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EFFECT OF ORGANIC FERTILIZER RATES AND SULFUR ON GROWTH AND PRODUCTIVITY OF BROAD BEAN UNDER SOUTH SINAI CONDITIONS

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The field work was carried out at a private farm at Tour city, South Sinai Governorate, during the two consecutive winter seasons of 2018/2019 and 2019/2020. The experiments were conducted to study the effect of organic manure, soil amendment *i.e.*, 0; 25; 30 and 35 m^3/feddan, and four rates of sulfur application *i.e*., 0; 100; 150 and 200 kg/feddan, where added during soil preparation for planting, on growth, yield and chemical composition of broad bean, Aspany F1 cv., grown in sandy soil conditions. Results revealed that all organic manure treatments showed increase in all growth and yield characters when compared with control treatment in both growing seasons. Organic manure at the rate of 35 m^3/feddan has given significant increase in plant height and weight; number of branches/plant; pods length, pod fresh weight and N; P and K (%), while organic manure at the rate of 30 m^3/feddan had superior significantly effect on number of pods/plant; number of seeds/pod; plant yield and total yield (ton/feddan), followed by organic manure at the rate of 35 m^3/feddan. No significant differences occurred between these two organic treatments in both seasons. Sulfur amendment at the rate of 200 kg/feddan, followed by the rate of 150 kg/feddan had got the highest values and significantly increased plant height and weight; number of branches/plant; number of pods/plant, pods length, average pod fresh weight, number of seeds/pod; plant yield; total yield (ton/feddan), as well as K and P (%). There were no significant differences between both treatments in both growing seasons.
Keywords: broad bean, organic manure, sulfur, growth, yield

Faba bean (*Vicia faba* L.) is a major leguminous crop as one of the main important source of protein for the Egyptian people (Nassib et al., 1991). Also, it is a good source of energy and amino acids (Nalle et al., 2010), as well as, its beneficial effect on soil quality and productivity. At the same time, faba bean offers ecosystem services such as renewable inputs of nitrogen into crops and soil via biological ambient N_2 fixation (Köpke and

Nemecek, 2010) and it is thought to be the third important feed grain worldwide (Singh et al., 2013).

Moreover, faba bean cropping might save about 100–200 kg N ha^{-1} in N fertilizers needed for crops, which are grown after broad bean (Jensen et al., 2010). In this concern, amending soils with rhizobium and organic amendments can further stimulate root nodulation (Abbas et al., 2011). In Egypt, it is considered as a strategic crop (Hegab et al., 2014).

The horizontal expansionism of agricultural area is one of the solutions to face a growing imbalance between the agricultural production and population increase in Egypt. so about 2.38 million feddans of sandy desert soil could be added to the cultivated area (Ministry of Agriculture and Land Reclamation, 2006). The coarsest texture soils are hard to be productive because of the lower water holding capacity, the higher aeration, the rapid drain, the lower content of the organic matter and the higher fertilizer leaching (El Banna, 1998). In commercial agriculture, the use of chemical fertilizers cannot be ruled out completely. However, there is a need for integrated application for alternate sources for nutrient for sustaining the desired crop productivity (Tiwari, 2002). Recently, the agricultural technology introduced the agricultural nature materials as soil conditioners.

Organic inputs include organic manures, crop residues and biofertilizers. These are low-cost and ecofriendly inputs that have tremendous potential for supplying nutrients, which reduce the dependence of chemical fertilizers. The use of organic soil amendments has been associated with desirable soil properties including higher plant available water holding capacity and cation exchange capacity and lower bulk density and can foster beneficial microorganisms (Doran, 1995 and Drinkwater et al., 1995). Benefits of compost amendments to the soil include pH stabilization and faster infiltration rate due to enhancing soil aggregation (Stamatiadis et al., 1999).

Organic fertilizers contain organic matter and include a diverse group of materials. Organic manures improve the behaviors of several elements in soils through that active group (fulvic and humic acids), which increase the ability to retain the elements in complex and chelate form. Organic manures release the elements over a period of time and are broken down slowly by soil microorganisms (Ali et al., 2014).

