



# Response of three broad bean cultivars to adding of tow animal manure

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## Abstract

A field experiment was conducted during the winter season 2021-2022 in the field experiments field of the College of Agriculture - Al-Qasim Green University to know the response of three cultivars of bean to the addition of two types of animal manure using a factorial experiment randomized complete block design (RCBD) and with three replicates, the first factor, three genotypes of the broad bean (local, Turkish and Spanish) The second factor is two types of animal manure at five levels (without adding and half recommendation animal, full animal recommendation, half poultry recommendation, and full poultry recommendation). The results showed that there were significant differences between the factors and their interactions under the 5% probability level for all the studied traits. The results showed that the genotypes varied in their traits. The local genotype achieved excelled and gave the highest average in most vegetative traits (such as chlorophyll content in leaves, plant height, number of branches and number of leaves). While the Spanish genotype excelled in 50% flowering trait, while the Turkish genotype was superior in leaf area, the results of the effect of the levels of the two organic fertilizers showed a significant effect if the entire addition of poultry manure excelled on the rest of the levels and led to a significant increase in the vegetative growth traits ( 50% flowering, chlorophyll content in leaves, plant height, number of leaves and leaf area, As for the interaction between genotypes with fertilizer additives, it had a significant effect, where the local genotype with the full recommendation for poultry manure was excelled in the traits of 50% flowering and plant height, while the local genotype with the full recommendation of animal manure was excelled in the trait of chlorophyll content in leaves. As for the Turkish genetic structure with the full recommendation for poultry, it was excelled in leaf area and harvest index, while half of the recommendation for poultry manure was excelled in the traits of the number of leaves. The Turkish genotype with the complete recommendation of animal manure also excelled in the trait of the number of branches, while there are no significant differences between the Spanish genotype with the full recommendation of poultry manure in the traits of vegetative growth. While the Spanish genotype with the full recommendation of animal manure excelled in its cultivar the number of days from cultivation to physiological maturity

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## Introduction

The *Vicia faba L* is one of the oldest crops known and cultivated by man, as it is used as food since the beginning of man's knowledge of the agricultural profession. It is considered one of the winter crops belonging to Fabaceae family where its seeds contain a high percentage of protein estimated at about 25-40%). Natalia et al. 2008), In addition, its seeds contain a high percentage of carbohydrates, reaching in most cultivars to 56%, and the minerals, fibres and vitamins they contain (Salem, 2009).cultivars of broad bean vary in vegetation

different in their size, height, the height of their stems and branches, which leads to the difference in the shape of the plant as well as the difference in the size of the seeds, some of them have large seeds and some have small seeds As well as the difference in the content of the seeds of nutrients and the percentage of protein, and these differences are often due to the nature of the cultivar, genetic composition and environmental conditions, (Daur et al., 2008). The process of adding chemical fertilizers is an economically costly process as well as its =

according to the nature of their growth, and are

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harmful impact on the environment, so other alternatives have been used, such as animal fertilizers (poultry, cows and buffalo waste) and human and plant waste as alternatives to chemical fertilizers, (Oad et al., 2004). The efficient addition of organic fertilizers ensures a high and continuous production of crops by improving the properties of the soil and increasing the development and activity of the roots (Abou EL Magd, 2006)Poultry manure also contains good amounts of nutrients and its residual effect for several seasons and its multiple benefits make it a successful alternative to chemical fertilizers and is considered one of the environmentally friendly processes (Hirzel et al., 2007)The results of Hudhali and Al-Jubouri, (2016) in their study on the bean plant (Luzdeotono) showed that there were significant differences between the averages for the traits of the number of days from planting up to 50% of flowering, plant height, number of branches and leaf area. Abdullah (2019) found, when studying four cultivars of barley, that there were significant differences between the cultivars, where the local cultivar excelled on the rest of the cultivars for the traits of plant height, number of branches, leaf area and chlorophyll content.Jassim et al. (2016) explained in their study on some fertilizers, where the addition was to the ground before planting, an organic fertilizer (sheep waste) was used. The results showed that the addition of organic fertilizer led to an increase in the height of the plant, the number of plant branches, plant leaves, and the content of chlorophyll in the leaves. An experiment was conducted on the effect of sheep manure on the growth and yield of beans. Where organic fertilizers (fermented sheep waste) were used, and the results showed that there are significant differences

between the levels of organic sheep waste. Where the level of addition of 5 tons.ha-1 was significantly excelled in all the studied traits, plant height, number of branches and chlorophyll content in leaves compared to no addition, which gave the lowest rates for the studied traits, Azzam (2019)

