Journal of Soil Sciences and Agricultural Engineering

Journal homepage: www.jssae.mans.edu.eg
Available online at: www.jssae.journals.ekb.eg

Effect of Different Levels of Compost and Nitrogen Fertilizers on Growth and Yield of Broad Bean (*Vicia faba* l.) Under Silty Clay Soil Conditions

Cross Mark

Muhamad Tahsen Maruf*

Natural Resources Department /College of Agricultural Engineering Sciences University of Sulaimani / Sulaymaniyah, Kurdistan Region – Iraq

ABSTRACT

The field experiment was conducted at Arbat location in sulaymaniyah governorate, Iraq. The main aim of this research is, to evaluate the impact of adding various levels of compost (Cattle Manure) and nitrogen (Urea) rates on Broad Bean (*Vicia faba* L.) yield and yield components. Experimental treatments have been organized and a factorial experiment was laid out in a complete randomized block design with three replicates. The treatments included three levels of compost, and three levels of nitrogen incorporated into the soil. The main results could be summarized as, the application of compost, nitrogen and the interactions, the vegetative growth parameters, plant height (cm), number of branches plant^{-1}, biological yield (g), pod length (cm), number of pods plant^{-1}, average of pod weight (g), seeds weight (g pod^{-1}), yield of seeds (*Mg* ha^{-1}), total yield of pods (*Mg* ha^{-1}), number of nodules plant^{-1} and % nitrogen, % protein in seeds of Broad Bean plant from Arbat location, were significantly increased by increasing the level of compost application from 0, 5 to 10 Mg ha^{-1}. Also the vegetative growth parameters, broad bean yield and pods quality as well as nutritive value of broad bean were significantly increased with increasing the level of nitrogen application from 0, 100 to 150 kg ha^{-1}.

Keywords: *Protein, Biological yield, Nodules*

INTRODUCTION

Broad bean (*Vicia faba* L.) grows in different parts of the country, it is one of important winter vegetables crops which belonging to Fabaceae family, which was known by humans, which has a high content of protein in the seeds about 25-30% (Sabh *et al*., 2008 and Shafeek *et al*., 2013) and contains its seeds on carbohydrates up to 56% with the presence of mineral elements and fiber up to 6% and fat 1.5% (Kandil and Hala, 2007). By the world population continues to increase and the demand for protein. Legumes are the major direct source of proteins; in addition, broad bean plants improve soil fertility by providing a substantial input of N fixation (Hubbell and Gerald, 2003). Depending on the plant density and the field management, this plant is able to fix nitrogen up to 40 kg ha^{-1} annually (Arun, 2007).

The selection of the appropriate category within the production area is one of the main factors for the increase of the crop and the crop species. Dhary and AL-Baldawi (2017) observed that the Spanish variety of broad bean gave highest leaf area per plant, number of pods per plant, number of seeds per pod and green seed yield compared to Netherland and Local varieties. Kakahy *et al*. (2012) found that the Spanish variety of broad bean increased a significant the number of seeds per pod compared to Turkish and Local varieties.

The growth and productivity of the broad been is affected by many factors, including chemical and organic fertilizers, where N P K fertilizer is necessary to increase production. Plant nutrition is the most important factors affecting growth and yield. Broad bean is highly responsive to N fertilization and N is usually the most limiting essential nutrient for Broad bean growth. Nitrogen supply also plays an important role in the balance between vegetative and reproductive growth for Broad bean (Marschner, 1995). Therefore, the use of organic fertilizer as a substitute for the chemical fertilizers in the role of this fertilizer in improving the soil structure and increase the efficiency of the roots on the absorption of water and soluble food from the soil and increase the ability of soil to retain water and nutrients and stimulate the activity of microorganisms in the soil and thus improve plant growth and their quality (Nuaimi, 2011). Jassim and AL-Dulaimi (2012) found that chicken and Cattle manure were superior in increasing plant height, branches number per plant, leaf area per plant, pods number per plant, pod weight and yield of green pods of broad bean plants. Renewed interest in organic farming has resulted in a need for research in sustainable farming practices this interest is in response to environmental and health concerns, also, there is a perception that organic farming will help alleviate problems associated with food safety and environmental quality and impact. Manure is a valuable and renewable resource that can be used as a fertilizer in crop production.

The objective of this study is to compare the effects of organic fertilizers and nitrogen fertilizers on Broad bean growth and yield under Silty Clay soil conditions.

MATERIALS AND METHODS

To assess the impact of compost (Cattle Manure) and nitrogen (Urea) on yield and yield constituents of Spanish variety of broad bean, grown under calcareous soil, the experiment was conducted at (Arbat) agricultural lands, the GPS readings (45 35 30 E, 35 24 35 N, and 648m above sea level with 3m accuracy) in sulaymaniyah

[*] **Corresponding author.**
E-mail address: muhamad.maruf@univsul.edu.iq
DOI: 10.21608/jssae.2021.171494

governorate, Iraq as shown in (Fig 1) during winter growing season from 20/11/2014 to 1/5/2015.

The experiment includes three levels of compost as Cattle Manure (M), (M0= 0, M1= 5 and M2= 10 Mg ha^{-1}) and three levels of nitrogen as Urea which contained 46% N (N0 = 0, N1 = 100 and N2 = 150 kg ha^{-1}). The compost was mixed together for each experimental unit before planting, and nitrogen fertilizer application methods were traditional application methods, using side application, of the fertilizers into pits between plants, before seed sowing (Finck, 1982). In spite of this application 80 kg P_2O_5 ha^{-1} and 100 kg K_2O ha^{-1} were applied in all plots as base dose. Average of the rainfall and air temperature climatic data of the experiment field location (Arbat) in 2014 and 2015 showing in (Table 1).

