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EFFECT OF SULPHUR AND RICE STRAW COMPOST ON SOME SOIL PROPERTIES, SOYBEAN YIELD AND ITS NUTRIENT CONTENTS

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ABSTRACT

A field experiment was conducted during two successive summer seasons of 2010 and 2011 at the experimental farm of Sakha Agric. Res. Station, Kafr EL-Sheikh Governorate. This study was conducted to investigate the effects of N-mineral and organic fertilizers (rice straw compost) with or without sulphur on soybean yield, its chemical composition and soil contents of N, P and K. The experiments were conducted in split plot design, where the main plots were allotted for soybean cultivars; Crowford (Cv_1), Giza111 (Cv_2), and Taiwan (Cv_3). The sub plots were allotted for fertilizer treatments: 1-N fertilizer as urea at level of 15 kg. Nfed^{-1} (control treatment) 2-Rice straw compost at rate of 10tonfed^{-1} (OM), 3 –Rice straw compost at rate of 10 tonfed^{-1} + sulphur at rate of 400 kgfed^{-1} (OM+S), 4- N fertilizers as urea at rate of 15 kg N fed^{-1} +sulphur of400kgfed^{-1} (N+S) .The treatments were replicated four times.

The results can be summarized as follows:-

1- The yield and its components of soybean were significantly affected by fertilizers treatments and soybean cultivars
2- The highest soybean biomass and seed yields were obtained by Cv_1 under OM +S treatment
3- The maximum values of N, P and K contents in the seeds were obtained by Cv_1 under OM treatment
4- The highest N and P content in straw were recorded by the control treatment, where the highest values of K content were obtained by OM +S treatment
5- N+S treatment had the highest protein content in the seeds.
6- OM treatment recorded the highest values of available N, P and K in soil

INTRODUCTION

Soybean (*Glycine Max L.*) as healthy food. It is a cheep source of oil and protein. Sulphur considered of special importance for leguminous plants due to its essentiality in amino and nucleic acids formation and protein metabolism (Mohamed *et al* 2001). Sulphur reduce soil pH resulting in higher nutrient availability and better physical conditions(Agrisnet :manures2011) .It is well known that soils of arid and semi-arid regions are poor in organic matter , so maintenance of soil organic matter is a partial problem of soil fertility in Egypt . Organic materials such as crop residues (rice straw) are available in abundance and reach tremendous amounts every year. The recycling of these materials to produce organic fertilizers (as compost) is very important for increasing the agricultural production, reducing the application rates of chemical fertilizers and therefore the prevention of environmental pollution(Saleh *et al* 2003). The regular addition of compost is one the best ways enhance soil organic and humic content, which helps to build a fertile soil structure. Such a soil structure makes better use of water and nutrients. It easier to till and, overall, is better able to achieve optimum yields on a long term basis (Keith and Jakie 2011). Gaber 2000 and Rangarajan *et al*., 2000 demonstrated through a filed study that organic fertilizers significantly increased N and K uptake and yield of legume crop.

The objective of the present work is to investigate the effects of N – mineral and organic fertilizers applaction with or without sulphur on soybean yield and its chemical composition, rather for soil contents of N, P and K for sustainable agriculture.

MATERIALS AND METHODS

A field experiment was carried out at Sakha Agriculture Research Station farm using soybean (*Glycine max L*.) during the two successive summer seasons of 2010and 2011. The soil of the experimental field was clayey in texture as shown in Table 1.Some soil chemical analysis was determined according to Page (1982) and physical properties of the soil were determined according to Klute (1986). Some properties of applied compost were presented in Table 2 .Split plot design was used. The main plots were assigned by three soybean cultivars, Crowford (CV_1), Giza 111(CV_2), and Taiwan (CV_3). The sub –plots were allotted to four treatments (1) N fertilizer as urea at level of 15 kg Nfed^{-1}; (2) Rice straw compost at rate of 10tonfed^{-1}; (3) Rice straw compost at rate of 10 ton fed^{-1} + sulphur at level of 400kgfed^{-1} as agriculture sulphur and (4) N fertilizer as urea at level of 15 kg Nfed^{-1}+ sulphur at level of 400kgfed^{-1}. The treatments were replicated four times for each. All treatments were fertilized with super phosphate (7kg pfed^{-1}) and potassium sulphute (24 kg k_2Ofed^{-1}) .The other recommended agriculture practices were done.