**Materials and methods**

The factorial experiment was conducted with two factors during the winter season 2021-2022 in the field of the College of Agriculture - Al-Qasim Green University. In order to study the response of three cultivars of broad bean to the addition of two types of animal manure. The first factor has three genotypes (local, Turkish and Spanish from the broad bean plant, and the second factor has two types of animal manure (poultry manure and buffalo manure) and two levels of each (full adding and half adding). The experiment was factored according to the randomized complete block design (RCBD) with three replicates, and the number of experimental units within each replicate was 15 experimental units (3 x 5).The first factor included three genotypes of broad beans (local, Turkish and Spanish) and the second factor five levels of organic fertilizer (without adding half the addition of poultry manure, half the addition of buffalo manure and the full addition of each of the two fertilizers).The width of the experimental unit is 2.25 m and its length is 5 m, and in each experimental unit there are three furrows, a length of 5 m and a width of 0.75 m.Random samples were taken from field soil at a depth of 0-30 cm for different locations and analyzed in the Laboratory of the Water and Soil Management Division in Mouradia, the results of which are shown in Table 1.

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**Table 1: shows some physical and chemical properties of field soil after mixing fertilizer with soil**

Samples type	N mg.g-1	P mg.g-1	K mg.g-1	M.O mg.g-1
Without additions	0.031	0.008	0.082	1.5
half poultry	0.093	0.0086	0.3	2.44
full poultry	0.157	0.0122	0.89	4.54
half animal	0.034	0.0097	0.26	1.98
full animal	0.049	0.0125	0.46	2.69
Poultry	0.247	0.079	30.4	70.1
animal	0.181	0.052	30.2	34.8



**Table 2: shows the Ec and pH of field soil**

Samples	pH	EC
Without additions	6.55	1.73 ms/cm
half poultry	7.08	3.25ms/cm
full poultry	7.58	3.88ms/cm
half animal	7.05	3.35ms/cm
full animal	6.99	3.13ms/cm
Poultry	6.64	22.7ms/cm
animal	7.24	15.13ms/cm

cultivation was conducted on 10/23/2021 by placing two seeds in the pit after grafting, after testing the germination percentage of the genotypes, which amounted to 59%. When half of the flowering was completed, growth traits were calculated.

1- Number of days from planting to 50% flowering: It was calculated from planting until the percentage of flowering reached 50% and based on the number of plants in the experimental unit.

2- The chlorophyll content of the leaves (SPAD). The content of chlorophyll in plant leaves after 50% of flowering was estimated by using a SPAD device of the type Chlorophyll meter Spad-502 plus by taking readings for five plants randomly and taking the average (Jemison and Williams, 2006).

3- Plant height, cm: The plant height was measured using a measure from the point of contact of the plant with the surface of the soil to the top of the plant, and the average measurement of five plants was taken from the middle lines taken at random from each experimental unit (Al-Sahoki, 1990).

4- Number of branches per plant (branch plant -1): The number of branches for each plant was calculated as an average of five plants taken at random.

5- Number of leaves per plant (leaf plant-1): The number of leaves per plant and for five plants was calculated and then its average was taken.

6- The leaf area of the plant cm<sup>2</sup>: The leaf area was calculated according to the following law

$$\text{Leaf area} = \text{length} \times \text{width} \times 0.57$$

$$\text{leaf area} = \text{leaf area} \times \text{number of leaf}$$

$$\text{Leaf area} = \text{leaf area} \times \text{number of plant leaves}$$

(Wally, 2016).

The results of the experiment were statistically analyzed according to the method of analysis of variance using a randomized complete block design (R.C.B.D).The significant differences between the treatments were calculated at a significant level of 0.05 for the least significant difference LSD. The Genstat program was used in the statistical

analysis.

