend to sulfur application.

Table (10): Effect of sulfur on some growth parameters of alfalfa in 1993 and 1994 growing seasons.

Growing seasons		1993			1994	
No. of cuts	1st	2nd	3rd	1st	2nd	3rd
Sulfur (ton/fed.)	cut	cut	cut	cut	cut	cut
			a-plant height (cm).			
0.4	40.55	63.84	67.34	74.79	72.48	70.58
0.8	42.19	64.12	70.88	74.63	73.26	71.63
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S
			b-leaf area (cm^2)			
0.4	6.39	5.68	3.87	4.29	5.37	4.67
0.8	6.23	5.74	4.72	4.75	5.15	5.02
L.S.D. (5%)	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
			c- leaf/stem ratio.			
0.4	1.37	0.88	1.13	1.78	0.94	1.26
0.8	1.37	0.83	1.19	1.19	0.78	1.27
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S.
			d- number of branches/plant.			
0.4	2.57	3.72	4.58	4.05	4.42	5.78
0.8	2.63	3.69	4.61	4.04	4.04	5.39
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S

III.2. On forage yield:

III.2.1. Fresh forage yield:

Data presented in Table (11) showed the values of fresh forage yield of buffel grass, alfalfa and their mixture as influenced by sulfur application.

Increasing sulfur rates from 0.4 to 0.8 ton/fed did not significantly affect the fresh forage yield during all cuts in both seasons. Similar results were obtained by Razmjoo and Henderlong (1997) who mentioned that sulfur application did not have a marked effect on alfalfa yield.

III.2.2. Dry forage yield:

Data in Table (12) showed that dry forage yield of buffel grass, alfalfa and their mixture as well as their accumulated yield was not significantly affected by increasing sulfur rates at all cuts of both seasons. Similar results were obtained by Helal (1991).

It was noticed from the results that sulfur application had some advantages on growth or yield of the cultivated plants but the differences could not reach the level of significance and this may be needed to raise the sulfur rates to achieve better results.

IV. Effect of interactions:

1. Cropping pattern x farmyard manure:

Buffel grass as a sole crop interacted with 30m^3/fed organic manure to achieve the highest value of leaf area at the third cut of the second season while the highest value of leaf/stem ratio was obtained at the third cut of the first season with buffel grass mixed with alfalfa and organic manure at the rate of 20 m^3/fed. (Table 13).

Table (13): Effect of cropping patterns and organic manure interaction on leaf area and leaf/stem ratio of buffel grass in 1993 and 1994 growing seasons.

Growing season	1993			1994		
Organic manure (m^3/fed.)	10	20	30	10	20	30
Cropping patterns	Leaf/stem ratio			Leaf area (cm^2)		
A:B	3rd cut			3rd cut		
0 : 1	0.63	0.43	0.58	6.53	6.37	9.72
1 : 1	0.38	0.70	0.65	8.20	7.48	7.67
L.S.D. (5%)		0.25			1.24	

A : Alfalfa **B : Buffel grass.**

Application of 30m^3/fed organic manure and sole cropping of alfalfa acted together to obtain the maximum total dry forage yield at the first cut of the second season (Table 14).

Table (14): Effect of cropping patterns and organic manure interaction on total dry forage yield of alfalfa at the first cut in 1994 growing season.

Cropping patterns	Organic manure (m^3/fed.)		
A : B	10	20	30
1 : 0	1.846	1.861	2.259
1 : 1	1.817	1.441	0.989

LSD (5%) = 0.644

A : Alfalfa
B : Buffel grass.

2. Cropping patterns x sulfur interaction:

Maximum value of alfalfa plant height was occured at the third cut of the first season when sulfur was applied at the rate of 0.8 ton/fed. to alfalfa monoculture while the reverse was true at 0.4 t/fed sulfur (Table15).

Table (15): Effect of cropping patterns and sulfur rates interaction on plant height of alfalfa in 1993 growing season.

