Effect of chemical and nano fertilizers on the yield and its components of broad bean crop

Raghad Katran Hassan[1] Nasser Marouf Nasser[2]

[1]Al-Musayyib Technical College, Al-Furat Al-Awsat Technical University

[2] Essaouira Technical Institute, Central Technical College

Nasser .78@mtu.edu.iq

Abstract

A field experiment was conducted in two locations, the first in Wasit province, Al-Hafria area, and the second in the Al-Azzawiya area, north of Babylon province, during 2022-2023 agricultural season, in order to study the effect of chemical and nano-fertilizers on traits of the yield and its components of the bean crop. The experiment included three factors, the first three cultivars: Aquadulce, Aquadulge, and LuzDeotono. The second factor is three levels of NPK chemical fertilizer (100, 50, 0%), and the third factor is three levels of nano-fertilizer at three concentrations (4, 2, 0 g L^{-1}). The experiment was applied in a split-plot method according to the design of complete plots. Randomized R.C.B.D with three replications. The Aquadulce cultivar excelled in the number of seeds per pod, reaching 6.05 and 5.92 pod seeds, the total yield was 9.11 and 9.45 tons .ha^{-1}, and the biological yield was 14.32 and 15.04 tons .ha^{-1} for the two location respectively. While the Luz De Otono cultivar gave the two highest averages in the number of pods .plant and the weight of 100 seeds, reaching 18.83 pods .$plant^{-1}$ in the second location and 159.22 g in the first location. Increasing the level of mineral fertilizer to 100% led to an increase in the yield trait and its components for the two location, as It gave the highest averages in the number of pods .plant, the number of seeds per pod, the total seed yield, and the biological yield, which reached 21.15 and 22.28 pods .$plant^{-1}$, 6.28, and 6.22 seed pod^{-1}, 11.94, and 12.36 tons per ha-1, and 17.66, and 18.27. Ton-1 for successive signatories compared to the control treatment. Spraying with nanofertilizer with the highest concentration of N2 gave the highest average weight of 100 seeds, reaching 164.25 and 163.65 grams for the two location respectively. The interaction between chemical and nano-fertilizers had a significant effect on some yield traits, as the combination (F2×N2) gave the two highest averages for total seed yield and biological yield, reaching 14.41 and 15.00 tons ha^{-1} and 20.87 and 21.60 tons ha-1 for the two location respectively. The interaction between the chemical fertilizer and the cultivars had a significant effect, as the combination (F2×V1) gave the highest averages in total yield, amounting to 12.50 and 13.20 tons ha^{-1}. The interaction between the nano-fertilizers and the cultivars had a significant effect, as the combination (N2×V2) gave the two highest

ISSN 2072-3857

averages in the number of The pods .plant and the weight of 100 seeds reached 20.33 pods .plant and 167.02 grams in the first location. The triple interaction was significant in the total seed yield and the biological yield of the two location in the sequence with the combination (F2×N2×V1), giving the two highest averages of 15.76 and 16.93 tons ha^{-1} and 22.79 and 24.77 tons ha^{-1}.

Keywords: chemical fertilizer, nano, cultivars

introduction:

The broad bean crop, Viciafaba L., is one of the important seed Fabaceae crops. It is a basic food for millions of people in poor countries. Its seeds contain a high percentage of protein, ranging between 28-38%, in addition to containing in most cultivars carbohydrates reaching a percentage of (40-46%). And fibres, mineral elements, and vitamins such as vitamin B1, B2, and vitamin C [17] . broad beans have an important role in improving soil properties by fixing atmospheric nitrogen. They also contribute to organizing agricultural cycles for crops, especially in rain-fed areas where it is difficult to use chemical fertilizers , The bean crop contributes to improving the physical and chemical traits of the soil through its important role in fixing atmospheric nitrogen because its roots contain root nodules that coexist with Rhizobium bacteria[2]. The total yield of beans in the world reached 8,210 tons ha^{-1} [10]. while its productivity in Iraq reached 3,790 kg ha^{-1} (Central Bureau of Statistics 2020.(The importance of chemical fertilization was known in 1960 in providing the necessary nutrients to increase the efficiency of agricultural production. It was noted that 50% of the increase in improving crop production is due to the use of mineral fertilizers[9] . Chemical fertilizers... It is classified into nitrogen, phosphorus and potassium fertilizers, in addition to calcium And magnesium and sulfur[13] . Nanotechnology may contribute to increasing agricultural production and also reduces environmental problems. Nanofertilizers are highly effective because they have a larger surface area [7] . The basis for expanding the cultivation of the bean crop and cultivating high-yielding cultivars to increase production is by following field methods with an effective effect [4]. The study aimed to determine the best amount of chemical and nano-fertilizer that contributes to improving the broad bean yield and to determine the best cultivar in responding to fertilization with different concentrations of Chemical and nano-fertilizers and studying the interaction between the study factors to find out the best combination in improving the characteristics of the broad bean crop.

Materials and methods:

The field experiment was conducted in two locations during the agricultural season (2022-

2023), and samples were taken randomly from different places and mixed together to take a compolocation sample representing the experimental field for both locations and at a depth of (0-30) cm.

Table. (1) Some physical and chemical traits of the experimental field before planting and for the two location (2022-2023)

unit	Secod location	First location	traits	
-	7.9	7.1	pH	
DS. m^{-1}	4.2	4.7	E.C	
Centmol per kg^{-1}	23	27	CEC	
mg/kg soil	17.9	14.8	availible nitrogen	
mg/kg soil	7.4	7.1	availible phosphorus	
mg/kg soil	189	182	availible potassium	
g/kg soil	102	100	Organic matter	
Mg. m^{-3}	1.21	1.27	Bulk density	
$g.kg^{-1}$	g kg-1 soil	229	Clay	Soil separators
	312	309	Silt	
	451	449	sand	
	silty		Soil texture	

Plowing operations were carried out using a flatbed plow, and leveling and smoothing operations were carried out. The land was divided according to the design used in the experiment, the field was planned, and the seeds were planted on October 15 [6], and the seeds were planted on lines, and the distance between one line and another was (60 cm), and the experimental unit was Using a board (3*3) containing six lines of length (3 m) per line. The seeds were planted at a distance of (25 cm) between one hole and another, and two seeds were placed in one hole. The experiment was carried out (the split-plate experiment). Split plots (according to a randomized complete block design) (R.C.B.D) with three replicates and includes a split-plate experiment to study three factors, which are the varieties Aquadulce, Aquadulge, and LuzDeotono, the chemical fertilizer at three levels (100, 50,0%) and the nano fertilizer at three concentrations (4,2,0 $g.L^{-1}$) Some characteristics were measured Yield: 1. Number of seeds per pod 2. Number of pods per plant 3. Weight of 100 seeds 4. Total seed yield 5. Biological yield.

ISSN 2072-3857

Results and discussion :