Studied characters:

1- Yield and its components: Biomass, seed yield (ton fed^{-1}) and 100seed weight (g).
2- Some mineral composition of soybean seed and straw: i.e., nitrogen, p Phosphorus and potassium were determined according to method introduced by Jackson (1967). Protein percentage was calculated by multiplying the total nitrogen% by 5.71 according (FAO/WHO.1973).
3- Nutrient contents (Available N, P and K) of representative surface soil samples (0-15cm) after soybean harvesting were determined according to the standard methods (Page, 1982). harvest index was determined by the following:

Harvest index = seed yield kg/ biomass yield kg

The data were subjected to statistical analysis according to (Snedecor and Cochran, 1980).

Table 1: Some characteristics of the experimental soil.

Characteristics	Season 2010	Season 2011	Characteristics	Season 2010	Season 2011
pH (1:2.5soil:water suspensions)	7.98	7.82	**Partials size distributions (%)**		
EC, dSm^{-1} (Soil paste) at 25°c	3.30	3.04	Sand	21.45	23.80
OM %	1.24	1.35	Silt	31.56	24.90
Soluble cations $meqL^{-1}$			Clay	46.99	51.30
Ca^{++}	10.05	13.42	Texture class	clayey	clayey
Mg^{++}	3.69	8.86	**Available macronutrients $mgKg^{-1}$**		
Na^{+}	19.90	7.71	N	28.50	30.50
K^{+}	0.83	1.01	P	7.77	8.50
Soluble anions $meqL^{-1}$			K	392.5	416.90
$CO3^{--}$	-	-	C/N	10.23	11.00
$HCO3^{-}$	9.90	3.50	Total CaCo3%	3.83	3.95
CL^{-}	19.10	18.72	CEC	33.00	34.50
$SO4^{--}$	5.47	8.78	S.P. %(saturation percentage)	79.72	78.50

Table 2: Some characteristics of the used rice straw compost

Characteristics	Values	Characteristics	Values
Soluble cations $meqL^{-1}$		**pH (1:10 composts :water suspension)**	6.51
Ca^{++}	5.98	EC, dSm^{-1} (1:10 composts suspensions)	2.31
Mg^{++}	4.17	OM %	58.15
Na^{+}	4.95	**Total macronutrients %**	
K^{+}	10.47	N	2.49
Soluble anions $meqL^{-1}$		P	1.08
CO_3^{--}	-	K	2.22
HCO_3^{-}	3.30	C/N	13.98
Cl^{-}	11.31	OC %	33.74
SO_4^{--}	10.96	Available N %	0.15

***The compost used in the second season was kept dry from the same compost used in the first season.**

RESULTS AND DISCUSSION

Yield and some yield components:-

Data presented in Tables 3, 4 and 5 show the effect of fertilization treatments, soybean cultivars and their interactions on soybean biomass, seed yields and 100 seeds weight in both seasons.

Biomass:

Analysis of variance showed highly significant effect of fertilization treatments on the biomass yield Table 3 the highest biomass yield (4.74 and 4.54 $tonfed^{-1}$) in the first and second seasons were obtained with using composted rice straw at rate of 10$tonfed^{-1}$ combined with sulphur at rate of 400$kgfed^{-1}$ (OM+S). This may be due to that the sulphur reduced pH of the soil resulting in higher nutrient availability. Moreover improving soil physical condition and increasing nutrient availability by composted rice straw. Similar results were obtained by Talha(2003) .Meanwhile the lowest values (4.41 and 4.19 tonfed-1) in the first and second seasons were recorded with the treatments (N+S) (N at rate of 15kgNfed^{-1} + sulphur at rate 400kgfed^{-1}) this may be due to presence of sulphur with urea make slow release nitrogen fertilizer which decrease available nitrogen at need time .The results were in agreement with those obtained by Knany *et al*.,(2004)who found that straw yield of faba bean at sulphur treatment clearly illustrates competitive effect between the nitrogen and sulphur which results in a low straw yield . The trends obtained for biomass yields of soybean as influenced by fertilizer treatments can be arranged as follows OM+S > OM > control N >N+S in the two seasons.