The majority of the nutrients in organic fertilizers are organically bound and slowly mineralized, so the potential for exceeding plant nutrient demands and associated environmental contamination is reduced relative to synthetic commercial fertilization (Stratton et al., 1995). Uses of organic materials are safe for human health and environmental elements. Also, the recycling of organic wastes can also increase soil fertility on the long run through increasing soil organic carbon and the storage of nutrients (Herencia et al., 2008). Also, organic materials improve the physical, chemical and biological characteristics of soils, even the poor soil structure of the sodic soils (Farid et al., 2014 and Kamel et al., 2016).

Research has shown that application of FYM or compost has significant impact on the chemical, physical and biological properties of the soil. Most of these effects are due to an increase in soil OM (Souza et al., 2010). Moreover, manure is an excellent source of major plant nutrients such as N, P and K, also provides many of the secondary nutrients that plants require. Manure also has a liming effect and neutralizes the acid characteristic of most small holder soils (Nzuma et al., 1998). Also, the improvement in the nodulation, growth and yield characters of faba bean and other legumes from organic amendments has been reported by different researchers (Singh, 2005 and Tadele et al., 2016). In the same line, Osama (2015) indicated that adding of organic substances either alone or in combinations has an effective role on enhancement of studied characters of plant growth; total chlorophyll content; leaf chemical constitutes; flowering pattern; yield components and seed chemical composition of faba bean as compared to the untreated plants. Also, applications of the organic extracts, as well as the compost/biogas tea increased significantly NPK uptake by the growing plants and consequently improved the dry matter yield of faba bean plants (Farid et al., 2018).

Concerning the sulfur needed by legume crops for symbiotic nitrogen fixation, the information is still scarce. Scherer and Lange (1996) observed yield reduction and a lower N accumulation of grain and fodder legumes under sulfur deficiency conditions. For this reason, Lange (1998) stated that growth of leguminous plant species may be affected by sulfur through its effect on N_2 fixation by *Rhizobium* bacteria. Also, the role of sulfur in legumes growth is important from the point of view that deficiency of the S-containing amino acids cysteine and methionine may limit the nutritional value of food and feed (Sexton et al., 1998). Sulfur has occupied an important place – after nitrogen, phosphorus, and potassium in balanced fertilization programs due to use of sulfur-free fertilizers (Mukherjee and Singh, 2002).

As numerous research studies show, shortage of sulfur component in the soil reduces the yield and seed quality of pulses (Tabe and Higgins, 1998 and Głowacka et al., 2019). Sulfur also plays a vital role in N_2 fixation (Kaiser et al., 2005 and Mendel and Bittner, 2006). Elemental S is a relatively new fertilizer used in agriculture, therefore its impact on the yield and chemical composition of plants is not yet fully known. Fertilizer not only is a source of S for plants after oxidation, but also considerably changes soil properties by acidifying (Zhou et al., 2009). Thus, it can alter the availability of minerals, including K. Elemental S, as a nutrient carrier and a component initiating many microbiological processes in soil, it is a significant factor in metabolic and physiological changes in legume yields (Niewiadomska et al., 2015).

MATERIALS AND METHODS

The field work was carried out at a private farm at Tour city, South Sinai Governorate, during the two consecutive winter seasons of 2018/2019 and 2019/2020. The physical and chemical soil characteristics of the studied site were determined according to Page et al. (1982) and Klute (1986) respectively, as recorded in table (1). The chemical analysis of irrigation water was carried out using the standard method of Page et al. (1982) and presented in table (2). In addition, the organic manure analysis presented in table (3).

Table (1). Some Physical and chemical properties of the experimental soil site.

Soil depth (cm)	Texture class	Soluble anions (me/l)			pH of soil paste	E.C dSm^{-1}	Soluble cations (me/l)			
		HCO_3^-	$SO_4^=$	Cl^-			Ca^{+2}	Mg^{+2}	Na^+	K^+
0-30	Sandy loam	2.10	17.65	23.64	7.24	4.36	8.23	12.56	20.20	2.4

pH: Acidity, E.C.: Electrical conductivity, me/l: milli equivalent per liter

Table (2). Chemical analysis of the irrigation water.

Soluble anions (me/l)			pH of soil paste	E.C dSm^{-1}	Soluble cations (me/l)			
HCO_3^-	$SO_4^=$	Cl^-			Ca^{+2}	Mg^{+2}	Na^+	K^+
1.44	1.89	4.37	0.77	7.88	2.6	3.86	0.78	0.46

pH: Acidity, E.C.: Electrical conductivity, dSm^{-1}: decseime per meter.