Cropping patterns	Sulfur (ton/fed.)	
A : B	0.4	0.8
	Plant height (cm) at the third cut (1993)	
1 : 0	62.02	72.67
1 : 1	70.69	71.07
LSD (5%)	6.78	

3. Organic manure x sulfur rates interactions:

Increasing organic manure rate up to 30m^3/fed. scored the highest leaf area value of buffel grass at the rate of 0.4 ton/fed. sulfur, while the

reverse was true under 0.8 ton/fed. sulfur. This was true at the third cut of the second season (Table 16).

Table (16): Effect of organic manure and sulfur rates interaction on leaf area of buffel grass in 1994 growing season.

Sulfur (ton/fed.)	Organic manure (m^3/fed.) 10	20	30
	Leaf area (cm^2) at the third cut.		
0.4	7.33	7.18	10.95
0.8	7.40	6.67	6.43

LSD (5%) = 1.24

Alfalfa plant height as well as leaf area were affected significantly by the prementioned interaction at the third cut of the first and second seasons, respectively (Table 17).

Table (17): Effect of organic manure and sulfur rates interaction on some characters of alfalfa at the third cut in 1993 and 1994 growing seasons.

Sulfur (ton/fed.)	Organic manure (m^3/fed.) 10	20	30
	a: Plant height (cm) in 1993		
	1993		
0.4	62.97	66.50	72.57
0.8	75.50	65.70	71.43
L.S.D. (0.05)		8.31	
	b: Leaf area (cm^2) in 1994		
	1994		
0.4	5.11	6.04	4.96
0.8	4.56	4.42	6.46
L.S.D. (0.05)		1.47	

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استجابة مخلوط البرسيم الحجازى وحشيشة البفل للتسميد العضوي والكبريت تحت ظروف الأراضي الجيرية

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أقيمت تجربتان حقليتان بمحطة بحوث مريوط التابعة لمركز بحوث الصحراء خلال الموسمين الزراعيين 1993 و1994 وذلك لدراسة تأثير الزراعة المنفردة لكل من حشيشة البفل والبرسيم الحجازى وكذلك مخلوطهما وثلاثة معدلات من السماد العضوي هي 10، 20، 30 متر مكعب / فدان بالاضافة إلى مستويين من الكبريت هما 0.4 و0.8 طن / فدان على صفات النمو والحاصل العلفي الغض والجاف. وقد صممت التجربة في تصميم قطاعات كاملة العشوائية في أربع مكررات، ويمكن تلخيص أهم النتائج كما يلي:

1- أدت زراعة حشيشة البفل مع البرسيم الحجازى في مخلوط إلى نقص كل من ارتفاع النبات ومساحة الورقة لحشيشة البفل وذلك مقارنة بالزراعة المنفردة بينما حدث العكس للبرسيم الحجازى حين زرع مخلوطاً مع حشيشة البفل، وقد لوحظ أيضاً زيادة عدد الأفرع / نبات للبرسيم الحجازى عند زراعته في المخلوط مقارنة بالزراعة المنفردة. وقد وجد أن حاصل المخلوط (حشيشة البفل والبرسيم الحجازى) الغض والجاف وكذلك الحاصل المتجمع قد تفوق على حاصل كل من المحصولين منفردين.
2- لم يتأثر ارتفاع النبات وكذلك النسبة المئوية للأوراق / السيقان لحشيشة البفل بزيادة معدل السماد العضوي من 10 إلى 30 متر مكعب/ فدان تأثيراً معنوياً بينما ازدادت مساحة الورقة زيادة معنوية في حشتين من 6 حشات المتحصل عليها. وقد تأثرت معظم الصفات الخضرية للبرسيم الحجازى تأثراً ايجابياً بزيادة مستوى التسميد العضوي حتى 30متر مكعب/ فدان وقد ازداد كل من حاصل العلف الجاف وكذلك الحاصل المتجمع لحشيشة البفل والبرسيم الحجازى ومخلوطهما بزيادة معدلات التسميد العضوي.
3- لم تتأثر صفات النمو وكذلك حاصل العلف الغض والجاف لحشيشة البفل والبرسيم الحجازى تأثراً معنوياً بالمستويات المختلفة من الكبريت وذلك في معظم الحشات مع بعض الاستثناءات القليلة.
4- كان للتفاعل بين العوامل الرئيسية للدراسة بعض التأثيرات المعنوية على بعض صفات النمو وحاصل العلف في بعض الحشات في كلا الموسمين.

