Annals of West University of Timişoara, ser. Biology, 2016, vol. 19 (2), pp.149-156

EFFECT OF CHEMICAL AND ORGANIC SOIL FERTILIZERS AND THEIR INTERACTIONS WITH SOME FOLIAR FERTILIZERS ON GROWTH AND YIELD OF BROAD BEAN (*VICIA FABA* L)

Ali Husain JASIM*, Huda Ahmed ATAB, Hameed Musa ABED
Agriculture College, Al-Qasim Green University, Iraq
**Corresponding author's e-mail address: ajasim11@gmail.com*
Received 12 April 2016; accepted 5 December 2016

ABSTRACT
Field experiment was conducted at the field of Agriculture College, Al-Qasim Green University at the agricultural season 2014/2015 to study the effect of two soil fertilizers (compound 18-18-18- at the rate of 200 kg.ha^{-1}and sheep manure as organic fertilizer at the rate of 10 tons.ha^{-1}) as well as control, and their interaction with foliar fertilizer of sea weed extract and urea as well as control (without the spray) on broad bean plants. Randomized Complete Block Design was used with three replication. The experimental unit contained 3 ridges (3m long and 80 cm apart, planted on both sides at distance of 25 cm) in saline soil (9.6dS.m^{-1}). The results showed that chemical or organic soil fertilization led to increase plant height, plant branches number, plant leaves, leaf chlorophyll content and leaf percentage content of nitrogen, phosphorus and potassium significantly compared to control treatment. Add compost Chemical. On the other foliar fertilizer caused a significant increase in all traits above compared to control (without spraying). The interaction between soil and foliar fertilizers had a significant effect on all traits above.

KEY WORDS: *broad bean, metal fertilizer, organic fertilizer, seaweed, sprinkle urea*

INTRODUCTION

Broad bean *Vicia faba* L. is a winter leguminous crops, which is one of the basic protein and energy sources (Akinci *et al.,* 2009), as well as it improves soil fertility (Shafeek *et al,* 2013). To improve growth and yield of broad been it must be attention to improve plant and soil service, including the quantity and quality of adding fertilizer. Potassium improves water relations in plant in addition to increase plant productivity (Islam *et al*., 2004). The extravagant in adding chemical fertilizers leads to depletion of soil organic matter in addition to the adverse effect on the environment (Islam & Munda, 2012). The addition of organic matter improves the qualities of soil physical and fertility, increase water efficiency, improve root growth and soil microorganisms activity, chelation of nutrients on the roofs of organic matter (Abou El-Magd *et al*, 2006). The researchers noted that the addition of foliar fertilizer improved growth and yield of leguminous plants (El-Habbasha *et al,* 2012; Jasim & Obaid, 2013). More studies indicate that 20% of Iraqi soils are in salty soil. On the other hand, increasing soil salinity lead to increase water stress and this leads to decrease plant dry material as well as the absorption of nutrients, while nutrient absorption increasing when increasing potassium fertilizer level which lead to increase dry matter production at salt stress conditions (Baque *et al*, 2006). So the

experiment was conducted to study the effect of adding soil and foliar fertilizer to improve growth and yield of broad bean and decrease the harmful effect of soil salinity stress.

MATERIALS AND METHODS

A field experiment was conducted during winter season of 2014-2015 in the experiences of Agriculture Coll., Al-Qasim Green University in silt clay soil at pH, 7.8 and 9.6 $dS.m^{-1}$ salinity, to study the response of broad bean (*Vicia faba* L.) to three soil fertilizing levels (without fertilization, add 200 kg.ha-1 of compound fertilizer NPK 18-18-18 and compost 10 t.ha-1 of sheep manure), and three foliar fertilizer levels (without spray, spraying seaweed extract and spraying urea), according to randomized complete block design with three replications. Broad bean seed (local variety) were soaked in water for 24 hours and were planting at 6/10/2014 (in hills 25 cm apart) on both side of ridges (80 cm apart) by putting 2 seeds in each hill and were pruned to one plant.hill-1.