Table (3). Analysis of organic manure used.

Season	Moisture (%)	Organic matter (%)	Total C %	C/N ratio	Total N %	Total P %	Total K%
2019	11.59	22.07	14.25	9.69	1.47	0.85	1.34
2020	10.40	20.65	13.47	10.44	1.29	0.87	1.45

The experiments have been performed to investigate the effect of organic manure amendment and sulfur application rates on growth, yield and its components in addition to chemical composition of broad bean plants (*Vicia faba*) grown under sandy soil conditions and drip irrigation system. Sixteen treatments represented a combination of four organic manure rates i.e., 0, 25, 30 and 35 m^3/feddan (cattle manure). Also, four rates of agricultural sulfur at the rate of 0, 100, 150 and 200 kg/feddan, were applied during preparation of soil for planting.

Calcium super phosphate (15.5% P_2O_5) at the rate of 300 kg /feddan, were added during land preparation. Potassium sulphate (48% K_2O) at the rate of 150 (kg/feddan) and ammonium sulphate (20.5% N) at the rate of 100 (kg/feddan) fertilizer quantities were divided and applied within drip irrigation system starting after 30 days from planting to end of maturity. While, broad bean seeds Aspany F1 c.v. were sown in the first week of October through the two growing seasons, respectively.

Experimental plot area was 32 m² (4 m wide * 8 m long), formed of four ridges, each ridges width is 60 cm and had one drip irrigation line. Broad bean seeds were soaked in warm water 6 hours before planting and treated by *Rhizobium* bacteria (purchased from the General Authority of Agricultural Funds and Equalization) then planted within two lines for each ridge 25 cm apart between seeds. All agricultural practices for broad bean crop were followed, according to the recommendation of Egyptian Ministry of Agriculture.

1. Growth Parameters of Vegetative Growth

After 90 days from planting, nine plants of each replicate were randomly taken for recording vegetative growth and yield characteristics, *i.e.,* plant height and weight; number of branches/plant; number of pods/plant, pods length and weight, number of seeds/pod and plant yield. In addition, all harvest times were weighted and calculated to calculate total yield (ton/feddan) from each treatment.

2. Chemical Composition

Three samples of bean pods from each subplot were taken and oven dried at 70ºC until stable weight obtained, then ground to fine particles and used to determine chemical content such as minerals, (N, P and K), Phosphorus was determined using the colorimetric method for phosphorus content using spectrophotometer according to Cottenie et al. (1982). Total nitrogen was determined using the modified micro Kjeldahl method, Potassium percentage was measured using flame photometer method as described by Brown and Lilliland (1964).

3. Experimental Design and Statistical Analysis

The experimental treatments were arranged in split plot design with three replicates, the main plots were assigned for organic manure, whereas, agriculture sulfur treatments rates were randomly arranged in the sub plots. Statistical analyses of obtained data were analyzed according to Thomas and Hills (1975).

RESULTS AND DISCUSSION

1. Plant Growth and Yield Parameters

Data in tables (4-6) concerning the growth and yield parameters, *i.e.*, plant height and weight; number of branches/plant; number of pods/plant, pods length, average pod fresh weight, number of seeds/pod; plant yield and total yield (ton/feddan). Results indicated that there were significant positive effects for both organic manure and sulfur application on all investigated growth parameters. The data could remark the following:

- Generally, all organic manure treatments showed increase in all growth and yield characters when compared with control treatment in both growing seasons. Organic manure at the rate of 35 m^3/feddan has shown significant superiority on plant height and weight; number of branches/plant; pods length and weight when compared with control treatment. Also, organic manure at the rate of 30 m^3/feddan were superior significantly on number of pods/plant; number of seeds/pod; plant yield and total yield (ton/feddan). There are no significant differences occurred between those two organic treatments in both seasons. Improvement effect of organic manure may be due to the role of organic manure in increasing soil organic carbon and the storage capacity of nutrients (Herencia et al., 2008); improving the chemical, physical and biological properties of the soil (Souza et al., 2010); increasing available water holding capacity, cation exchange capacity; lowering bulk density and improving the behaviors of several elements in soils (Ali et al., 2014). The obtained results are in the same line with those reported by Singh (2005), Osama (2015), Tadele et al. (2016) and Farid et al. (2018). They found that organic amendments showed improvement in the nodulation, growth and yield characters of broad bean and other legumes.
- Sulfur treatments generally showed improvement of values in all growth and yield parameters when compared with control treatment. At the rate of 200 kg/feddan, followed by the rate of 150 kg/feddan, sulfur amendment had the highest values and significant increased the plant height and weight; number of branches/plant; number of pods/plant, pods length, average pod fresh weight, number of seeds/pod; plant yield and total yield (ton/feddan) and there were no significant differences between both treatments in both seasons. The role of sulfur in legumes growth is important from the point of view that deficiency of the S-containing amino acids cysteine and methionine may limit the nutritional value of food and feed (Sexton et al., 1998). Also, sulfur plays a vital role in N_2 fixation (Kaiser et al., 2005 and Mendel and Bittner, 2006). Thus, it can alter the availability of minerals, including K. Elemental S, as a nutrient carrier and a component initiating many microbiological processes in soil, is a significant factor in metabolic and physiological changes in legume