Table 3 : Effect of fertilization treatments on soybean biomass, seed yield tonfed^{-1}, and 100-seed weight (g) in the first and second seasons

Treatments	Biomass		Seed yield		100-seed weight		Harvest index	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control (N)	4. 72	4.50	2.17	2.07	19.36	19.16	0.460	0.460
OM	4.59	4.42	2.23	2.13	16.64	16.44	0.486	0.482
OM+S	4.74	4.54	2.42	2.29	16.18	15.98	0.511	0.504
N+S	4.41	4.19	2.00	1.89	17.29	17.09	0.454	0.451
F-test	**	**	**	**	**	**	**	**
LSD0.05	0.11	0.17	0.09	0.10	0.08	0.08	0.015	0.015

Data in Table 4 revealed that the soybean cultivars were different significantly in biomass yield in the two seasons. Crowford cultivars (Cv_1) had the highest values (4.77 and 4.57 ton/fed) in the first and second seasons followed by Giza111 cultivar (4.54 and 4.36tonfed^{-1}) and the lowest values of (4.51 and 4.31 ton/fed) were recorded with Taiwan cultivars. These differences may be due to the differences in the genetic ground of the used cultivars which led to different response to fertilization treatments.

Table 4: Effect of soybean cultivars on biomass, seeds yields ton/fed and 100-seed weight (g) in the first and second seasons.

Cultivars	Biomass(ton/fed)		Seed yield(ton/fed)		100 seed weight(g)	
	1st	2nd	1st	2nd	1st	2nd
Cv_1	4.77	4.57	2.29	2.19	17.25	17.05
Cv_2	4.54	4.36	2.13	2.03	16.86	16.66
Cv_3	4.51	4.31	2.19	2.07	17.99	17.79
F-test	**	**	**	**	**	**
LSD0.05	0.22	0.22	0.09	0.09	1.01	1.01

Effect of the interaction between fertilization treatments and soybean cultivars had significant differences on biomass yield during the first and second seasons.

Table 5 show that the highest biomass yield (5.06 and 4.86 tonfed^{-1}) in the first and second seasons were obtained with application of (OM+S) treatment for Crowford cultivar (Cv_1) during both seasons respectively.

Table 5: Effect of the interaction between fertilization and cultivars on soybean biomass, seed yields $tonfed^{-1}$, and 100 seed weight (g) in the first and second seasons.

Treatments	1st			2nd		
	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3
Biomass yield ($tonfed^{-1}$)						
Control (N)	4.80 b	4.63 a	4.68 a	4.60 b	4.43 a	4.48 a
OM	4.77 b	4.50 b	4.50 ab	4.57 b	4.44 a	4.31 a
OM+S	5.06 a	4.66 a	4.52 ab	4.86 a	4.46 a	4.32 a
N+S	4.47 c	4.39 b	4.38 b	4.27 c	4.19 b	4.13 b
Seed yield ($tonfed^{-1}$)						
Control (N)	2.17 c	2.13 b	2.21 b	2.09 c	2.03 b	2.11 b
OM	2.43 b	2.10 b	2.15 b	2.33 b	2.00 b	2.05 b
OM+S	2.54 a	2.31 a	2.39 a	2.44 a	2.21 a	2.23 a
N+S	2.01 d	1.97 c	2.01 c	1.91 d	1.87 c	1.90 c
100-Seed weight (g.)						
Control (N)	18.50 a	18.44 a	21.14 a	18.30 a	18.24 a	20.94 a
OM	16.60 b	16.53 b	16.78 b	16.40 b	16.33 b	16.58 b
OM+S	15.92 b	15.74 b	16.87 b	15.72 b	15.54 b	16.67 b
N+S	17.97 a	16.72 b	17.17 b	17.77 a	16.52 b	16.97 b

Means followed by a common letter are not significant at the level 5 % according to DMRT.