### Results and discussion

50% flowering: The results of Table 1 showed the Spanish genotype excelled by giving it the lowest average of 79.27 days for 50% flowering trait. While the local genotype gave the highest average of 86.80 days, and here the effect of genotype on this trait appears, and the reason for the discrepancy in the number of days from planting to 50% flowering may be due to the difference in the genotype as some structures may differ among themselves in the vegetative growth so it is shorter than others, Therefore, we note that it flowering early, and these results are similar to what was reached by Mulualem et al. (2012). It is noted from the same table that the entire addition of poultry manure gave the highest average for the trait, which reached 84.67 days, While the treatment without the addition of fertilizer gave the lowest average of 80 days, and there was no significant difference between it and the half of the addition of animal manure, which amounted to 81.78 days. The reason for this may be due to the fact that the increase in animal manure (poultry manure) led to an increase in nutrients and their readiness for absorption by the plant, which led to an increase in the capacity of the photosynthesis process, which in turn leads to the plant reaching the stage of 50% flowering, and these results are consistent with (Delicious and Khanyab, 2017).As for the interaction, the interaction between the local genotype with the complete addition of poultry manure showed the highest average of 88 days, while the interaction between the Turkish cultivar without fertilizer gave the lowest average of 75 days.It is also noted that half of the addition and the full addition of poultry manure gave an average higher than the general average for 50% flowering.



**Table 1: Effect of genotype and level of organic fertilizer on 50% flowering.**

genotype s	fertilizer					Average effect of genotype s
	Without adding fertilizer	Half Recommendation (animal manure)	full Recommendation (animal manure)	Half Recommendation (Poultry Manure)	full Recommendation (Poultry Manure)	
local	85.67	86.33	86.33	87.67	88.00	86.80
Turkish	75.00	79.33	79.67	81.67	86.00	80.33
Spanish	79.33	79.67	78.67	78.67	80.00	79.27
Average effect of fertilizer	80.00	81.78	81.56	82.67	84.67	
L.S.D 0.05	genotype s	fertilizer	interaction	overall average	Variation coefficient %	
	0.84	1.09	1.89	82.13	1.40	

**Chlorophyll content in leaves (SPAD)**

As we note from Table (2) that the local genotype gave the highest average chlorophyll content of 17.48 (SPAD), while the Spanish genotype gave the lowest average for this trait of 45.03 (SPAD), Hence, the effect of the genotype on the chlorophyll pigment content of the leaves appears, or perhaps the reason is due to the difference between the cultivars in their content of chlorophyll, and this difference may not be significant because the amount of chlorophyll pigmentation is almost determined in most cultivars that belong to broad bean. These results are in agreement with the findings (Hendawe and Younes, 2013). It is noted from the same table that the entire recommendation for poultry gave the highest

average of 47.92 (SPAD) compared to without adding poultry manure, which gave the lowest average of 43.73 (SPAD), This may be due to the fact that adding animal fertilizers may increase the percentage of chlorophyll in the plant, and this was confirmed by Al-Moussawi (2014). As for the interaction, the local genotype with the entire recommendation of animal manure gave the highest mean of 50.14 (SPAD). While the Spanish genotype with no addition of manure gave a lower average of 42.61 (SPAD), and it is noted that the entire recommendation of animal manure and the entire recommendation of poultry manure gave a higher average than the general average of 46.13 (SPAD).

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**Table 2: Effect of genotype and level of organic fertilizer on the content of chlorophyll pigments (SPAD) in leaves.**

genotype s	fertilizer					Average effect of genotype s
	Without adding fertilizer	Half Recommendation (animal manure)	full Recommendation (animal manure)	Half Recommendation (Poultry Manure)	full Recommendation (Poultry Manure)	
local	45.80	49.38	50.14	46.78	48.74	48.17
Turkish	42.77	45.43	46.40	44.09	47.33	45.21
Spanish	42.61	42.90	46.50	45.45	47.67	45.03
Average effect of fertilizer	43.73	45.90	47.68	45.44	47.92	
L.S.D 0.05	genotype s	fertilizer	interaction	overall average	Variation coefficient %	
	1.18	0.91	2.04	46.13	2.6	

**Plant height (cm)**

Table (3) that the local genotype gave the highest average plant height of 135.92 cm compared to the