Table (5). Effect of organic manure and sulfur on plant height and weight and number of branches/plant of broad bean plants during 2018/2019 and 2019/2020 growing seasons.

Seasons	1st season														
Characters / Treatments	Plant height (cm)					Plant weight (g)					Number of branches/plant				
Organic application	Control	Org.	Org.	Org.	X̄	Control	Org.	Org.	Org.	X̄	Control	Org.	Org.	Org.	X̄
Sulfur application		25 m³	30 m³	35 m³			25 m³	30 m³	35 m³			25 m³	30 m³	35 m³	
Control	61.1	79.7	85.2	91.5	79.4	403.0	575.6	534.5	700.7	553.4	2.8	3.2	3.2	3.6	3.2
Sulfur 100 kg	76.4	93.7	103.8	107.4	95.3	481.2	645.9	663.7	741.3	633.0	3.2	3.4	4.0	3.7	3.6
Sulfur 150 kg	86.2	102.2	117.0	119.5	106.2	564.3	689.2	711.3	737.0	675.5	2.7	3.6	4.5	4.7	3.9
Sulfur 200 kg	87.3	110.8	121.7	124.5	111.1	518.7	681.7	732.3	781.0	678.4	2.9	3.2	4.8	5.1	4.0
X̄	77.8	96.6	106.9	110.7		491.8	648.1	660.5	740.0		2.9	3.3	4.1	4.3	
2nd season															
Control	63.5	84.9	83.6	86.6	79.7	425.0	592.3	553.2	674.0	561.1	2.6	3.0	4.2	4.1	3.5
Sulfur 100 kg	80.1	87.1	99.3	105.8	93.1	507.7	635.7	671.4	761.2	644.0	2.5	3.3	4.6	4.6	3.8
Sulfur 150 kg	84.2	97.2	118.6	124.8	106.2	534.7	660.9	689.3	803.3	672.0	2.9	3.8	4.6	4.6	4.0
Sulfur 200 kg	89.3	105.6	123.1	128.8	111.7	592.3	658.9	742.4	772.0	691.4	2.8	3.8	4.6	5.0	4.1
X̄	79.3	93.7	106.1	111.5		514.9	636.9	664.1	752.6		2.7	3.5	4.5	4.6	
L.S.D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2						Sea. 1	Sea. 2
Organic rate			8.58	11.02			56.9	110.90						0.43	0.28
Sulfur application			5.91	6.07			40.3	78.41						0.41	0.24
Interaction			NS	NS			NS	NS						NS	NS

Table (5). Effect of organic manure and sulfur on number of pods/plant, pods length and diameters, number of seeds/pod of broad bean plants during 2018/2019 and 2019/2020 growing seasons.