Seeds yield:

Analysis of variance showed high significantly effect of fertilization treatments on seeds yield in the two seasons .It could be noticed from Table 3 that composted rice straw combined with sulphur treatment (OM+S) caused a markedly positive effect on seed yield (2.42 and 2.29 $tonfed^{-1}$) in the first and second season as compared with (N+S) treatment which recorded the lowest values (2.00 and 1.89 $tonfed^{-1}$, respectively). The trend obtained for seed yield as influenced by fertilization treatments are similar to these obtained for biomass yield. Data in Table 4 show high significantly effect on seed yield by soybean cultivars .The seed yield as affected by cultivars can be arranged as follow : Manner Crowford cultivar (Cv_1)> Taiwan (Cv_3) > Giza111 (Cv_2). This result prove that soybean crowford cultivar is superior to the others in the two seasons (2.29 and 2.19 $tonfed^{-1}$). The interaction between fertilization treatments and soybean cultivars had highly significant effect on soybean seed yield in both seasons. The highest seed yield was obtained by Cv_1 under OM+S treatment (2.54 and 2.44 $tonfed^{-1}$) .Similar results were obtained by Talha 2003.

100-seed weight:

Data in Table 3 show a highly significant effect of fertilization treatments on soybean 100-seed weight in the two seasons. The highest values of 19.36 and 19.16 g were obtained with the control treatment (N at rate 15kg N fed^{-1}). Whereas, the lowest values of 16.18 and 15.98 g were recorded with (OM+S) treatment in the first and second seasons, respectively .This may be due to (OM+S) treatment enhanced bods formation which produce high number of bods /plant which affected seed filling. The obtained results are in agreement those obtaind by with Mohammadi *et al*., 2011, who stated that nitrogen plays an important role in grain filling .Soybean 100-seed weight was high significantly affected by soybean cultivars. The highest values of 17.99 and

17.79 g were obtained by Taiwan cultivar followed by Crowford cultivar of (17.25 and 17.05 g) and the lowest values of(16.86 and 16.66 g) were recorded with Giza 111 cultivar in the first and second season respectively. The effect of the interaction between fertilization treatments and soybean cultivars on 100-seed weight was highly significant in both seasons. The highest values were obtained under N treatment for all cultivars in the two seasons.

Nitrogen content of seeds:

Fertilizer treatments had highly significant effect on N-content of soybean seeds in both seasons (Table 6).

Nitrogen content as affected by fertilization treatments can be arranged as follow OM> N> OM+S> N+S .These results were in line with available N in the soil. This could be explained on the fact that, the release of nitrogen N (NO_3, and NH_4) was higher due to lower the C/N ratio of the added compost to soil 13.98 (Mengel and Kirkby 1982). The decreasing of N-content by soybean seed yield as affected by OM +S treatment is probably due to presence of sulphur increased nitrogen utilization efficiency which led to increase seed yield with low nitrogen content. Soybean cultivars significantly affect N-content in soybean seeds in the first and second season (Table 7), the highest values of 198.53 and 179.62 kg $Nfed^{-1}$ were obtained with Cv_1in the first and second seasons, respectively.

Table 6: Effect of fertilization treatments on N, P and K contents of soybean seeds ($kgfed^{-1}$) in the two seasons.

Treatments	Seed content $Kgfed^{-1}$.					
	N		P		K	
	1st	2nd	1st	2nd	1st	2nd
Control(N)	189.88	169.80	36.07	33.25	44.0	37.99
OM	202.99	183.23	41.39	37.97	44.67	41.75
OM+S	185.99	166.80	37.28	33.78	41.96	39.43
N+S	180.76	163.52	29.87	27.23	36.21	33.67
F-test	**	**	**	**	**	**
LSD0.05	9.28	8.63	2.31	1.72	2.17	2.18

Table 7: Effect of soybean cultivars on N, P and K contents of soybean seeds ($kgfed^{-1}$) in the two seasons.

Cultivars	Seed content $Kgfed^{-1}$.					
	N		P		K	
	1st	2nd	1st	2nd	1st	2nd
Cv_1	198.53	179.62	39.48	36.23	42.95	40.48
Cv_2	182.54	164.54	34.51	31.72	38.94	36.50
Cv_3	188.65	168.38	34.47	31.22	40.54	37.65
F-test	**	**	**	**	**	**
LSD0.05	7.44	4.68	2.47	2.18	2.66	2.31

The interaction between fertilization treatments and soybean cultivars Table 8 show that the highest N- content of seeds was recorded with Cv_3 and Cv_1 under OM treatment in the first and second seasons, respectively.