1. Number of seeds per pod (seed pod $^{-1}$)

The results of the statistical analysis showed a significant effect of the individual factors and the bi-interaction between Chemical Fertilizer, Nano Fertilizer, Chemical Fertilizer, Cultivars, and the triple interactions in the first location, while the significant effect was limited to the single factors, the bi-interaction between Chemical Fertilizer and Cultivars, and the triple interactions in this traits .It was observed that there was a significant increase in the number of seeds per pod for both locations with an increase in the level of chemical fertilizer, as the highest level of the mineral F2 recorded the two highest averages for this trait, reaching 6.28 and 6.22 seed pod^{-1}, while the control treatment F0 gave the two lowest averages for the number of seeds in the pod, reaching 6.28 and 6.22 seed pods^{-1}. 4.62 and 4.72 seeds pod^{-1}. The reason for this may be that this increase is due to the role of bacteria, which contributed to increasing the nodulation process and its weight, thus increasing the fixation of atmospheric nitrogen and providing it to the plant, as well as contributing to equipping the plant with plant hormones, which helped in the nodulation process and good seed growth. And reducing competition between them for food materials [18], and this result agreed with the findings of [8] who showed that there were significant differences in the number of seeds per pod when adding NPK compound fertilizer to the broad bean crop.The results also showed that spraying nano fertilizer with the highest concentration of N2 led to an increase in the number of seeds per pod for both locations, as it gave the highest averages of 5.90 and 5.92 seed pod^{-1}, while the control treatment N0 gave the lowest average of 5.04 and 5.01 seed pod^{-1}. The reason for this may be attributed to the increase in pod length at the same concentrations, which in turn leads to an increase in the number of seeds in the pod. This result agreed with the findings of [12] who showed that there was a significant increase in the number of seeds in the pod when nano fertilizer was added to the bean crop. The cultivar (V1) also recorded the highest averages for the number of seeds per pod, reaching 6.05 and 5.92 seeds per pod, for both locations, while the cultivar (V2) gave the lowest averages, reaching 5.04 and 5.32 seeds per pod, respectively, for both locations. This result agreed with What was indicated by [3] who showed that there was a significant increase in the types of broad beans. As for the effect of the interaction between Chemical Fertilizer and Nano Fertilizer, it was significant in the first location only. The highest level of Chemical Fertilizer F2 with the highest concentration of Nano N2 was recorded for the combination (F2×N2). The

ISSN 2072-3857

highest average for this trait reached 6.43 pod-1 seeds, while The control treatment for both the mineral F0 and nano fertilizer N0 combination (F0×N0) gave the lowest average of 4.01 seeds pod^{-1} in the first location only.There was also a significant effect of the binary interaction between chemical fertilizer and cultivars for both locations, as the highest level of mineral F2 with the cultivar (V1) gave the combination (F2×V1) the highest average number of seeds per pod, amounting to 6.84 seeds pod-1 in the first location, and the combination (F2×V1) gave the highest average. V2) The highest average for this trait was 6.46 pod seeds $^{-1}$ in the second location.While the triple intervention had a significant effect for both locations on this trait, as the combination consisting of the highest level of chemical and the highest concentration of nano fertilizer with the Aquadulca cultivar ((F2×N2×V1) gave the highest average of 7.06 seeds pod^{-1} in the first location, and the combination gave (F2×N2×V3 had the highest average of 6.97 seeds pod^{-1} in the second location, while the combination (F0×N0×V2) gave the two lowest averages in this trait, reaching 3.56 and 3.63 seeds pod^{-1}, respectively, for both locations.

ISSN 2072-3857

Table (2) The effect of chemical fertilizer and nano fertilizer on the number of seeds per pod (seed pod^{-1}) for the first location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
5.11	5.70	5.46	4.17	F_0	V1
6.20	6.63	6.36	5.60	F_1	
6.84	7.06	7.00	6.46	F_2	
4.21	4.46	4.60	3.56	F_0	V2
5.16	5.43	5.70	4.36	F_1	
5.74	5.86	5.60	5.76	F_2	
4.53	4.83	4.46	4.30	F_0	V3
6.17	6.73	6.43	5.36	F_1	
6.27	6.36	6.63	5.83	F_2	
0.24	0.37			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
6.05	6.46	6.27	5.41	V1	
5.04	5.25	5.30	4.56	V2	
5.66	5.97	5.84	5.16	V3	
0.09	N.S			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer × nano fertilizer				
4.62	5.00	4.84	4.01	F0	
5.84	6.26	6.16	5.11	F1	
6.28	6.43	6.41	6.02	F2	
0.16	0.23			LSD (0.05)	
average nano fertilizer					
0.12	5.90	5.80	5.04	LSD (0.05)	