Seasons	1st season														
Characters / Treatments	No. of pods/plant					Pods length					No. of seeds/pod				
Organic application	Control	Org.	Org.	Org.	$\bar{X}$	Control	Org.	Org.	Org.	$\bar{X}$	Control	Org.	Org.	Org.	$\bar{X}$
Sulfur application		25 m^3	30 m^3	35 m^3			25 m^3	30 m^3	35 m^3			25 m^3	30 m^3	35 m^3	
Control	6.5	9.5	9.7	9.2	8.7	8.2	10.2	15.1	15.6	12.3	2.4	2.9	3.2	2.8	2.8
Sulfur 100 kg	8.4	10.0	11.8	11.2	10.4	9.1	11.9	18.7	19.3	14.8	2.9	3.2	3.5	3.4	3.3
Sulfur 150 kg	8.8	10.9	11.8	10.5	10.5	8.8	13.2	20.9	20.7	15.9	2.9	3.1	3.7	3.7	3.4
Sulfur 200 kg	8.4	10.7	11.8	12.1	10.7	9.8	14.1	22.4	21.5	16.9	2.7	2.9	4.0	4.1	3.4
$\bar{X}$	8.0	10.3	11.3	10.8		9.0	12.4	19.3	19.3		2.7	3.1	3.6	3.5	
2nd season															
Control	6.2	9.0	10.2	9.1	8.7	8.0	10.2	16.7	15.2	12.5	3.1	3.7	3.3	3.6	3.4
Sulfur 100 kg	6.9	9.7	11.6	11.0	9.8	9.1	11.2	16.7	20.7	14.4	3.3	3.5	4.2	3.7	3.7
Sulfur 150 kg	7.9	10.6	12.3	11.6	10.6	8.7	12.2	20.4	22.3	15.9	3.6	3.5	4.4	4.1	3.9
Sulfur 200 kg	8.2	10.4	12.3	12.1	10.8	9.3	14.2	21.0	21.9	16.6	3.7	3.7	4.2	4.4	4.0
$\bar{X}$	7.3	9.9	11.6	11.0		8.8	12.0	18.7	20.0		3.4	3.6	4.0	3.9	
L. S. D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2						Sea. 1	Sea. 2
Organic treatment			0.52	0.76			1.25	1.66						0.28	0.41
Sulfur application			0.87	0.64			1.30	1.29						0.32	0.23
Interaction			NS	NS			NS	NS						NS	0.45

Table (6). Effect of organic manure and sulfur on average pod weight, plant yield and total yield of broad bean plants during 2018/2019 and 2019/2020 growing seasons.

Seasons	1st season														
Characters / Treatments	Average pod weight					Plant yield					Total yield ton/feddan				
Organic application	Control	Org.	Org.	Org.	X¯	Control	Org.	Org.	Org.	X¯	Control	Org.	Org.	Org.	X¯
Sulfur application		25 m³	30 m³	35 m³			25 m³	30 m³	35 m³			25 m³	30 m³	35 m³	
Control	7.1	9.9	11.3	11.3	9.9	45.9	93.6	108.8	103.7	88.0	1.5	3.1	3.7	3.5	3.0
Sulfur 100 kg	8.2	10.6	12.9	16.4	12.0	68.3	106.8	195.4	143.9	128.6	2.3	3.6	6.1	4.8	4.2
Sulfur 150 kg	8.6	11.0	15.1	16.5	12.8	76.2	119.6	181.9	174.0	137.9	2.6	4.0	6.1	5.8	4.6
Sulfur 200 kg	8.7	11.4	16.4	15.3	13.0	72.0	121.8	180.7	190.3	141.2	2.4	4.1	6.1	6.4	4.7
X¯	8.2	10.7	13.9	14.9		65.6	110.5	166.7	153.0		2.2	3.7	5.5	5.1	
2nd season															
Control	7.6	9.6	12.2	12.4	10.4	47.3	86.8	126.8	110.8	92.9	1.6	2.9	4.3	3.7	3.1
Sulfur 100 kg	8.5	10.9	11.8	14.8	11.5	58.7	106.6	158.3	147.7	117.8	2.0	3.6	5.3	5.0	4.0
Sulfur 150 kg	8.5	12.2	14.0	15.6	12.6	67.3	130.0	190.7	162.8	137.7	2.3	4.4	6.4	5.5	4.6
Sulfur 200 kg	8.4	13.2	16.2	15.9	13.4	68.7	136.2	195.1	196.5	149.1	2.3	4.6	6.6	6.6	5.0
X¯	8.2	11.5	13.5	14.7		60.5	114.9	167.7	154.5		2.0	3.9	5.6	5.2	
L. S. D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2					Sea. 1	Sea. 2	
Organic treatment			1.04	1.41			14.68	13.95					0.42	0.47	
Sulfur application			0.99	0.78			11.11	13.57					0.31	0.46	
Interaction			1.98	1.56			22.22	NS					0.61	NS	

yields (Niewiadomska et al., 2015). These results agree with those reported by Scherer and Lange (1996), who observed yield reduction and a lower N accumulation in grain and fodder legumes under S deficiency conditions. Also, Lange (1998) stated that growth of leguminous plant species may be affected by S through its effect on N_2 fixation by *Rhizobium* bacteria.