The experiment was conducted on the 110 m^2 area (7.3 m × 14.9 m), in 9 experimental units with three replicates, the area of each experimental unit was 1.21 m^2 (1.1 × 1.1) m, each experimental plot included 3 rows in 1.1 m length, and the distance between these three was 0.30 m while it was 0.40 m within the rows of the individual plants, to obtain a mean density of 70,000 plants ha^{-1}, and the distance between the experimental units was 0.5 m while the distance between the blocks was 1m.

Experimental treatments have been organized in a factorial experiment by using the complete randomized block design (CRBD) by having three replicates (Fig 2).

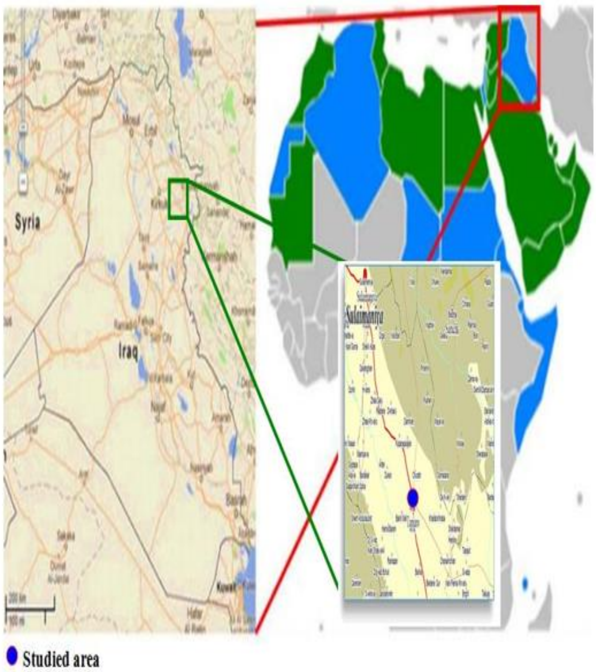

Figure 1. The location of the studied area

Table 1. Average of the rainfall and air temperature climatic data of the experiment field location (Arbat)

Days	November 2014			December 2014			January 2015			February 2015			March 2015			April 2015		
	Rainfall	Temp. °C		Rainfall	Temp. °C		Rainfall	Temp. °C		Rainfall	Temp. °C		Rainfall	Temp. °C		Rainfall	Temp. °C	
	mm	Max.	Min.	mm	Max.	Min.	mm	Max.	Min.	mm	Max.	Min.	mm	Max.	Min.	mm	Max.	Min.
1	7.8	16	11	0.1	10	4	0	11	2	0	11	2	0	15	5	0	15	6
2	6.8	14	9	4.8	7	5	0.2	13	6	0	15	3	0	13	4	0	18	6
3	22.2	10	8	1.2	10	6	0.1	10	3	0	17	5	3.5	11	4	0	17	7
4	0.8	12	7	0	13	6	3	6	4	0	15	6	3	9	5	0	20	8
5	0	10	5	0	14	6	0.2	8	3	0	12	4	1.1	10	4	0	19	7
6	0	14	4	0	15	6	0	11	2	0	14	3	0	13	1	0	21	8
7	0	17	5	0	15	6	1.5	8	4	0	15	4	0	17	3	0	23	9
8	0	17	6	0	15	6	11.7	3	0	0	15	6	0	18	6	0	24	11
9	0	17	6	0	16	7	0.6	1	-4	0.2	13	6	0	18	6	0	27	12
10	0	17	6	1.1	10	8	0	3	-2	4.7	12	7	0.3	13	7	1.6	25	14
11	0	18	7	0	14	5	1.9	2	-3	4.7	11	7	1.3	15	7	5.9	20	12
12	0	17	7	0	15	5	0	4	-4	1.4	9	5	0.5	15	6	0.6	19	9
13	0	17	7	0	16	7	0	7	-3	0	11	1	1.9	15	7	1.2	19	9
14	0	17	9	17.8	10	7	0	10	-1	0	10	3	1.6	15	7	1	20	8
15	0	18	12	7.5	11	7	1.3	11	2	0	10	2	1.6	15	6	0.5	21	9
16	0.1	18	10	0	11	5	2.8	8	3	2.5	7	4	3.5	14	6	0	24	9
17	3.8	15	10	0	11	4	0	7	0	0.3	11	4	3.7	12	5	0	20	9
18	0.3	15	8	0	11	3	0	7	0	0	12	3	0.8	14	4	0	21	9
19	0	16	7	0	11	4	0	7	0	0.7	11	4	0	19	8	0	21	9
20	0	16	7	2	9	5	0	10	1	8.6	8	1	13.8	14	9	0	22	9
21	1.2	16	8	1.5	10	5	0	12	2	0.4	4	-2	0.4	14	6	0	24	12
22	17.5	12	9	0	10	2	0	13	2	0	8	0	5.9	10	3	0	22	12
23	7.9	11	6	2.9	5	2	0	12	2	0	10	0	0.4	6	1	0.4	20	11
24	0.6	12	8	4.1	6	2	0	12	2	0	12	0	0	12	2	0	14	7
25	0.5	12	6	0	9	1	0	13	2	0.9	9	5	0.2	13	4	0	16	4
26	1.3	12	7	0	11	2	0	15	4	0	12	1	0.2	15	7	0	23	7
27	12.2	8	6	0	8	3	0	14	6	0	15	3	0	18	5	0	24	9
28	0.9	10	4	0	10	6	0.2	12	6	0	17	4	0	19	7	0.3	24	13
29	0	10	3	0	12	4	0	12	7				1.4	17	9	0	28	13
30	0	10	3	0	12	3	4.4	13	5				13	13	9	0	30	14
31				0	12	3	0.5	9	4				0.5	14	7			

