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EFFECT OF SOME ORGANIC FERTILIZERS TREATMENTS ON DRY SEED YIELD OF BROAD BEAN (*Vicia faba* L.)

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Abstract

A simple experiment was conducted at 2012-2013 growth season to study the addition effect of chicken and cattle manure, granular humus alone or with foliar application of humic acid or seaweed extraction as well as control and chemical treatments on yield of broad bean. The results were summarized as follow: Most of treatments caused a significant increase on all parameters studied. Chicken manure + humic acid was superior to most of other transactions in pods number.plant^{-1}, seeds number.pod^{-1} and seed yield, and it gave an increase percentage of 62.3%, 49.5% and 150% respectively, compared to control. Cattle manure + seaweed extraction caused higher proportion of protein in the seeds and it gave an increase percentage of 92.2% compared to control treatment.

Key words*: chicken and cattle manure, granular humus, humic acid, seaweed, broad bean.*

INTRODUCTION

Broad bean (*Vicia faba* L.) is a famous winter leguminous crops in Iraq. It is considered as a good source of vegetarian protein for human consumption**,** and it is cultivated in crop rotations to improve soil properties (Jasim, 2007). Chemical and organic fertilizers are an essential process in plant management. Adequate fertilizers led to increase the crop yields, improves the nutrient element concentration in plant tissue and soil macro and micro nutrient status. Chemical fertilizers are expensive and harmful effects on the environment (Adediran et al., 2004), therefore recommended the addition of organic matter (animals manure, humic acid and seaweed extract) as an alternative to chemical fertilizers (Oad et al., 2004). The addition of organic fertilizers efficiently ensures high production and continuous crops by improving soil properties and increase roots development and soil micro organisms activity (Abou EL-Magd et al., 2006; Ayoola and Maknide, 2009). Some researchers reported that spraying with humic acid improve plant growth and yield (Akinci et al., 2009). Adding humic acid caused a significant increase in dry matter production by broad bean (El-Ghozoli, 2003) and bean (El-Bassiony et al., 2010). Seaweed extract was used to encourage growth and delay aging (Khan et al., 2009). Because of the importance effect of fertilizer types, especially organic fertilizers in influencing the quantity and quality of yield as well as external and physiological aspects of plant growth, this study was carried to compare the effect of a some organic fertilizers (chicken and cattle manure, granular humus, humic acid and seaweed extract spray, alone or in combination) on broad bean yield compared with control or chemical fertilization (NP)and as an alternative.

MATERIALS AND METHODS

A farm experiment was conducted at the farm of Agriculture College, Babylon University during 2012-2013 growth season to study the response of broad bean plants to chicken or cattle manure alone or with foliar organic fertilizers compared with recommended chemical fertilizer. The experiment was conducted according to the randomized complete block design (RCBD) with three replications; each replicates contained 13 experimental unit (each of it contained four ridges (3m length and 75 cm width).
Degradable chicken or cattle manure at a level of $20m^3.h^{-1}$ before seeding was used. The experiment included 13 treatments:
1- control;

2- chemical fertilizer (di-ammonium-phosphate);
3- degradable chicken manure (20 $m^3.h^{-1}$) adding before seeding;
4- degradable cattle manure (20 $m^3.h^{-1}$) adding before seeding;
5- granular humus;
6- humic acid;
7- seaweed extract;
8- degradable chicken manure + humic acid;
9- degradable cattle manure + humic acid;
10- granular humus + humic acid;
11- degradable chicken manure + seaweed extract;
12- degradable cattle manure + seaweed extract;
13- granular humus + seaweed extract.

Broad bean seeds (Spanish var.) were soaked in water for 24 hours and planted after calibration on one side of the ridges at 25 cm apart on 15 October 2012.After 45 days of germination, foliar fertilizers were done and after one month later the second spray was done. Plant and soil service process were done as the same as it was recommended. At harvest, dry pods of plants from the two internal ridges were harvested, and from it, number of pods per plant, dry seeds per plant and unit area were calculated. Statistical analysis was performed according to the program Gen. Stat (Edition 3), the averages were compared according to Least ($LSD_{0.05}$).

RESULTS AND DISCUSSIONS

Table 1 showed that all fertilizer treatments were superior in pods no. plants $^{-1}$ (except granular humus treatment) significantly compared to control. The table showed also that there were a significant differences between the superior treatments in which chicken manure + humic acid was superior upon chemical fertilizer, granular humus, humic acid, cattle manure + humic acid and granular humus + humic acid treatments, and caused a percentage increase of 62.3% compared to control.