The experimental unit was (3.2*4 m) contained 4 ridges and left one ridge between each experimental unit and the other. Soil and plant management were done uniformly by the recommendations. Soil fertilizer treatments were added before planting in line (15 cm) down of planting line. Foliar fertilizers treatments were added in two times (1 month after planting and at flowering stage).

At flowering stage, chlorophyll content (SPAD) were calculated.

Two weeks after final treatments, the 4^{th} leaves of 5 plants from each experimental unit were taken dried and grinding to assess its content of N, P and K. At the end of the experiment, plant height, number of leaves, plant tillers were measured.

At maturity, dry seed yield of inner ridges were calculated.

The data were analyzed in accordance with the practice of Design (Steel & Torrie, 2000) and compared to the averages by teams less moral test.

RESULTS AND DISCUSSIONS

Table 1 shows that soil fertilizers with metal or organic fertilizer led to increase plant height significantly compared to control with a percentage increase of 23.5% and 20% respectively compared to control. Sprinkle seaweed extract and urea also led to increase plant height significantly compared control treatment (without spraying) with a percentage increase of 6.8% and 7.9% respectively compared to control. The interaction caused a significant increase in plant height and reached its highest value (64.1 cm) at mineral fertilizer with urea spraying, without a significant difference with any of mineral or organic soil fertilizer interactions.

TABLE 1: Effect of soil and foliar fertilizers and on broad bean height (cm)

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	46.7	53.9	52.7	51.1
NPK	61.7	63.5	64.1	63.1
Organic	58.7	61.8	63.4	61.3
Average of foliar fertilizer	55.7	59.7	60.1	
$LSD_{0.05}$	Interaction= 5.66		soil or foliar fert.=3.27	

Table 2 shows that the addition of mineral or organic soil fertilizers led to increase the number of branchs.plant^{-1} compared to control with a percentage increase of 26.8% and 29.3% respectively compared to control. Sprinkle seaweed extract and urea also led to increase tillers number significantly compared to control (without spray) with a percentage increase of 11.1% and 13.3% respectively compared to control. The interaction had a significant effect in increasing plant tillers and reached its highest value of 5.6 when adding compost with urea spraying , without significant difference with seaweed extract plus of each of soil fertilizers.

TABLE 2: Effect of soil and foliar fertilizers and on branches.plant^{-1}

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	3.7	4.0	4.5	4.1
NPK	4.8	5.5	5.2	5.2
Organic	4.9	5.4	5.6	5.3
Average of foliar fertilizer	4.5	5.0	5.1	
$LSD_{0.05}$	Interaction=0.39		soil or foliar fert.=0.225	

Table 3 shows that soil fertilized with metal or organic fertilizers caused a significant increase in the number of leaves per plant compared to control with a percentage increase of 19% and 22.2% respectively compared to control. Sprinkle seaweed extract and urea also led to increase the number of leaves per plant significantly compared to control with a percentage increase of 7.6% and 4.9% respectively compared to control. The interaction caused a significant effect in increasing the number of leaves compared to control and reached its highest value of 61.4 when adding compost fertilizer with urea spraying, without significant difference between any interaction of metal or organic soil fertilizers with urea or seaweed extract.

TABLE 3: Effect of soil and foliar fertilizers and on leaves number.plant^{-1}

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	45.1	51.3	50.5	49.0
NPK	56.6	60.0	58.3	58.3
Organic	58.7	61.4	59.5	59.9
Average of foliar fertilizer	53.5	57.6	56.1	
$LSD_{0.05}$	Interaction= 4.1		soil or foliar fert.=2.37	

Table 4 shows that soil fertilizer with metal or manure fertilizers led to increase leaves chlorophyll content significantly compared to control with a percentage increase of 10.4% and 13% respectively compared to control. Spraying seaweed extract or urea caused significant increases in leaves chlorophyll content compared to control with a percentage increase of 4.9% and 3.9% respectively compared to control. The interaction had a significant effect in increasing leaves chlorophyll content and reached its highest value of 56.8 (Spad) when adding

compost with sprinkle seaweed extract, without a significant difference between any interactions of mineral or manure fertilizer with seaweed extract or urea.