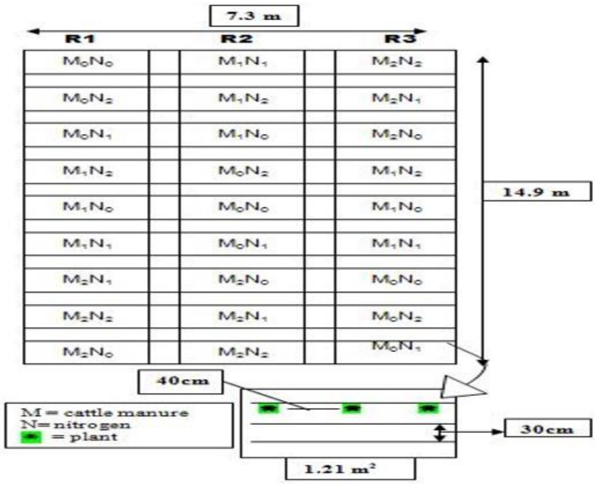

Figure 2. Scheme of the experimental design in the field

All required management practices were done at proper times, and the standard practices were used for weed control. Soil samples were taken before planting from a depth of 0-40 cm of the soil used in the field experiments. The soil samples were air-dried, filtered by a 2 mm sieve, and kept in plastic bottles until analyzed. Some of the chemical and physical characteristics measured for soil and chemical characteristics for cattle manure (Table 2). Sampling time before or at bloom (after 130 days from planting) in the 28/3/2015. three plants taken from each experimental unit, after washing the plants first with tap water and then with distilled water to remove dust particles, the samples were placed in paper bags and dried at (65 Cº) for three days. The dry weight was then obtained and the plants total dry matter weight was recorded. The oven-dry weight of dry matter was recorded and expressed in grams per plant. The dry seeds were weighed from each harvested area and the dried samples were ground in a stainless steel mill and stored until needed for chemical analyses. Physiological parameters were measured as follows: all the growth parameters were recorded, plant height (cm), number of branches plant^{-1}, biological yield (g), number of pod length (cm), number of pods plant^{-1}, average of pod weight (g), seeds weight (g pod^{-1}), yield of seeds (*M*g ha^{-1}), Total yield of pods (*M*g ha^{-1}), number of nodules plant^{-1} and % nitrogen, % protein in seeds of Broad Bean plant.

Table 2. Some chemical and physical Characteristics of the soil and cattle manure

Soil		Cattle Manure	
Characteristics	**Value unity**	**Characteristics**	**Value unity**
pH	7.56	pH	7.3
EC at 25 ºC	0.59 dS m^{-1}	EC at 25 ºC	7.1 dS m^{-1}
CEC	32.2 Cmolc kg^{-1}	OM	525.4 g kg^{-1}
OM	25.89 g kg^{-1}	Total P (P_2O_5)	4.87g kg^{-1}
$CaCO_3$	57.21 g kg^{-1}	Total K (K_2O)	7.89g kg^{-1}
Available P	3.95 mg kg^{-1}	Total N	14.57 g kg^{-1}
Available K	189.12 mg kg^{-1}	Total Organic Carbon	304.76g kg^{-1}
Total N	1.48 mg kg^{-1}	C/N ratio	20.92
Water content	61.95 g kg^{-1}	Water content	68.5 g kg^{-1}
Mechanical Analysis (PSD)			
Clay	463.0 g kg^{-1}		
Silt	432.0 g kg^{-1}		
Sand	105 g kg^{-1}		
Textural name	Silty Clay		

At maturity, the crop was harvested on 1/5/2015, after reaching the mature physiological stage (when maturity symptoms occur on plants). The weight of seeds for each experimental unit was determined, and the yield was expressed in (*M*g ha^{-1}). Other yield parameters were also collected. A small sample of the seeds selected randomly from the seeds yield of each experimental unit. Concentration of Nitrogen was according to Kjeldahl method, as described in Rowell 1996 (Rowell, 1996). The protein percentages in plant were accounted by multiplying nitrogen content by 6.25 (Blck, 1983).

The statistical analyses the comparisons between means of treatments were done using LSD 0.05 (Steel, and Torrie, 1980).