Spanish genotype, which gave the lowest average of 93.76 cm and that these differences in plant height .It may be due to the effect of genotype and the



extent of adaptation of these cultivars to the surrounding environmental conditions, or the reason may be due to the nature of gene expression differences between one cultivar and another, and this is what Hendawey and Younes (2013) indicated. It is noted from the same table that the entire recommendation for poultry gave the highest average of 133.77 cm, while without adding fertilizer, it gave the lowest average of 102.82 cm. The increase in plant height is due to the role of organic matter in increasing the number and size of leaves and supplying them with adequate nutrients . Which increases the amount of light interception and then an increase in the process of

photosynthesis and an increase in the amount of manufactured materials in the leaf that the plant benefits from in forming its parts and the growth of these parts in the best way, and these results are consistent with what Al-Salmani and Al-Bandawy found (2014). As for the interaction, the local genotype with the entire recommendation of poultry manure gave the highest average of 154.67 cm, while the Spanish genotype without adding manure gave the lowest average of 87.93 cm, It was also noted that half of the recommendation for poultry manure and the entire recommendation for poultry gave an average higher than the general average of 117.70 cm.

**Table 3: Effect of genotype and level of organic fertilizer on plant height trait(cm).**

genotypes	fertilizer					Average effect of genotypes
	Without adding fertilizer	Half Recommendation (animal manure)	full Recommendation (animal manure)	Half Recommendation (Poultry Manure)	full Recommendation (Poultry Manure)	
local	122.47	128.20	132.80	141.47	154.67	135.92
Turkish	98.07	118.87	123.20	129.47	147.57	123.43
Spanish	87.93	92.60	96.73	92.47	99.07	93.76
Average effect of fertilizer	102.82	113.22	117.58	121.13	133.77	
L.S.D 0.05	genotypes	fertilizer	interaction	overall average	Variation coefficient %	
	3.10	4.00	6.93	117.70	3.50	

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**Number of branches (branch Plant-1)**

Table (4) that the local genotype gave the highest average of 17.17 branch Plant-1 While the Spanish genetic structure gave the lowest average number of branches, which amounted to 11.09 branch Plant-1, hence the genetic influence on the number of branches appears. 2011),Also, the variation between the cultivars is due to the genetic variation among them in their ability to branch. These results are in agreement with the findings of Fouda (2015). We also note from the same table that the entire recommendation for animal fertilizer gave the highest average of 17.30 branch Plant-1, while without adding fertilizer it gave the lowest average for this trait of 12.20 branch Plant-1, This increase in the number of branches in the plant may be attributed to the role of organic matter (animal fertilizers) in releasing nutrients, the most important of which is nitrogen, which is necessary

for the elongation and division of cells, growth and development of plants, and the role of organic matter in improving the physical and biological properties of the soil and increasing the readiness for absorption of most macro and Micro elements, which is reflected positively. On the general activity of the plant and the increase in the number of its branches (Muhammad), 2008).As for the interaction, the Turkish genotype with the entire recommendation gave an animal the highest average of 20 branch Plant-1, while the Spanish genotype without adding fertilizer gave the lowest average of 9 branch Plant-1, and we note that the entire recommendation of animal fertilizer and the entire recommendation of poultry gave a higher average From the overall average, it was 14.39 branch Plant-1.



**Table 4: Effect of genotype and level of organic fertilizer on the characteristics of the number of branches in the plant.**

genotype s	fertilizer					Average effect of genotype s
	Without adding fertilizer	Half Recommendation (animal manure)	full Recommendation (animal manure)	Half Recommendation (Poultry Manure)	full Recommendation (Poultry Manure)	
local	15.10	16.67	19.07	16.20	18.80	17.17
Turkish	12.50	11.67	21.00	13.33	16.07	14.91
Spanish	9.00	9.83	11.83	10.77	14.00	11.09
Average effect of fertilizer	12.20	12.72	17.30	13.43	16.29	
L.S.D 0.05	genotype s	fertilizer	interaction	overall average	Variation coefficient %	
	0.77	1.00	1.73	14.39	7.20	