Phosphorus content of seeds:

Data in Table 6 show that a highly significant effect of fertilization treatments on P-content of soybean seeds in the two seasons. Phosphorus content as affected by fertilization treatments can be arranged in decreasing order as follow OM>OM+S > N > N+S. This may be due to OM led to increase total count of soil microorganisms which increase phosphours solubilizing on the other hand, presence of sulphur decrease some fungi sp. Similar results were reported by (Sui and Thompson, 2000) who concluded that organic soil amendments, such as vegetative mulches, reduce the sorption of P in soil and increase the equilibrium P concentration in the soil solution. Data in Table 13 confirm the previous results, the highest available phosphorus were recorded by OM treatment in the both seasons. Data in Table 7 show a highly significant effect of soybean cultivars on P-content by seeds in the two seasons. The highest values of 39.48 and 36.23 kg Pfed^{-1} were obtained by Cv_1 cultivar in the first and second seasons, respectively .This may be due to Cv_1 cultivar has high root system compared with the other used varieties which absorb more P.

The interaction between fertilization treatments and soybean cultivars Table 8 showed that the highest P-content seed yield was obtained by Cv_1 under OM treatment in both seasons.

Table 8: Effect of the interaction between fertilization treatments and soybean cultivars on N, P and K content of soybean seeds (kgfed^{-1}).

treatments	1st			2nd		
	Cv_1	Cv_2	Cv_3	Cv_1	Cv_2	Cv_3
N-content kgfed^{-1}						
Control (N)	191.54a	189.47a	188.23b	169.45b	169.60ab	170.35ab
OM	208.65a	192.50a	209.81a	192.52a	173.12a	184.06a
OM+S	203.57a	172.31b	182.11b	182.10ab	154.10b	163.53b
N+S	191.99a	174.81b	174.44b	174.42b	160.54ab	155.60b
P- content kgfed^{-1}						
Control (N)	37.36c	33.57b	37.29a	34.63c	30.78c	34.33a
OM	46.91a	40.81a	36.45a	43.61a	37.71a	32.60a
OM+S	43.59b	35.35b	32.90b	39.26b	32.51b	29.36c
N+S	30.05d	28.31c	31.23b	27.41	25.89d	28.39c
K- content kgfed^{-1}						
Control (N)	41.71b	39.31b	40.17b	39.45b	36.85b	37.68a
OM	47.68a	42.73a	43.61a	45.07a	40.22a	39.96a
OM+S	46.25a	38.65b	40.98b	43.63a	36.21b	38.46a
N+S	36.15c	35.08c	37.39c	33.78c	32.74c	34.50b

Means followed by a common letter are not significantly different at the 5% by DMRT.

Potassum content of seeds:

The results in Table 6 show a highly significant effect of fertilization treatment on K content in seeds in the two seasons. The highest values (44.67 and 41.75 kg /fed^{-1}) were obtained by OM treatment in the first and second seasons, respectively. The obtained data confirmed the absolute superiority of the OM treatment in increasing the available potassium(Table 13). The results could be explained on the fact that , the cation exchange capacity (CEC) of soil increases as OM% increases , consequently , the availability of Ca^{2+}, Mg^{2+}, K^{+}, and Na^{+} increases (Magdoff and well 2004). K content by soybean seeds was high significantly affected by soybean cultivars and can be arranged in decreasing order $Cv_1 > Cv_3 > Cv_2$. The interaction between the studies parameter gave significant effect on K-content by seeds in the two seasons .The highest values (47.68 and 45.07 kg k/fed) were obtained by Cv_1 under OM treatment in the first and second seasons, respectively.