RESULTS AND DISCUSSION

The attained results will be presented as follows:

A- Vegetative growth criteria:

Table 3, demonstrated that compost (cattle manure), nitrogen fertilizers and their interactions were significantly impacted in plant height (cm), number of branches plant^{-1} and biological yield (g) of Broad Bean for Arbat location. Depending on the applied levels of compost fertilizer, the compost- level (10 *M*g ha^{-1}) was significantly different from all other treatments which obtained the maximum mean values of plant height, number of branches and biological yield (68.38 cm, 6.889 branches plant^{-1} and 304.797 g) respectively, while the lowest mean values was (64.50 cm, 4.556 branches plant^{-1} and 266.367 g) recorded at control. The superiority in the vegetative growth by the higher level of compost might be attributed to its favorable effect on the physical characters of the soil and increases could be due to organic fertilizers are the most used plant nutrient sources which provide macro and micronutrients at different quantities and they made great contribution on agricultural production due to their positive effects on crop growth and may be due to the role of catalyst in the organic manure in the root and vegetable growth of the plant. (Marculescu *et al*. 2002; Ozores-Hampton *et al*. 2011). The obtained results are in good agreement with Abeer and Sabeha (2019); Luay and Farhan (2012); Sabh, and Shallan (2008). Concerning on the nitrogen fertilizer, the nitrogen-level (150 kg ha^{-1}) was significantly different from all other treatments which obtained the maximum mean values of plant height, number of branches and biological yield (66.56 cm, 6.333 branches plant^{-1} and 292.486 g) respectively, while the lowest mean values was (65.91 cm, 5.889 branches plant^{-1} and 283.730 g) recorded at control. These findings are similar with those recorded by Hamessa (1973). The increases could be due to nitrogen is of decisive importance, this element is required to make proteins and structural components; there is no substitute for this element (Nitrogen).

Concerning the interaction between applied compost and nitrogen fertilizer levels, significant differences were found between compost and nitrogen in plant height (cm), number of branches plant^{-1} and biological yield (g), at ($P \leq 0.05$). The results show that their effect significantly increased the mean values plant height and number of branches (68.53 cm, 7.333 branches plant^{-1}) which was recorded from (M_2N_0) and the mean value of biological yield (306.983 g) was recorded from

(M_2N_2) to (64.17 cm, 4.333 branches plant^{-1}) which was recorded from (M_0N_0) and the mean value of biological yield (258.190 g) was recorded from (M_0N_1). This increment in vegetative growth of broad bean plants by increasing the levels of Compost (cattle manure) and nitrogen fertilizer application may be due to the role of Compost (cattle manure) and nitrogen fertilizer on plant nutrition; for instance, promotion of enzymes activity and enhancing the translocation of assimilates and protein synthesis. The reason for the increase in plant height is due to the positive role of nitrogen in increasing the activity of meristematic tissues and cell division, and the importance of nitrogen in building amino acids such as tryptophan, which forms the basis for building auxins, which has a role in cell division and expansion (Loddo and Gooding, 2012). Also, organic matter has an important role in increasing plant height, and this is due to the role that organic fertilizers play in reducing the degree of soil interaction, which has a clear effect on increasing the readiness of nutrients in the soil and thus increasing the absorption of it on the one hand and on the other hand, the organic fertilizer can prepare Various nutrients, thus increasing their absorption by the roots (Barakat *et al*. 2012).

Table 3. Effect of compost (cattle manure), nitrogen fertilizers and their interactions on the plant height (cm), number of branches plant^{-1} and biological yield (g) of Broad Bean.

Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	64.17c	64.67c	64.67c	64.50c	Plant height (cm)
5	65.03c	66.13b	66.77b	65.98b	
10	68.53a	68.37a	68.23a	68.38a	
Nitrogen effect	65.91b	66.39ab	66.56a		
Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	4.333 c	4.667 bc	4.667 bc	4.556a	Number of branches plant^{-1}
5	6.000 ab	6.000 ab	7.000 a	6.333a	
10	7.333 a	6.000 ab	7.333 a	6.889b	
Nitrogen effect	5.889a	5.556a	6.333a		
Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	268.197 ef	258.190 f	272.713 de	266.367c	Biological yield (g)
5	281.780 cd	288.317 bc	297.760 ab	289.286b	
10	301.213 ab	306.193 a	306.983 a	304.797a	
Nitrogen effect	283.730b	284.233b	292.486a		

Means within a column, row and their interactions separatlly followed with the same letters are not significantly different according to Duncan's multiple range tests at ($p \leq 0.05$).

B- Reproductive growth criteria:

Relying on the effect of the compost (cattle manure), nitrogen fertilizers and their interactions on the pod length (cm), number of pods plant^{-1} and average of pod weight (g) of Broad Bean, it was found that the added compost and nitrogen-levels were significantly affected on the pod length, number of pods and average of pod weight at ($P \leq 0.05$), table 4. This effect reflected on the pod length (cm), which increased significantly with increasing compost–levels, the higher mean number was (21.643) produced at (10 Mg ha^{-1}) when the lowest mean number was observed at control which was (17.480). The nitrogen rate application was significantly different from a pod length (cm), which was gained higher mean value (19.752) produced at (150 kg ha^{-1}), compared to other treatments. Regarding the interaction effect of compost and nitrogen application-levels, significant differences were obtained. The pod length (cm) ranged from (17.160 to 22.597) cm, the highest value was recorded at (M_2N_2), while the lowest values were obtained from (M_0N_1). The obtained results were in a good accordance with those recorded by (Sabh, and Shallan, 2008). The increases could be due to the higher amount of compost in soil, compost practices increase soil pH, and plant-available nutrients.

On the other hand increase in applied compost rates indicated significant increases in number of pods plant^{-1} at ($P \leq 0.05$). The highest mean value was found at compost-level (10 Mg ha^{-1}) which was (7.111) in comparison with the lowest mean value (6.111) which recorded at control. Concerning the effect of nitrogen, the studied nitrogen -levels were significantly different on the base of number of pods plant^{-1}. The highest value was found at nitrogen -level (150 kg ha^{-1}) which was (6.778) in comparison with the lowest value (6.444) which recorded at control. An interaction between compost and nitrogen -levels caused significant differences in the number of pods plant-1 at ($P \leq 0.05$). The greatest number of pods plant^{-1} recorded by (M_2N_2) treatment was (7.333), in comparing with the lowest value (6.000) obtained by (M_0N_1 and M_0N_1) treatments.