The increase is attributable to the role of organic matter in the release of nutrients, notably nitrogen which is necessary for the elongation and cell division and growth and development of plant, and the role of organic matter in improving the properties vital to the soil by increasing number and quality of microbes that increase the readiness of the absorption of most nutrients, which is reflected positively the general activity of the plant (Sarkar et al., 2004). This is consistent with that found by Arjumand et al., 2013 on broad bean plants. The reason for the increase is also due to the role of organic matter in the processing and supply of good nutrient for plants, which appears in the growth characteristics of the crop, and these results are consistent with the findings of the researchers that the addition of organic matter had achieved significant increases in the yield of leguminous crops (Shaaban and Okasha, 2007; El-Desuki et al., 2010).

Table 1. Effect of treatments on pod number per plant

Treatments		**Treatments**	
control	5.70	chicken manure + humic acid	9.27
chemical fertilizer	8.00	cattle manure + humic acid	7.97
chicken manure	9.17	granular humus + humic acid	8.00
cattle manure	8.27	chicken manure + seaweed	9.13
granular humus	6.67	cattle manure + seaweed	8.93
humic acid	7.27	granular humus + seaweed	8.27
seaweed extract	8.97		
$L.SD_{0.05}$	1.233		

Table 2 showed the superiority of fertilization: chemical fertilizer, chicken manure, chicken manure + humic acid, cattle manure + humic acid, chicken manure + seaweed extract, cattle manure + seaweed extract significantly compared to control in the number seeds per pod. The treatment of chicken manure + humic acid was superior upon all treatments except for the treatment of chicken manure + seaweed extract, with a percentage increase of 49.5% compared to control treatment. And also shows that spray humic acid or seaweed extract for plants fertilized with chicken or cattle manure led to the strengthening of the increase in the number of seeds per pod significantly compared to control.

The increase was attributed to the role of organic matter in supplied the plants with nutrient-sufficient, which increases the vegetative parts and thus increase in the photosynthesis process, which utilized in the

composition of plant parts and thus decrease of competition and abortion, which led to the increase in the number of seeds per pod, this is consistent with Anju and Vijayalakshmi (2013) on common bean and Maheshbabu et al. (2008) on soya bean.

The increase in the seed number per pod by chemical fertilizer (NP) was attributable to the role of phosphorus in increasing the activity and growth of plant roots as well as increasing plant vegetative growth, and to the phosphorus entry in most vehicles energy-rich which is necessary in plant biosynthesis (Silva et al., 2011). This was consistent with Ahmed and EL-Bagy (2007) in broad bean. And sprayed humic acid or seaweed extract led to increased permeability of cell membranes, which leads to easier transmission of nutrients to sites that require their presence and reduce abortion and thus increase seeds no. per pod (Buyukkeskin and Akinci, 2011).

Table 2. Effect of treatments on seed number per pod

Treatments		Treatments	
control	3.300	chicken manure + humic acid	4.933
chemical fertilizer	4.233	cattle manure + humic acid	4.333
chicken manure	3.933	granular humus + humic acid	3.833
cattle manure	3.667	chicken manure + seaweed	4.567
granular humus	3.400	cattle manure + seaweed	3.900
humic acid	3.567	granular humus + seaweed	3.833
seaweed extract	3.633		
$L.SD_{0.05}$	0.5756		

Table (3 and 4) showed that all fertilizer treatments were superior significantly (except the treatment of granular humus) in dry seeds yield per plant and per unit area, compared to control. Chicken manure + humic acid was superior on all treatments (except chemical fertilizer, chicken manure, cattle manure + seaweed extract, chicken manure + seaweed extract), with an increase percentage of 150% compared to control. The increase by adding chicken or cattle manure attributed to the amount of nutrients released from degrading the organic matter which increase cells activity and size, and increase the components of yield such as pod number per plant and seeds number per pod (Table1and2) and thus seed yield. This is consistent with Kovacs et al(2008) on broad bean. The increase by chemical fertilizer (NP) is attributable to the role of the two components N and P in the plant (El-Gizawy and Mehasen, 2009). This is consistent with Daur et al. (2008), Ahmed and EL-Bagy (2007) on broad bean. The increase in seed yield by spray seaweed extract was attributed to plant hormones containing in the extract that led to the increase in the number of origins of flowering and fruit and be transformed materials formed in the process of photosynthesis to the fruit as well as it`s containing of amino acids, vitamins and mineral elements (Stirk et al., 2004). This result is consistent with Sabh and Shallan (2008).