ISSN 2072-3857

Table (3) The effect of chemical fertilizer and nano fertilizer on the number of grain per pod (seed pod-1) for the second location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
5.06	5.33	5.36	4.50	F_0	V1
6.32	6.60	6.56	5.80	F_1	
6.37	6.66	6.85	5.60	F_2	
4.67	5.16	5.22	3.63	F_0	V2
5.45	5.43	5.90	5.03	F_1	
5.84	6.26	5.83	5.43	F_2	
4.42	4.70	4.50	4.06	F_0	V3
5.73	6.20	5.83	5.16	F_1	
6.46	6.97	6.56	5.86	F_2	
0.27	0.49			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
5.92	6.19	6.26	5.30	V1	
5.32	5.62	5.65	4.70	V2	
5.54	5.95	5.63	5.03	V3	
0.23	N.S			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer × nano fertilizer				
4.72	5.06	5.02	4.06	F0	
5.83	6.07	6.10	5.33	F1	
6.22	6.63	6.41	5.63	F2	
0.14	N.S			LSD (0.05)	
average nano fertilizer					
0.17	5.92	5.84	5.01	LSD (0.05)	

Number of pods . plant (pod plant $^{-1}$)

The results of the statistical analysis showed a significant effect of the individual factors and the bi- and triple interactions for both location on the number of pods . plant.The results indicate that there is a significant effect

ISSN 2072-3857

of chemical fertilizer in increasing the number of pods . plant for both location, as the highest level of chemical F2 gave the two highest averages for this trait, amounting to 21.15 and 22.28 pods plant $^{-1}$, while the control treatment F0 gave the two lowest averages for the number of pods . plant, amounting to 14.33 and 14.18. pods plant $^{-1}$for the two location respectively. The reason for this is that adding chemical fertilizers such as nitrogen, phosphorus and potassium increases the strength of growth and increases photosynthesis and thus the net process of photosynthesis, which leads to an increase in the number of pods in the plant. This result agreed with what was indicated by [16] who showed an increase in the number of pods when adding NPK mineral fertilizer to the broad bean crop.It became clear that spraying with nanoparticles led to a significant increase in the number of pods . plant for both location, as the highest concentration of nanoN2 recorded the two highest averages for this trait, amounting to 19.84 and 20.23 pods plant $^{-1}$, while the control N0 treatment gave the two lowest averages for the number of pods . plant, amounting to 15.06 and 15. 75 pods plant $^{-1}$. The reason for this may be that adding nanofertilizer at different stages of growth benefits the plant by encouraging vegetative growth, such as plant height, leaf area, chlorophyll content, and number of plant branches, thus increasing the rate of photosynthesis, which in turn works to increase the production of necessary organic materials. To form flowers and thus increase the number of pods in the plant, and this result agreed with the findings of [5] who reported increasing the number of pods by increasing nano spraying on the broad bean crop. It is clear from the results that there is a significant difference between the cultivars in increasing the number of pods, as the cultivar (V2) achieved the highest average of 18.18 pods plant $^{-1}$in the first location, and the cultivar (V3) excelled, recording the highest average for this trait of 18.83 pods plant $^{-1}$in the second location. While the cultivar (V1) gave the lowest average of 17.23 pods plant $^{-1}$in the first location, while in the second location, the cultivar (V2) achieved the lowest average number of pods . plant, which amounted to 17.07 pods plant $^{-1}$. The interaction between chemical and nano-fertilizer was significant in both locations, as the combination (F2×N2), represented by the highest level of chemical F2 with the highest concentration of nano-N2, gave the two highest averages for this trait, reaching 24.26 and 24.62 plant pods-1, while the combination (F0×N0) gave) Represented by the control treatment for both chemical and nano, the lowest number of pods . plant reached 12.19 and 11.70 pods plant $^{-1}$, respectively, for both location. There was also