Table (3): Effect of cropping patterns on fresh forage yield (ton/fed.) of buffel grass, alfalfa and their mixture in 1993 and 1994 growing seasons.

No. of cuts	1st cut			2nd cut			3rd cut			Accumulated yield		
Cropping patterns B:A	B	A	M	B	A	M	B	A	M	B	A	M
						1993						
1:0	0.472	-	-	1.321	-	-	3.176	-	-	4.922	-	-
1:1	0.313	0.428	0.747	0.649	1.059	1.703	1.520	2.186	3.706	2.483	3.673	6.156
0:1	-	0.547	-	-	1.350	-	-	2.644	-	-	4.544	-
L.S.D. (5%)	0.135	N.S	0.168	0.319	0.082	0.333	0.690	0.450	0.595	1.055	0.649	0.880
						1994						
1:0	0.922	-	-	0.416	-	-	2.436	-	-	3.775	-	-
1:1	0.141	3.907	4.048	0.086	2.128	2.214	1.489	4.238	5.726	1.716	10.272	12.050
0:1	-	5.156	-	-	2.606	-	-	3.438	-	-	11.199	-
L.S.D. (5%)	0.222	0.945	0.814	0.123	0.321	0.286	0.439	0.777	0.753	0.621	N.S	1.391

B : Buffel grass **A : Alfalfa** **M : Mixture**

Table (4): Effect of cropping patterns on dry forage yield (ton/fed.) of buffel grass, alfalfa and their mixtures in 1993 and 1994 growing seasons.

No. of cuts	1st cut			2nd cut			3rd cut			accumulated yield		
Cropping patterns B:A	B	A	M	B	A	M	B	A	M	B	A	M
						1993						
1:0	0.173	-	-	0.472	-	-	0.736	-	-	1.385	-	-
1:1	0.133	0.175	0.308	0.252	0.439	0.691	0.380	0.520	0.899	0.764	1.134	1.898
0:1	-	0.214	-	-	0.562	-	-	0.664	-	-	1.440	-
L.S.D. (5%)	N.S	N.S	0.075	0.128	N.S	0.140	0.190	0.120	0.162	0.323	N.S	0.290
						1994						
1:0	0.390	-	-	0.152	-	-	0.817	-	-	1.358	-	-
1:1	0.054	1.416	1.470	0.037	0.958	0.995	0.501	1.504	2.002	0.592	3.836	4.467
0:1	-	1.989	-	-	1.103	-	-	1.238	-	-	4.330	-
L.S.D. (5%)	0.119	0.372	0.321	0.046	N.S	0.129	0.142	N.S	0.269	0.240	N.S	0.540

B : Buffel grass **A : Alfalfa** **M : Mixture**

Table (7): Effect of organic manure on fresh forage yield (ton/fed.) of alfalfa, buffel grass and their mixture in 1993 and 1994 growing seasons.

No. of cuts	1st cut			2nd cut			3rd cut			accumulated yield		
Cropping Patterns												
	B	A	M	B	A	M	B	A	M	B	A	M
Organic manure (m^3/fed.)												
						1993						
10	0.360	0.442	0.540	0.806	1.135	1.294	2.235	2.342	3.051	3.367	3.923	4.900
20	0.426	0.513	0.626	0.962	0.253	1.471	2.175	2.278	2.969	3.563	4.045	5.070
30	0.392	0.507	0.599	1.188	0.225	1.609	2.634	2.625	3.482	4.178	4.357	5.690
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
						1994						
10	0.532	4.633	3.443	0.154	2.433	1.725	1.707	3.908	3.744	2.393	10.975	8.911
20	0.463	4.367	3.219	0.294	2.217	1.674	1.872	3.649	3.681	2.628	10.233	8.572
30	0.601	4.593	3.462	0.307	2.450	1.900	2.308	3.957	4.177	3.215	11.000	9.540
L.S.D. (5%)	N.S	N.S	N.S	0.151	N.S.	N.S	0.538	N.S	N.S	0.761	N.S	N.S