TABLE 4: Effect of soil and foliar fertilizers and on chlorophyll (spad)

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	46.5	50.8	49.9	49.1
NPK	53.7	54.5	54.4	54.2
Organic	54.4	56.8	56.3	55.5
Average of foliar fertilizer	51.5	54.0	53.53	
$LSD_{0.05}$	Interaction= 3.12		soil or foliar fert.=1.80	

Table 5 shows that mineral or organic fertilizers led to increase nitrogen leaves content significantly, with a percentage increase of 40.9% and 26.8% respectively compared control. Metal fertilizer was superior upon manure with a percentage increase of 11%. Spraying seaweed extract and urea had a significant effect in increasing nitrogen leaves content with a percentage increase of 14.9% and 31.7% respectively compared to control. Spraying urea was superior upon seaweed extract with an increase of 14.5%. The interaction between soil and foliar fertilization had a significant effect in increasing nitrogen leaves content and reached its highest value 4.63% when adding mineral fertilizer with urea spraying which differ significantly compared to all the other interactions.

TABLE 5: Effect of soil and foliar fertilizers and on leaves N content

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	2.340	3.042	3.232	2.871
NPK	3.612	3.890	4.630	4.044
Organic	3.186	3.571	4.166	3.641
Average of foliar fertilizer	3.046	3.501	4.009	
$LSD_{0.05}$	Interaction= 0.2880		soil or foliar fert.=0.1663	

Table 6 shows that soil fertilization with mineral or organic fertilizers led to increase phosphorus leaves content significantly with a percentage increase of 30.1% and 20.4% respectively compared to control. Metal fertilizer was superior upon manure fertilizer with an increase of 8.1%. Spray seaweed extract and urea had a significant effect in increasing the content of phosphorus, with a percentage increase of 9.9% and 14.2% respectively compared to control. The interaction between soil and spraying fertilization had a significant effect in increasing the content of phosphorus and reached its highest value 0.264% when adding mineral fertilizer with spraying with seaweed extract.

TABLE 6: Effect of soil and foliar fertilizers and on leaves P content

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	0.176	0.205	0.207	0.196
NPK	0.244	0.264	0.258	0.255
Organic	0.217	0.231	0.260	0.236
Average of foliar fertilizer	0.212	0.233	0.242	
$LSD_{0.05}$	Interaction= 0.0255		soil or foliar fert.=0.0147	

Table 7 shows that soil fertilization with mineral or organic fertilizers led to increase potassium leaves content significantly with a percentage increase of 36.9% and 29.5% respectively compared to control. Metal fertilizer was superior upon manure with an increase of 5.7%. Spray seaweed extract and urea caused significant effect in increasing potassium leaves with a percentage increase of 14.3% and 18.1% respectively compared to control. The interaction between soil and foliar fertilization caused a significant effect in increasing potassium and reached its highest value 4.08% when adding mineral fertilizer with sprinkle of urea.

TABLE 7: Effect of soil and foliar fertilizers and on leaves K content

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	2.505	2.979	3.030	2.838
NPK	3.514	4.062	4.080	3.885
Organic	3.365	3.680	3.976	3.674
Average of foliar fertilizer	3.128	3.574	3.695	
$LSD_{0.05}$	Interaction=0.2882		soil or foliar fert.=0.1664	

Table 8 shows that soil fertilization with metal or manure fertilizers led to a significant increase dry seed yield (2.548 and 2.444 $t.ha^{-1}$ respectively) compared to control (1.946 $t.ha^{-1}$) with a percentage increase percentage of 30.9% and 25.6% compared to control, with no significant differs between the two types of fertilizers. Spraying seaweed extract and urea had a significant effect in increasing dry seed yield with a percentage increase of 8.1 and 15% respectively compared to control. The interaction between soil and spraying fertilization caused a significant effect in increasing dry seed yield and reached its highest value 2.633 and 2.609 $t.ha^{-1}$ when metaland organic fertilizers interact with urea spraying respectively.