Table 4. Effect of compost (cattle manure), nitrogen fertilizers and their interactions on the pod length (cm), number of pods plant^{-1} and average of pod weight (g) of Broad Bean.

Compost as Cattle Manure (M) Mg ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	17.643 d	17.160 d	17.637 d	17.480c	Pod length (cm)
5	17.993 cd	18.087 cd	19.023 bc	18.368b	
10	20.060 b	22.273 a	22.597 a	21.643a	
Nitrogen effect	18.566b	19.173ab	19.752a		
Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	6.000 c	6.000 c	6.333 bc	6.111c	Number of pods plant^{-1}
5	6.333 bc	6.667 abc	6.667 abc	6.556b	
10	7.000 ab	7.000 ab	7.333 a	7.111a	
Nitrogen effect	6.444a	6.556a	6.778a		
Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	20.027 d	20.097 d	20.063 d	20.062c	Average of pod weight (g)
5	20.407 d	20.310 d	21.023 c	20.580b	
10	21.633 b	22.917 a	22.707 a	22.419a	
Nitrogen effect	20.689b	21.108a	21.264a		

Means within a column, row and their interactions separatlly followed with the same letters are not significantly different according to Duncan's multiple range tests at ($p \leq 0.05$).

The result regarding average of pod weight (g) of Broad Bean plant showed that the application of compost (cattle manure) and nitrogen rates to the soil was affected significantly at (P<0.05). Table 4, show that the average of pod weight was improved significantly with increasing compost-levels from Arbat location, and the greatest amount of average of pod weight was obtained at (10 *M*g ha^{-1}) with average value (22.419) and the lowest amount was recorded at control, with average value (20.062). Although slight differences were noticed among the studied nitrogen rates, but statistically they are different significantly. Regarding the interaction between compost and nitrogen -levels on the average of pod weight at ($P \leq 0.05$).The average of pod weight in this study was ranged from (20.027 to 22.707), the maximum value was obtained from (M_2N_2), while the minimum value was obtained from (M_0N_0). The obtained results were similar to those recorded by (Musleh *et al*. 1976; Aguilera *et al*. 1995).

C- Yield Characters:

Regarding the presented data in table 5, it appeared that the compost (cattle manure), nitrogen fertilizers and their interactions significantly influenced the seeds weight (g pod^{-1}), yield of seeds (*M*g ha^{-1}) and Total yield of pods (*M*g ha^{-1}) of Broad Bean, at ($P \leq 0.05$). Significant improvement in Seeds weight (g pod^{-1}) was also observed by application the compost-levels. The maximum mean value was (18.967), obtained at (10 *M*g ha^{-1}), which was different significantly comparing with that obtained at control which was (17.308). However, the nitrogen effect on Seeds weight was found to be significant. The maximum mean value was (18.324), obtained at (150 kg ha^{-1}), which was different significantly comparing with that obtained at control which was (17.932), and the interaction effect of compost and nitrogen- levels was found to be significant. The Seeds weight in this study varied from 17.190 to 19.173 g pod^{-1}. The maximum value was produced by (M_2N_1), while the minimum value was produced by (M_0N_0). Relying on the effect of the compost (cattle manure), nitrogen rate application on the Yield of seeds (*M*g ha^{-1}) of Broad Bean, it was found that the added compost and nitrogen-levels were significantly affected at ($P \leq 0.05$), table 5.

This effect reflected on the Yield of seeds, which increased significantly with increasing compost–levels, the higher mean value was (4.740) produced at (10 *M*g ha^{-1}) when the lowest mean value was observed at control which was (3.060). The nitrogen rate application was significantly different from a Yield of seeds (*M*g ha^{-1}) of Broad Bean, which were gained higher mean value (3.982) produced at (150 kg ha^{-1}), compared to other treatments. Regarding the interaction effect of compost and nitrogen application-levels, significant differences were obtained due to the interaction between compost and nitrogen application-levels. The Yield of seeds value ranged from (3.027 to 4.797) *M*g ha^{-1}, the highest value was recorded at (M_2N_2), while the lowest value was obtained from (M_0N_1). The total yield of pods (*M*g ha^{-1}) of Broad Bean was found to be significantly affected by compost (cattle manure) and nitrogen rates fertilizer application at ($P \leq 0.05$).

Table 5, show that both compost and nitrogen fertilizer levels application were significantly affected on the total yield of pods. The total yield of pods (*M*g ha^{-1}) of Broad Bean increased significantly. The maximum value was obtained at (10 *M*g ha^{-1}), with a mean (30.863 *M*g ha^{-1}), while the minimum value (19.350 *M*g ha^{-1}) was recorded at control. Depending on the effect of nitrogen fertilization rate on the total yield of pods, are significantly different, maximum value was obtained at (150 kg ha^{-1}), with a mean (25.961 *M*g ha^{-1}), while the minimum value (23.137 *M*g ha^{-1}) was recorded at control. Concerning the interaction between compost and nitrogen fertilizer levels application on a total yield of pods, significant differences were found at ($P \leq 0.05$). The range of a total yield of pods from (18.694 to 32.981) *M*g ha^{-1}, the highest value was recorded from (M_2N_2), while the lowest value was recorded from (M_0N_0). The obtained results were nearly same as those recorded by (Musleh *et al*. 1976; Aguilera *et al*. 1995).