- The interaction effect showed that the highest values of the number of seeds/pod were recorded with organic manure at the rate of 35 m³/feddan + sulfur at the rate of 200 kg/feddan and organic manure at the rate of 30 m³/feddan + sulfur at the rate of 150 kg/feddan in the second season only. While, the heighest values of average pod weight were recorded with organic manure at the rate of 35 m³/feddan + sulfur at the rate of 150 kg/feddan in the first season and with organic manure at the rate of 30 m³/feddan + sulfur at the rate of 200 kg/feddan in the second season. Moreover, the combination treatment between organic manure at the rate of 30 m³/feddan + sulfur at the rate of 100 kg/feddan and organic manure at the rate of 35 m³/feddan + sulfur at the rate of 200 kg/feddan showed the highest values significantly on plant yield and total yield, respectively, in the first season only.

2. Chemical Composition

Obtained results in fig. (1) indicate significant positive effect for both studied factors, i.e., organic manure and sulfur application on chemical components. From the obtained data, the following could be remarked:

- Organic manure at the rate of 35 m³/feddan was superior significantly on N; P and K (%), followed by organic manure at the rate of 30 m³/feddan without significant differences when compared with control treatment in both seasons. These results are in the same line with those reported by Farid et al. (2018), who found that application of the organic extracts, as well as the compost/biogas tea increased significantly NPK uptake by the grown plants and consequently improved the dry matter yield of faba bean plants**.**
- Sulfur treatments showed improvement of the values of chemical content. Also, sulfur amendment at the rate of 200 kg/feddan, followed by the rate of 150 kg/feddan had the highest values and significant increased K and P (%) in the first season only. Also, sulfur amendment at the rate of 150 kg/feddan, followed by the rate of 200 had the highest values of N (%) on the first season only. The growth of leguminous plant species may be affected by S through its effect on N_2 fixation by *Rhizobium* bacteria. Also, the role of sulfur in legumes growth is important from the point of view that deficiency of the S-containing amino acids cysteine and methionine may limit the nutritional value of food and feed (Lange, 1998 and Sexton et al., 1998).