Nutrients content in soybean straw:

Data in Table 9 show that fertilization treatments gave a highly significant effect on N, P and K content by straw in both seasons. This trend in nutrients content by straw yield among the treatments was different for seeds. The highest N and P content by straw were obtained with the control treatment (40.25 and 31.74 kg N fed^{-1}) and (12.74 and 11.42 kg P fed^{-1}) in the first and second seasons respectively. While the lowest N and P-content were recorded with (N+S) treatment (36.00 and 27.62 kg N fed^{-1}) and (9.06 and 8.22 kg P fed^{-1}) for first and second seasons, respectively. The observed reduction in N and P –content by soybean straw could be explained by Chandrasekar *et al*. (2005), who concluded that developing seed utilize nitrogen and P from the vegetative parts for the syenthesis of storage and non storage grain proteins. On the other hand the highest values of K-content by straw were recorded with OM+ S treatment (40.90and 37.82 kg K fed^{-1}) in the first and second seasons, respectively. While OM treatment recorded the lowest values (33.51 and 30.73 kg $Kfed^{-1}$).

Table 9: Effect of fertilization treatments on N, P and K contents in soybean straw ($kgfed^{-1}$) in the two seasons

Treatments	Nutrients content $Kgfed^{-1}$					
	N-content		P- content		K- content	
	1st	2nd	1st	2nd	1st	2nd
Control(N)	40.25	31.74	12.74	11.42	39.17	36.17
OM	39.28	31.05	11.34	10.41	33.51	30.73
OM+S	39.07	30.27	10.33	9.51	40.90	37.82
N+S	36.00	27.62	9.06	8.22	35.06	32.22
F-test	**	**	**	**	**	**
LSD0.05	2.96	2.79	1.00	0.72	2.97	2.85

Data in Table 10 show that soybean cultivars had no significant effect on N- content by straw in the first season, while it had highly significant effect in the second season. Soybean cultivars had no significant effect in P – content by straw yield in both seasons, on the other hand, it had highly significant effect on K – content as shown in Table 10 the highest values of (39.32 and 36.32 kg k fed^{-1}) were obtained with Cv_1 in the first and second seasons, respectively this may be due to Cv_1 is highest vegetative growth which reflected on the nutrients content.

Table 10: Effect of soybean cultivars on N, P and K content of soybean straw kgfed^{-1} in the two seasons

Cultivars	Nutrients content Kgfed^{-1}					
	N-content		P- content		K- content	
	1st	2nd	1st	2nd	1st	2nd
Cv_1	38.24	29.47	10.78	9.86	39.33	36.32
Cv_2	38.55	29.99	10.82	9.90	36.57	33.67
Cv_3	39.16	31.04	11.01	9.90	35.58	32.72
F-test	NS	**	NS	NS	**	**
LSD0.05	-	2.48	-	-	2.90	2.78

Data in Table 11 show the effect of interaction between fertilization and soybean cultivars on N, P and K contents of soybean straw.

N-content of straw was affected significantly by the interaction between the studied factors. The highest values (43.30 and 34.91 kg Nfed^{-1}) were recorded with Cv_3under OM treatment in the first and second seasons respectively. While P-content of straw was not affected significantly by the interaction Table 11 Potassum content of straw significantly affected by the interaction between fertilization treatments and soybean cultivars in the first and second seasons. The highest values (42.85 and 39.70 kg Kfed^{-1}) were obtained by Cv_1 under OM+S treatment.

Table 11: Effect of the interaction between fertilization treatments and soybean cultivars on N, P and K contents of soybean straw (kgfed^{-1}) in the two seasons.

	1st			2nd		
	Cv_1	**Cv_2**	**Cv_3**	**Cv_1**	**Cv_2**	**Cv_3**
			N-content			
Control (N)	38.31ab	40.16a	42.29a	28.97ab	31.34a	34.91a
OM	38.15ab	36.37b	43.30a	30.08a	28.36a	34.61a
OM+S	40.85 a	37.80a	38.57b	31.73a	28.95a	30.13b
N+S	35.64b	39.88b	32.46c	27.11b	31.32a	24.43c
			P- content			
Control (N)	12.67a	12.61a	12.933a	11.66a	11.63a	10.94a
OM	11.98a	11.28a	10.77a	11.02a	10.34a	9.90a
OM+S	9.91a	10.57a	10.50a	9.03a	9.64a	9.85a
N+S	8.54a	8.85a	9.83a	7.73a	7.99a	8.96a
			K- content			
Control (N)	41.79a	37.64ab	38.10a	38.69a	34.59ab	35.14a
OM	34.30c	32.64c	33.58b	31.48c	29.90c	30.81b
OM+S	42.85a	39.99a	39.85a	39.70a	36.95a	36.81a
N+S	38.38b	36.01b	30.80b	35.41b	33.12b	28.13b