TABLE 8: Effect of soil and foliar fertilizers and on seed yield ($t.ha^{-1}$)

Foliar fertilizers / Soil fertilizers	control	seaweed	urea	Average of soil fertilizer
control	1.727	1.944	2.168	1.946
NPK	2.439	2.571	2.633	2.548
Organic	2.277	2.447	2.609	2.444
Average of foliar fertilizer	2.148	2.321	2.470	
$LSD_{0.05}$	Interaction= 0.2768		soil or foliar fert.=0.1650	

The experience shows that adding soil chemical fertilizer as well as urea spraying caused a significant increase of plant height, tillers number, leaf number, leaves chlorophyll content, N, P, K leaves content and dry seeds yield. This results were due to an adequate supply of nitrogen, phosphorus and potassium, which led to improve plant growth, where nitrogen leads to improved plant physiological processes such as photosynthesis and entering in the composition of amino acids that make up proteins and enzymes (Taiz & Zeiger, 2006; Ianovici, 2011). Also, phosphorus plays an important role in increasing the effectiveness, growth of roots and shoots and the formation of high-energy compounds (Silva *et al*., 2011). As well as potassium which increases the effectiveness of enzymes, improves protein synthesis, ingredients carbohydrate and transfer of food processing products (Taiz & Zeiger, 2006), as that potassium is one of the most effective osmotic cations in plant cells (Mehdi *et al.* 2007), which works as a promoter for water absorption and increase root permeability and working as role of guard cells and to its role in increasing water use efficiency (Zekri & Obreza, 2009; Ianovici, 2012).

Spraying urea provide the plant with amounts of nitrogen absorption fast as possible to make up for the shortfall caused by salt stress and thus be positive results in growth and this is consistent with the results of Jasim and Obaid (2013). On the other hand, spraying seaweed extract led to a significant increase in prescriptions vegetative growth and the content of chlorophyll and nutrients (N, P, K) and yield. This results may be due to its content of auxin and gibberellins like compounds which leads to increase the origins of flower and contributes in guiding the transfer of materials manufactured in the leaves to the fruits formed, in addition to its containing of amino acids, vitamins and nutrients (Stirk *et al*. 2004). This results were consistent with Jasim al-Dulaimi (2014) that spraying seaweed extract on broad bean plants led to increase plant content of free auxin and gibberellins. On the other hand, spraying seaweed extract leads to increase stability of cell membranes which leads to facilitating the movement of nutrients and thus increase growth and reduce the phenomenon of flower abortion, which is reflected positively in increasing yield (Khan *et al*. 2009). Urea spraying contributed to obtain nitrogen during a critical period which helps reduce flower abortion (Janeczek *et al*. 2004). Insufficient nutrient supply through development of reproductive stage affect in losing flowers and small pods, while spraying nutrients are an easy way to increase yield in the bean (Eweida *et al,* 1980).

The interaction between the factors had significant effect on the characteristics of growth and yield as a result of synergies and offset food shortages, especially in the critical periods of growth and stress, which was reflected in the positive growth traits and yield.

CONCLUSIONS

The results of this study suggest that adding organic fertilization enhanced by spraying urea or seaweed extract gave the best growth and yield of broad bean . It was a good alternative to chemical fertilizers by stop adding or reducing the amounts of chemical fertilizer, thus reducing the environmental damage and promote sustainable agriculture.

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