Table 5. Effect of compost (cattle manure), nitrogen fertilizers and their interactions on the Seeds weight (g pod^{-1}), Yield of seeds (Mg ha^{-1}) and Total yield of pods (Mg ha^{-1}) of Broad Bean.

Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	17.190 f	17.310 f	17.423 ef	17.308c	Seeds weight (g pod^{-1})
5	17.877 de	18.323 cd	18.553 bc	18.251b	
10	18.730 abc	19.173 a	18.997 ab	18.967a	
Nitrogen effect	17.932b	18.269a	18.324a		
Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	3.067 c	3.027 c	3.087 c	3.060c	Yield of seeds (*M*g ha^{-1})
5	3.727 b	3.810 b	4.063 b	3.867b	
10	4.647 a	4.777 a	4.797 a	4.740a	
Nitrogen effect	3.813a	3.871a	3.982a		
Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	18.694 d	18.759 d	20.599 cd	19.350c	Total yield of pods (*M*g ha^{-1})
5	21.436 bcd	24.166 bc	25.003 b	23.535b	
10	29.281 a	31.026 a	32.281 a	30.863a	
Nitrogen effect	23.137b	24.650ab	25.961b		

Means within a column, row and their interactions separatlly followed with the same letters are not significantly different according to Duncan's multiple range tests at ($p \leq 0.05$).

D- Number of Nodules per plant, Nitrogen and Protein (%):

Table 6, appear that the number of nodules plant^{-1} and % nitrogen, % protein in seeds of Broad Bean plant was significantly impacted by compost (cattle manure), nitrogen fertilizers and their interactions application at ($p \leq 0.05$). The number of nodules plant^{-1} was improved significantly with increasing compost-levels, and the greatest amount was obtained at (10 *M*g ha^{-1}) with average value (24.111) and the lowest amount was recorded at control, with average value (18.111). Although slight differences were noticed among the studied nitrogen rates, but statistically they are different significantly. Regarding the interaction between compost and nitrogen-levels on the number of nodules plant^{-1} at ($P \leq 0.05$).The number of nodules plant^{-1} in this study was ranged from (17.667 to 24.333) nodules plant^{-1}, the maximum value was obtained from (M_2N_2), while the minimum value was obtained from (M_0N_1).

Total nitrogen content in the seeds of Broad Bean plant was found to be significantly affected by application of compost (cattle manure), nitrogen levels at ($P \leq 0.05$). The results show in table (6) for Arbat location that by increasing applied compost -rates the nitrogen content in seeds increased significantly. The maximum value was obtained at (10 *M*g ha^{-1}), with a mean (4.891 %), while the minimum mean value was recorded at control, which was (4.225 %). Depending on the nitrogen levels, although slight differences were noticed among the study, and statistically they are not different significantly. The maximum value was obtained at (150 kg ha^{-1}), with the mean (4.611 %), while the minimum mean value was recorded at control, which was (4.539 %). Regarding the interaction between compost (cattle manure) and nitrogen-level on the nitrogen content in the seeds at ($P \leq 0.05$). These results show that by increasing the compost and nitrogen-levels the nitrogen content in the seeds increased significantly. The amount of nitrogen content in the seeds ranged from (4.223 to 4.932) %, the maximum value was produced by (M_2N_2), while the minimum value was produced by (M_0N_0 and M_0N_1).the result in table 6, refer to the significant effect of compost (cattle manure) and nitrogen rates on protein content in the seeds of Broad Bean plant. The results showed that increasing in the compost rates increases the protein content in seeds significantly. The maximum value was obtained at (10 *M*g ha^{-1}), with a mean (30.576 %), while the minimum mean value was recorded at control, which was (26.404 %).

Table 6. Effect of compost (cattle manure), nitrogen fertilizers and their interactions on the number of nodules plant^{-1}, % nitrogen and % protein in seeds of Broad Bean.

Compost as Cattle Manure (M) *M*g ha^{-1}	Nitrogen as Urea (N) kg ha^{-1} 0	100	150	Compost effect	
0	18.000 d	17.667 d	18.667 d	18.111c	Number of Nodules Plant^{-1}
5	20.333 c	20.333 c	22.333 b	21.000b	
10	24.000 a	24.000 a	24.333 a	24.111a	
Nitrogen effect	20.778b	20.667b	21.778a		
Compost as Cattle Manure (M) *M*g ha^{-1}	**Nitrogen as Urea (N) kg ha^{-1} 0**	**100**	**150**	**Compost effect**	
0	4.223 f	4.223 f	4.228 f	4.225c	% Nitrogen
5	4.539 e	4.594 d	4.673 c	4.602b	
10	4.857 b	4.885 b	4.932 a	4.891a	
Nitrogen effect	4.539c	4.568b	4.611a		
Compost as Cattle Manure (M) *M*g ha^{-1}	**Nitrogen as Urea (N) kg ha^{-1} 0**	**100**	**150**	**Compost effect**	
0	26.392 f	26.396 f	26.425 f	26.404c	% Protein
5	28.369 e	28.715 d	29.204 c	28.763b	
10	30.354 b	30.533 b	30.827 a	30.572a	
Nitrogen effect	28.372c	28.548b	28.819a		

Means within a column, row and their interactions separatlly followed with the same letters are not significantly different according to Duncan's multiple range tests at ($p \leq 0.05$).