Means followed by a common letter are not significantly different at the 5% level by DMRT

Protein percentage (%) of seeds:

Data in Table 12 show that the fertilization treatments had highly significant effect in protein percentage of seeds. The highest mean values of the ,treatment (51.80 and 48.98 %) in the first and second seasons respectively were recorded with N+S treatment. The results could be explained on the fact that, sulphur as essential mineral nutrient play key roles in protein production Chandel *et al*. (2003). Mengel and kirkby (1982) illustrated the essential role of S in promoting growth and N fixation by leguminous plants. Soybean cultivars and interaction between the treatment and cultivars had no significant effect on protein (%) in the seeds.

Table 12: Effect of fertilization treatments, soybean cultivars and the interaction between them on protein % of seeds in the two seasons

Treatments	1st			Mean of treatments	2nd			Mean of treatments
	Cv_1	Cv_2	Cv_3		Cv_1	Cv_2	Cv_3	
Control N	49.11b	50.92a	49.05b	49.69	46.33a	48.02a	46.20a	46.87
OM	47.90c	47.58b	50.13a	48.51	45.04a	44.65a	47.28a	45.66
OM+S	47.48c	46.91b	48.89b	47.69	44.62a	44.05a	45.68a	44.77
N+S	54.66a	50.97a	49.76b	51.80	52.23a	48.12a	46.59a	48.98
Mean of cultivar	49.78	49.08	49.41	49.42	47.06	46.22	46.43	46.57

Statistical analysis	1st		2nd	
	F-test	LSD0.05	F-test	LSD0.05
Treatments	**	2.30	**	2.28
Cultivars	NS	-	NS	-
Interactions	NS	-	NS	-

Effect of fertilization treatments on soil properties after soybean harvesting of 2010-2011summer seasons

Soil organic matter:

Data in Table 13 show that soil organic matter content was increased after harvesting soybean plants in both seasons due to compost application , such increasing was arranged in the following descending order; OM+S > OM >N+S> N .This may be due to presence of the residual OM from the compost of rice straw . These results are supported by Talha *et al*. (2007).

Soil pH:

Soil pH is probably the most commonly measured, as well as one of the most useful chemical properties. It helps to predict the relative availability of most inorganic nutrients. Data in Table 13 show that soil pH values slightly decreased after application of the different treatments in the compared with the control. The soil pH decreased from 8.25 and 8.21 (control) to 7.83 and 7.81 in treatment of (OM+ S) in both seasons .The favorable effect of sulphur on reducing soil pH values might be due to the action of acidity produced as a result of sulphur oxidation to sulphuric acid by soil microorganisms, thus providing more H^+ ions in soil (Abd-Allahh1998).

Soil salinity:

Effect of different fertilization treatments with or without sulphur on soil salinity after harvesting soybean plants are shown in Table 13. Data show that addition of sulphur amendments (N+S) increased soil salinity as reflected on the EC of soil paste extracts. The values of EC slightly increased from (3.40to 4.70 and 3.48 to4.36) in the two seasons of treatments (N and N+S) respectively. This may be due to the dissolving action of sulphuric acid resulted from sulphur oxidation by microbial activity which reaction the $CaCO_3$ and calcium phosphates and ends up with the formation of $CaSO_4$, total salinity is thus increased. The same conclusions were reported by (Abd-Allahh1998).

Available soil macronutrients contents:

Data in Table 13 reveale that the fertilization treatments clearly affects the availability of N, P and K after harvesting of soybean plants.Available N, P and K content in soil were increased up to 163.10; 174.41, 18.87; 26.64 and 503.10, 577.2 mg/kg for OM in the two seasons. It was noticed that soil available nutrients contents resulting from the application of composted rice straw .This may be due to the growth period of soybean is short time which reflect residual of nutrients from , OM decomposition. Thus highly levels were interpreted by many others, Metwally and Khamis (1998) stated that organic maturing plays role in increasing the N availability through microorganism activity besides decreasing N losses by leaching and volatilization. The increase in the availability of soluble P from additions of compost which has an effect that described as resulting from phosphohumic complexes that minimize immobilization processes, anion replacement of phosphate by humatc ions, and coating of sesquioxide particles by humus to form a cover which reduces the phosphate fixating capacity (Rechcing1995).