**Number of Leaves (Leaf.plant-1)**

We note from Table (5) that the local genotype gave the highest average number of leaves, amounting to 230.20 Leaf.plant-1 While the Spanish genotype gave the lowest average for this trait, which was 85.40 leaf-1. Hence, the effect of the genotypes on the leaves appears, if the broad bean cultivars differ in the number of leaves among themselves. The reason is due to the genetic nature of it related to the genes responsible for the degree of gene expression of these genes, where it was observed that the cultivars of broad bean vary in the number of leaves, but it has a significant effect on the yield and this change is due to the difference in the number of branches per plant Khattab et al. (2016).We also note from the same table that the

entire recommendation to add poultry manure gave the highest average of 196.40 Leaf.plant-1, while without adding fertilizer, it gave the lowest average for this trait of 140.80 Leaf.plant-1.As for the interaction between the genotypes and the levels of fertilizer additions, the local genotype with half a recommendation of poultry manure gave the highest average of 268.70 Leaf.plant-1, while the Spanish genotype without fertilizer gave the lowest average for this trait amounting to 69 Leaf.plant-1. and that the full recommendation of animal manure with half of the recommendation and the full recommendation of poultry manure gave an average higher than the general average, which amounted to 166.6 Leaf.plant-1.

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**Table 5: Effect of the genotype of broad bean and the level of organic fertilizer on the trait of the number of leaves per plant**

genotype s	fertilizer					Average effect of genotype s
	Without adding fertilizer	Half Recommendation (animal manure)	full Recommendation (animal manure)	Half Recommendation (Poultry Manure)	full Recommendation (Poultry Manure)	
local	233.10	200.10	212.50	268.70	236.90	230.20
Turkish	120.30	158.10	220.00	152.90	254.40	181.10
Spanish	69.00	76.70	89.70	93.50	97.90	85.40
Average effect of fertilizer	140.80	145.00	174.10	171.70	196.40	
L.S.D 0.05	genotype s	fertilizer	interaction	overall average	Variation coefficient %	
	12.66	16.35	28.32	166.60	10.20	

**Leaf area (m2)**

Table (6) that the Turkish genotype gave the highest average leaf area trait of 2.59 m2, and there



was no significant difference between it and the local cultivar, which had an average leaf area of 2.56 m<sup>2</sup>. While the Spaniard gave the lowest average of 1.19 m<sup>2</sup>, hence the effect of genotype on the trait of leaf area, and these results are consistent with the findings of Al Ani and Abdul Hamid (2017). We also note from the same table regarding the fertilizer recommendations that the entire addition of poultry gave the highest average for this trait of 02.7 m<sup>2</sup>, while without adding fertilizer it gave the lowest average of 1.57 m<sup>2</sup>, The reason for this difference may be due to the animal manure's content of the necessary nutrients,

especially nitrogen, which is an important element for plant growth and development, as it enters the building of protein and part of chlorophyll, which is positively reflected on vegetative growth and thus increases the leaf area of the plant. These results are consistent with the results of Aziz et al. (2010). As for the interaction between genotypes and fertilizer additions, the Turkish genotype with the full recommendation gave poultry the highest average of 3.66 m<sup>2</sup>, While the Spanish genotype without adding fertilizer gave the lowest average of 0.83 m<sup>2</sup>.

**Table 6: Effect of the genotype of broad bean and the level of organic fertilizer on the leaf area of the plant (m<sup>2</sup>).**

genotype s	fertilizer					Average effect of genotype s
	Without adding fertilizer	Half Recommendation (animal manure)	full Recommendation (animal manure)	Half Recommendation (Poultry Manure)	full Recommendation (Poultry Manure)	
local	2.35	2.31	2.47	2.76	2.90	2.56
Turkish	1.53	2.23	3.28	2.27	3.66	2.59
Spanish	0.83	1.00	1.37	1.24	1.53	1.19
Average effect of fertilizer	1.57	1.85	2.37	2.09	2.70	
L.S.D 0.05	genotype s	fertilizer	interaction	overall average	Variation coefficient %	
	0.13	0.17	0.30	2.12	8.40	

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**Conclusions**

The local genotype had a significant effect on most vegetative growth traits. The addition of organic fertilizers to the bean plant led to an increase in all growth indicators, represented by vegetative traits. The interaction between the genotypes and the levels of the two organic fertilizers led to a difference in all the studied traits.

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