Although slight differences were noticed among the studied on the nitrogen levels, but statistically, they are different not significantly. The maximum value was obtained at (150 kg ha^{-1}), with the mean (28.819 %), while the minimum mean value was recorded at control, which was (28.372 %). Regarding the interaction between compost (cattle manure) and nitrogen-level on the protein content in the seeds at ($P \leq 0.05$). The amount of protein ranged from (26.392 to 30.827) %, the maximum protein content produced by (M_2N_2), while the minimum protein content was produced by (M_0N_0).

From the above results it has been observed that the application of compost (cattle manure) and nitrogen rates in the higher levels (M_2N_2 and M_2N_1) have a significant effect on yield and yield components of Broad Bean plant in Arbat location-sulaymaniyah governorate, because the compost improve the soil structure, which have been reported to enhance nutrient availability, nutrient absorption, nutrient utilization, plant growth, physiology and metabolism through various mechanisms (Walled *et al.* 2019). The results showed that all fertilization factors had a positive effect on some vegetative and yield traits. The effect of the fertilization was different between the fertilization factors in the vegetative growth characteristics. The fertilization treatments also had a significant effect on most of the studied traits due to the positive effect of organic and chemical fertilizers on most vegetative characteristics and the moral effect in most characteristics. This may be due to the ease and readiness of the nitrogen present in the chemical fertilizer (Cooke, 1972). May be due to the positive role of the element of nitrogen in the chemical fertilizer, which is included in the composition of important biological substances in the plant, such as proteins, nucleic acids and chlorophyll, which helps to increase the division of cells and increase the number and thus increase vegetative growth (Yagodin, 1984). While the positive effect of organic fertilizer in some vegetative growth characteristics and more yield characteristics, may be due to the organic fertilizer content of various sources on the organic compounds dissolved in water, such as sugars, amino acids and humic acids and organic acids, all these compounds contribute directly or indirectly to the growth and development of the plant are encouraging growth by enzymatic or hormonal as it contains nutrients needed by the plant or they affect the nutrient availability already present in the soil by improving soil pH and thus improving plant productivity (AL-Bayati and Kammel, 2014).

CONCLUSIONS

The results of the current work indicate that compost has a positive impact on the yield and its components in broad bean. Using compost may decrease the demand for other chemical fertilizers to a reasonable extent. These wanted outcomes might be attributable to its impact on broad bean growth and physiology. Besides raising yield quantities of broad bean, compost may also contribute to realizing the objectives of agricultural sustainability.

Nitrogen is a central macronutrient needed for plant growth and development. Because nitrogen and compost are involved in affecting physiological and biochemical pathways, they have to be studied thoroughly and profoundly In order to grasp better the nutritional mechanisms of nitrogen about compost and in order to serve as a guideline for developing balanced fertilizer formulas to optimize yield quality and quantity. According to the results obtained from the present research, we guide the related directions to farmers in sulaymaniyah governorate, Kurdistan region–Iraq to cultivate the cv. Spanish of Broad Bean. It is necessary to implement more studies on other levels of compost in Broad Bean plant at different dose along with the nitrogen and other methods of application for reaping higher yield and quality apart from sustaining the soil health. Evaluation of soil fertility status to other potential Broad Bean growing areas should be done to understand the deficiency situation of the nutrients.

REFERENCES

Abeer, M., Sabeha, H. (2019): Effect of organic manure and spraying with boron in seed yield and its components for broad bean (*Vicia faba* L.).- Plant Archives Journal 19(2):1229-1233.

Aguilera, D. C., Recald, M. L. (1995): Effect of plant density and inorganic nitrogen fertilizer on field bean (Vicia faba).- Journal Agric. Sci. Camb. 125(1): 87-93.

AL-Bayati, H. J., Kammel, T.J., (2014): Improving growth and yield by application organic fertilizers compared with chemical fertilizers on tow cucumber (*Cucumis sativus* L.) cultivar which grown under unheated plastic house. - Mesopotamia Journal of Agriculture 42 (1): 168- 176.

Arun, K.S., (2007): Bio fertilizers for sustainable agriculture. - Mechanism of Psolubilization. Sixth edition, Agribios publishers, Jodhpur India. 196-197.

Barakat, M. R., Yehia, T. A., Sayed, B.M. (2012): Response of Newhall Naval orange to Bio – organic ferilization under newly reclamed area conditions I:vegetative growth and nutritional status.- Journal of Horticultural Science and Ornamental Plants 4(1): 18-25.

Blck, C.A., (1983): Methods of plant Analysis. - Parts I and II. Amer. Soc. Agron. Ins. Publ., Madison, Wisc, USA.

Cooke, G.W. (1972): Fertilizing For Minimum Yield. - Crosby Lock Wood and Son ltd. London.

Dhary, S.I., AL-Baldawi, M.H. (2017): Response of different varieties of faba bean to plant source organic fertilizers. - The Iraqi Journal of Agricultural Sciences 48(4): 1141 – 1147.

Finck, A. (1982): Fertilizers and Fertilization: Introduction and Practical Guide to Crop Fertilization. - Verlage Chemie, Weinheim, Deerfield Beach. Switzerland: 438.

Hamissa, M.R. (1973): Fertility studies on some legume crops in Egypt. IAEA, 149-Symposium on use of isotopes for study of fertilizer utilization by legume crop.- Viena 8-12.

Hubbell, D. H., Gerald, K. (2003): Biological nitrogen fixation. Fact sheet of the soil and water science department, Florida Cooperative Extension Service, institute of food and agriculture sciences, University of Florida, pp: 4.