Table 3. Effect of treatments on dry seed yield (gm).plant^{-1}

Treatments		Treatments	
control	24.6	chicken manure + humic acid	62.6
chemical fertilizer	56.3	cattle manure + humic acid	46.6
chicken manure	51.7	granular humus + humic acid	41.9
cattle manure	42.3	chicken manure + seaweed	59.4
granular humus	32.1	cattle manure + seaweed	51.0
humic acid	37.7	granular humus + seaweed	46.9
seaweed extract	44.4		
$L.SD_{0.05}$	11.54		

Table 4. Effect of treatments on dry seed yield (Ton.hectare^{-1})

Treatments		Treatments	
control	1.333	chicken manure + humic acid	3.333
chemical fertilizer	3.033	cattle manure + humic acid	2.500
chicken manure	2.800	granular humus + humic acid	2.233
cattle manure	2.300	chicken manure + seaweed	3.233
granular humus	1.717	cattle manure + seaweed	2.767
humic acid	2.050	granular humus + seaweed	2.533
seaweed extract	2.400		
$L.SD_{0.05}$	0.597		

Table (5) shows that all fertilizer treatments were superior on control in 100 seeds weight (except for the treatment of spray seaweed extract, cattle manure + spray humic acid, granular humus + spray humic acid). The table

also shows that chemical fertilizer treatment was superior on all treatments significantly, with a percentage increase of (22.7%) compared to control.

The increase is due to the role of humic in increasing permeability of cell membranes which increases the speed of entry of nutrients into the cell because of the presence of effective hydroxyl and carboxyl (Chen and Aviad, 1990). Organic matter that contains most of the nutrients leads to increase the amount of protein and carbohydrates accumulated in the seed which leads to increase the weight of the seed (Arjumand et al., 2013). The increase in the weight of 100 seeds by chemical fertilizer (NP) attributed to the providing of these elements to be ready for absorption by the plant, and to the role of each of nitrogen and phosphorus to encourage vegetative and roots growth and the performance of activities vital (Hauggard and Jensen, 2001). This was consistent with Ahmed and EL-Bagy (2007) and Daur et al. (2008).

Table 5. Effect of treatments on 100 seeds weight(gm)

Treatments		**Treatments**	
control	128.00	chicken manure + humic acid	141.00
chemical fertilizer	157.00	cattle manure + humic acid	137.33
chicken manure	142.00	granular humus + humic acid	136.33
cattle manure	139.67	chicken manure + seaweed	142.33
granular humus	141.67	cattle manure + seaweed	145.67
humic acid	145.67	granular humus + seaweed	144.33
seaweed extract	134.00		
$L.SD_{0.05}$			9.916

Table 6 shows that all fertilizer treatments caused a significant increase in protein percentage (except for the treatment of granular humus, humic acid, granular humus + seaweeds) compared to control. The table shows also that the superior treatments did not differ with each other, and the highest value obtained from cattle manure + spray seaweeds extract, which achieved a percentage increase (92.2%) compared to control.

The reason for increasing protein concentration when adding organic fertilizers is due to the high concentration of nutrient elements which is easy to absorb by the plant, and the property of humic acids in increasing the activity of most enzymes, including proteinase which converts the nitrogen to protein in the plant, which accumulates in the seeds during maturation. This is consistent with Mahmoud et al. (2012).

The increase is due to the role of humic acids which are produced during the decomposition of organic matter, and works to increase the permeability of cell membranes, and speeds up the absorption of nutrients (Esmaeilian et al., 2012). The increase in protein by chemical fertilization (NP) is attributed to the role of N and P in the plant (Kovacs et al., 2008; Kandil et al., 2013). The increase of protein by spraying seaweed extract with chicken or cattle manureis attributed to its contain of amino acids and vitamins and many of the elements (Stirk et al., 2004). This was consistent with Sabh and Shallan (2008).

Table 6. Effect of treatments on seed protein percentage

Treatments		**Treatments**	
control	13.80	chicken manure + humic acid	25.33
chemical fertilizer	22.10	cattle manure + humic acid	24.53
chicken manure	24.83	granular humus + humic acid	20.80
cattle manure	20.77	chicken manure + seaweed	24.57
granular humus	14.73	cattle manure + seaweed	26.53
humic acid	19.33	granular humus + seaweed	19.20
seaweed extract	24.47		
$L.SD_{0.05}$			5.97

CONCLUSIONS

It will be concluded that chicken or cattle manure with humic acid or seaweed fertilizers were more effective in enhancing growth and yield of broad bean than chemical fertilizer.

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