Concerning the increasing of available K^+ after addition of compost, Tan (1993) found that humic and fulvic acids are capable for dissolving very small amounts potassium from the soil minerals by chelating complex reaction or both with released amounts of K being increased by time.

Table 13: Effect of fertilization treatment, on the soil properties after soybean harvesting of 2010-2011seseans

Treatments	pH		EC (dSm^{-1})		OM %		N available ($mgKg^{-1}$)		P available ($mgKg^{-1}$)		K available ($mgKg^{-1}$)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Control(N)	8.25	8.21	3.40	3.48	1.40	1.58	81.55	81.55	16.65	25.53	417.3	412.4
OM	7.88	7.91	3.28	3.40	1.70	2.00	163.1	174.41	18.87	26.64	503.1	577.2
OM+S	7.83	7.81	3.40	3.34	1.83	2.02	89.71	97.86	16.55	20.53	401.7	432.9
N+S	8.16	8.01	4.70	4.36	1.59	1.81	48.93	50.00	15.54	24.42	357.7	382.7

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تاثير الكبريت وكمبوست قش الأرز على خواص الأرض ومحصول فول الصويا ومكوناته ومحتواه من العناصر

ناصرإبراهيم علي طلحة ، ابراهيم السيد اسماعيل نصر الدين ،بهجت عبد القوى زامل و عاطف صبحي محمود السعدي
معهد بحوث الاراضي والمياه والبيئه- مركز البحوث الزراعية

أقيمت تجربة حقلية فى المزرعة البحثية بمحطة البحوث الزراعية بسخا- محافظة كفرالشيخ –مصر خلال الموسمين المتعاقبين 2010 و 2011بهدف دراسة تأثير التسميد النتروجينى المعدنى والعضوى (كمبوست قش الأرز) فى وجود وغياب الكبريت على محصول فول الصويا ومكوناته وامتصاصة للنتروجين والفوسفور والبوتاسيوم وبعض خواص التربة ومحتواها من النتروجين والفوسفور والبوتاسيوم الميسروقد أقيمت التجربة فى تصميم قطع منشقة مرة واحدة مع اربع مكررات وكان العامل الرئيسى هو اصناف فول الصوياوهى

1 - كراوفورد (Crowford (Cv_1))
2- جيزة 111.(Giza, 111(Cv_2))
٣ - تيوان (Taiwan (Cv_3))

والعامل تحت رئيسى هو المعاملات السمادية وهى

1- سماد يوريا بمعدل 15كجم/فدان (معاملة كنترول)
2- كمبوست قش الارز بمعدل 10طن/فدان
3- كمبوست قش الأرز بمعدل 10طن /فدان مع كبريت بمعدل 400كجم/فدان
4- سماد يوريا بمعدل 15كجم نتروجين للفدان مع كبريت بمعدل 400كجم /فدان

وتتلخص النتائج كمايلى :-

1- محصول فول الصويا ومكوناته تأثرت معنويا بكل من المعاملات السمادية المعدنية والكمبوست وأيضا الأصناف.
2- أعلى قيمة للمحصول الحيوى ومحصول الحبوب كانت مع معاملة الكمبوست والكبريت مع صنف كراوفورد
3- أعلى محتوى للحبوب من النتروجين والفوسفور والبوتاسيوم مع معاملة الكمبوست مع صنف كراوفورد
4- أعلى محتوى للقش من النتروجين والفوسفور مع معاملة الكنترول بينما اعلى محتوى من البوتاسيوم مع معاملة الكمبوست مع الكبريت
5- معاملة النتروجين المعدنى مع الكبرت اعطت اعلى نسبة من البروتين فى الحبوب
6- معاملة الكمبوست حققت اعلى تركيز ميسر فى التربة من النتروجين والفوسفور والبوتاسيوم وزيادة المادة العضوية وانخفاض pH التربة

قام بتحكيم البحث

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