Jassim, A.H., AL-Dulaimi (2012): Effect of adding organic fertilizers and foliar application of humic acid and seaweed extract in growth and green pod yield of broad bean (Vicia faba L.). - Euphrates Journal of Agriculture Sciences 6(1): 163-172.

Kakahy, A.N., Ahmad, N.D., Abdullahi, A. S. (2012): The effect of planting distance on yield of bean (Vicia faba L.) under drip irrigation system. - African Journal of Agricultural Research 46(7): 6110 – 6114.

Kandil, S.A., Hala, Z.R. (2007): Effect of cobalt fertilizers on growth, yield and nutrient of faba bean (Vicia faba L.). - Plant Journal of Applied Sciences Research 3(9): 867 – 872.

Loddo, S., Gooding, M. J. (2012): Semi- dwarfing (Rht-B1b) Improves nitrogenuse efficiency in wheat, but not at economically optimal levels of nitrogen availability.Cereal. Res. Commun.

Luay, D. F. (2012): The Effect of Organic Matter and Potassium Fertilizers on Growth and Yield of Broad Bean (*Vicia faba* L.). - University of Diyala-College of Agriculture- Res. J . Agric. Sci. 4(1): 50-61.

Marculescu, A., Barbu, C. S, Babit, H., Hanganu, D. D. (2002): Possibilities of influencing the biosynthesis and accumulation of the active principals in Chrysanthemum balsamita L. specie Roum. Biotech. Lett. 7(1): 577-548.

Marschner, H. (1995): Mineral nutrition of higher plants. - Academic Press. (London).

Musleh, K.I., Kareem, A., Rashid, K., Bishara, M. A. (1976): Study on the effect of N.P.K. of fertilizer rates on the growth and yield of broad bean. Report 1. Central of Fertility and Fertilizer Research.

Nuaimi, S.A. (2011:. Principles of Plant Nutrition. (Translated).5th Edition. Ministry of Higher Education and Science Research, Iraq. 1440 pp.

Ozores-Hampton, M.P., Stansly P.A., Salame, T.P. (2011): Soil chemical, biological and physical properties of a sandy soil subjected to long-term organic amendments. - J. Sustain. Agric. 353: 243-259.

Rowell, D.L. (1996): Soil science. Methods and application. - Univ. of Reading. UK.

Sabh, A.Z., Shallan, M.A. (2008): Effect of Organic Fertilization of Broad Bean (*Vicia faba* L.) By Using Different Marine Macroalgae in Relation to the Morphological, Anatomical Characteristics and Chemical Constituents of the Plant. - Australian Journal of Basic and Applied Sciences 2(4): 1076-1091.

Shafeek, M.R., Helmy, Y.I., Nadia, M., Fatma A. (2013): Effect of foliar fertilizer with nutritional compound and humic acid on growth and yield of broad bean plants under sandy soil conditions. - Vegetable Research Dept., National Research Centre, Dokki, Cairo, Egypt. J. of Applied Sciences Research 9(6): 3674-3680.

Steel, R. G. D. Torrie, J. H. (1980): Principles and Procedures of Statistics. - 2nd ed. Mc Graw Hill Book., New York.

Walled B., Hussein J. M., Fadel, F., Shamil Y. (2019): Effect of chemical and organic fertilizer on three varieties of broad bean. - Mesopotamia J. of Agric. 47(2): 73-82.

Yagodin, B.A. (1984): Agriculture Chemistry (1ed). - Mir Publishers, Moscow. USSR

تأثير المستويات المختلفة من الكومبوست والأسمدة النيتروجينية على نمو وإنتاج الباقلاء (*Vicia faba* L.) في ظروف التربة الطميية الطينية

محمد تحسين معروف

قسم الموارد الطبيعية، كلية علوم الهندسة الزراعية، جامعة السليمانية، السليمانية، إقليم كردستان، العرا ق

أجريت التجربة الميدانية في موقع عربت بمحافظة السليمانية ، العراق. الهدف الرئيسي من هذا البحث هو تقييم تأثير إضافة مستويات مختلفة من السماد الكومبوست (روث الماشية) ومعدلات النيتروجين (اليوريا) على محصول الباقلاء (*Vicia faba* L) ومكوناته. تم تنظيم المعاملات التجريبية ووضعت تجربة عاملية في تصميم القطاعات العشوائية الكاملة بثلاث مكررات. تضمنت المعالجات ثلاثة مستويات من الكومبوست وثلاثة مستويات من النيتروجين. يمكن تلخيص النتائج الرئيسية على النحو التالي، اضافة الكومبوست من صفر، 5 إلى 10 طن لكل هكتار اثرت بشكل معنوي علي معاملات النمو الخضري، ارتفاع النبات (سم)، عدد فروع لكل النبات، المحصول البيولوجي (غم)، طول القرنة (سم)، عدد القرون لكل نبات، متوسط وزن القرون (غم)، وزن البذور (غرام لكل قرنة)، انتاج البذور (طن لكل هكتار)، إجمالي إنتاج القرون (طن لكل هكتار)، عدد العقيدات لكل النبات و ٪ نيتروجين ،٪ بروتين في بذور نبات الباقلاء. كما تم زيادة متغيرات النمو الخضري، محصول الباقلاء وجودة القرون وكذلك القيمة الغذائية للباقلاء مع زيادة مستوى إضافة النيتروجين من صفر، 100 إلى 150 كغم هكتار.