A : Alfalfa. **B : Buffel grass** **M : Mixture**

Table (8): Effect of organic manure on dry forage yield (ton/fed.) of alfalfa, buffel grass and their mixture in 1993 and 1994 growing seasons.

No. of cuts	1st cut			2nd cut			3rd cut			accumulated yield		
Cropping.Patterns	B	A	M	B	A	M	B	A	M	B	A	M
Organic manure (m^3/fed.)												
						1993						
10	0.138	0.174	0.208	0.283	0.472	0.504	0.530	0.559	0.726	0.951	1.205	1.480
20	0.169	0.208	0.251	0.364	0.512	0.584	0.525	0.578	0.735	1.058	1.326	1.591
30	0.154	0.201	0.237	0.438	0.517	0.638	0.618	0.639	0.842	1.216	1.357	1.721
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
						1994						
10	0.194	1.831	1.350	0.059	1.074	0.755	0.581	1.439	1.347	0.834	4.283	3.460
20	0.196	1.651	1.231	0.108	0.947	0.720	0.594	1.289	1.272	0.897	3.897	3.210
30	0.277	1.624	1.267	0.116	1.070	0.791	0.802	1.385	1.455	1.195	4.074	3.520
L.S.D. (5%)	N.S	N.S	N.S	0.056	N.S	N.S	0.174	N.S	N.S	0.301	N.S	N.S

A : Alfalfa. **B : Buffel grass** **M : Mixture**

Table (11): Effect of sulfur on fresh forage yield (ton/fed.) of alfalfa, buffel grass and their mixture in 1993 and 1994 growing seasons.

No. of cuts	1st cut			2nd cut			3rd cut			accumulated yield		
Cropping.Patterns	B	A	M	B	A	M	B	A	M	B	A	M
Sulfur (ton/fed.)												
						1993						
0.4	0.400	0.494	0.600	0.952	1.245	1.461	2.158	2.433	3.061	3.487	4.173	5.130
0.8	0.385	0.481	0.577	1.018	1.164	1.455	2.538	2.397	3.274	3.918	4.044	5.310
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
						1994						
0.4	0.578	4.462	3.361	0.260	2.306	1.711	1.981	3.759	3.827	2.819	10.526	8.900
0.8	0.485	4.600	3.390	0.243	2.428	1.822	1.944	3.918	3.908	2.672	10.945	9.120
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

A : Alfalfa. **B : Buffel grass** **M : Mixture**

Table (12): Effect of sulfur on dry forage yield (ton/fed.) of alfalfa, buffel grass and their mixture in 1993 and 1994 growing seasons.

No. of cuts	1st cut			2nd cut			3rd cut			accumulated yield		
Cropping.Patterns	B	A	M	B	A	M	B	A	M	B	A	M
Sulfur (ton/fed.)												
						1993						
0.4	0.154	0.200	0.236	0.343	0.520	0.576	0.533	0.600	0.755	1.029	1.339	1.610
0.8	0.152	0.189	0.228	0.381	0.480	0.574	0.583	0.584	0.780	1.120	1.253	1.580
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S
						1994						
0.4	0.240	1.726	1.310	0.091	0.990	0.721	0.653	1.369	1.359	0.984	4.042	3.361
0.8	0.205	1.679	1.256	0.096	1.071	0.778	0.665	1.374	1.357	0.967	4.123	3.430
L.S.D. (5%)	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

A : Alfalfa. **B : Buffel grass** **M : Mixture7**