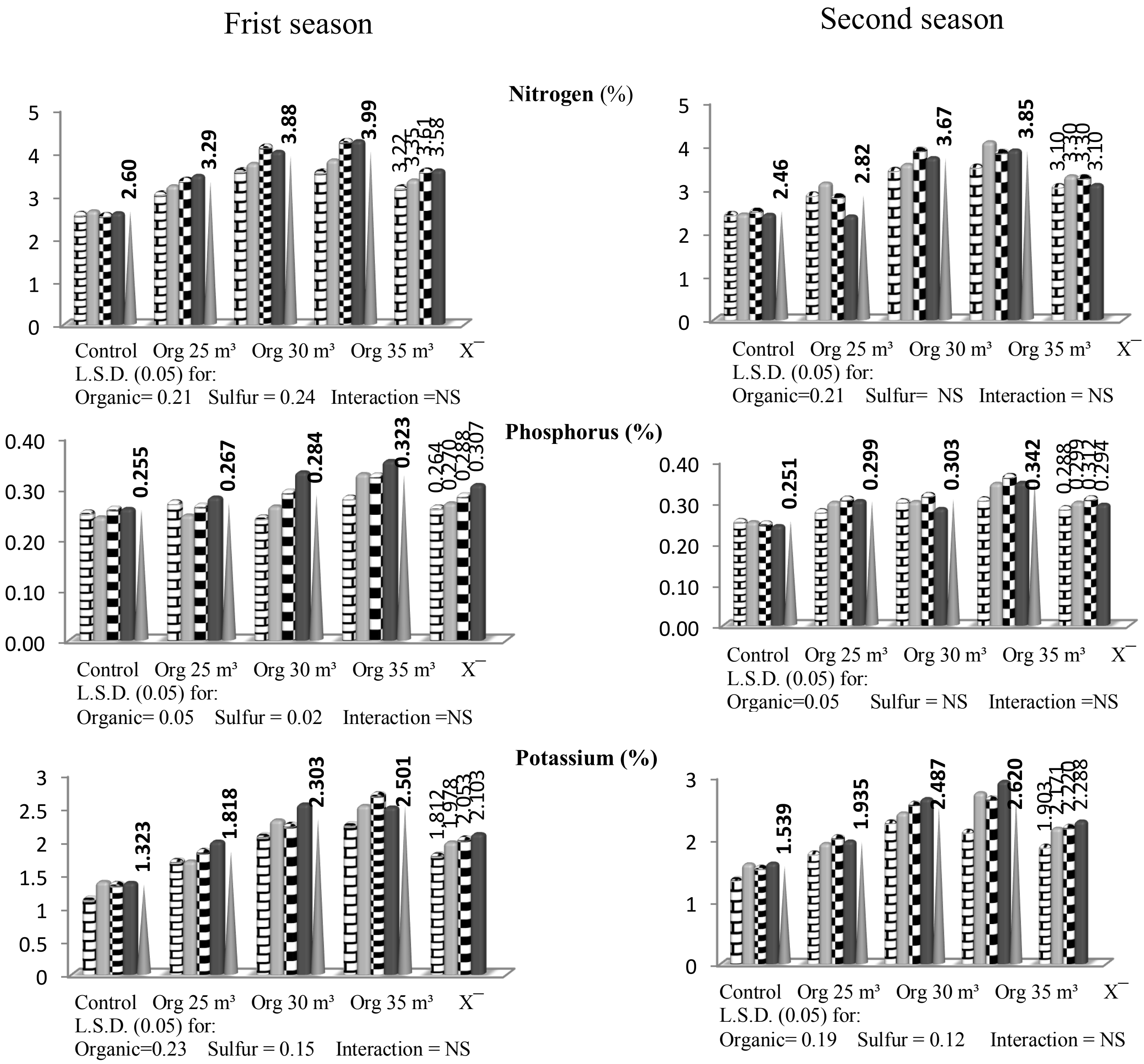

Fig (1): Effect of organic manure and sulfur on N; P and K (%) of bean plants during 2018/2019 and 2019/2020 growing seasons.

Control Sulfur 100 kg/fed. Sulfur150 kg/fed. Sulfur 200 kg/fed.

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تأثير معدلات السماد العضوي والكبريت على نمو وانتاجية الفول الرومي تحت ظروف جنوب سيناء

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أجريت الدراسة بمزرعة خاصة بمدينة الطور بمحافظة جنوب سيناء خلال موسيمين شتويين متتاليين ٢٠١٩/٢٠١٨ و٢٠٢٠/٢٠١٩. أقيمت التجربة لدراسة تأثير الإضافة الأرضية بالسماد العضوي بمعدلات صفر، ٢٥، ٣٠ و٣٥ متر مكعب/فدان وأربع معدلات للكبريت (صفر، ١٠٠، ١٥٠ و٢٠٠ كجم/فدان على نمو وإنتاجية الفول الرومي الأسباني F1 تحت ظروف الأراضي الرملية. أوضحت النتائج أن كل معدلات الإضافة من السماد العضوي تفوقت في صفات النمو والمحصول بالمقارنة بالكنترول (بدون إضافة) في الموسمين. في حين السماد العضوي بمعدل ٣٥ مترمكعب/فدان أعطى زيادة معنوية في طول ووزن النبات، عدد الأفرع/نبات، طول القرن، الوزن الطازج للقرن ونسبة النتروجين والفسفور والبوتاسيوم. فى حين أعطت معاملة السماد العضوي بمعدل ٣٠ متر مكعب/فدان تفوق معنوي في عدد القرون/نبات، عدد الحبوب/قرن، محصول النبات والمحصول الكلي تبعه معدل ٣٥ متر مكعب/فدان ولم يظهر فروق معنوية بين كلا المعدلين في كلا الموسمين. إضافة الكبريت بمعدل ٢٠٠ كجم/فدان تبعه معدل إضافة ١٥٠/كجم/فدان سجلت أعلى قيم معنوية في صفات طول ووزن النبات، عدد الأفرع/نبات، عدد القرون/نبات، طول القرن، الوزن الطازج للقرن، عدد الحبوب للقرن، محصول النبات والمحصول الكلي ونسبة الفسفور والبوتاسيوم، ولم يظهر فروق معنوية بين كلا المعدلين في كلا الموسمين.