ISSN 2072-3857

a significant effect of the bilateral interaction between the chemical fertilizer and the cultivars on the number of pods . plant, as the highest level of the chemical F2 with the cultivar (V3) combination (F2×V3) gave the highest average for this trait, amounting to 21.93 pods plant $^{-1}$in the first location, and the cultivar (V1) achieved The combination (F2×V1) recorded the highest average number of pods, amounting to 23.87 pods . plant, at the second location, while the control treatment (no fertilization) F0 with the cultivar (V1). The combination (F0×V1) recorded the lowest average number of pods . plant, amounting to 12.98 pods plant $^{-1}$in the first location, while the second location gave the cultivar (V2) the lowest average for this trait, amounting to 13.04 pods plant $^{-1}$.As for the effect of the interaction between the nanofertilizer and the cultivars, it was significant in the number of pods . plant for both location. The highest concentration of nanoN2 with the cultivar (V2) and the combination (N2×V2) gave the highest average for this trait, amounting to 20.33 pods plant $^{-1}$in the first location. The combination (N2×V1) had the highest average for the same trait, amounting to 21.65 pods plant $^{-1}$in the second location, while the control treatment for nano N0 as cultivar (V1) gave the combination (N0×V1) the lowest average number of pods . plant, amounting to 13.94 pods plant $^{-1}$. In the first location and the combination (N0×V2), the lowest average for the same trait was recorded, amounting to 14.73 pods plant $^{-1}$, in the second location. The triple intervention also had a significant effect on the number of pods . plant for both location, as the combination consisting of the highest level and concentration of both chemical and nano with the LUZ DeOtono (V3) cultivar (F2×N2×V3) gave the highest average for this trait, amounting to 25.23 pods . plant-1. In the first location, in the second location, the combination (F2×N2×V1) gave the highest average of 27.93 pods plant $^{-1}$, while the control treatment (F0×N0×V1) gave the lowest average number of pods . plant, amounting to 10.42 pods plant $^{-1}$for both location.

ISSN 2072-3857

Table (4) The effect of chemical and nanofertilization on the number of pods . plant (pods plant $^{-1}$) for the first location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
12.98	14.46	14.06	10.42	F_0	V1
18.12	20.26	18.80	15.30	F_1	
20.59	24.26	21.41	16.10	F_2	
14.75	16.13	15.76	12.36	F_0	V2
18.85	21.56	17.60	17.40	F_1	
20.93	23.30	22.66	16.83	F_2	
15.27	16.06	15.96	13.80	F_0	V3
16.56	17.26	16.20	16.23	F_1	
21.93	25.23	23.46	17.10	F_2	
0.69	1.23			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
17.23	19.66	18.09	13.94	V1	
18.18	20.33	18.67	15.53	V2	
17.92	19.52	18.54	15.71	V3	
0.47	0.70			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer × nano fertilizer				
14.33	15.55	15.26	12.19	F0	
17.84	19.70	17.53	16.31	F1	
21.15	24.26	22.51	16.67	F2	
0.43	0.72			LSD (0.05)	
average nano fertilizer					
0.42	19.84	18.43	15.06	LSD (0.05)	

ISSN 2072-3857

Table (5) The effect of chemical fertilizer and nano fertilizer on the number of pods per plant (plant pod^{-1}) for the second location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
13.88	16.60	14.50	10.55	F_0	V1
18.43	20.43	19.20	15.67	F_1	
23.87	27.93	22.25	21.43	F_2	
13.04	14.33	13.76	11.03	F_0	V2
17.52	20.56	17.57	14.43	F_1	
20.65	22.03	21.20	18.73	F_2	
15.62	16.80	16.53	13.53	F_0	V3
18.55	19.52	18.30	17.83	F_1	
22.33	23.90	24.56	18.53	F_2	
0.66	1.01			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
18.73	21.65	18.65	15.88	V1	
17.07	18.97	17.51	14.73	V2	
18.83	20.07	19.80	16.63	V3	
0.49	0.60			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer × nano fertilizer				
14.18	15.91	14.93	11.70	F0	
18.17	20.17	18.35	15.97	F1	
22.28	24.62	22.67	19.56	F2	
0.39	0.59			LSD (0.05)	
average nano fertilizer					
0.33	20.23	18.65	15.75	LSD (0.05)	

Weight of 100 seeds (g)

It was clear from the results of the statistical analysis that there was a significant effect of the individual factors and the bi and triple interactions in the first location, while the results of the second location showed the significant effect of the chemical and nano-fertilizers and the cultivars and the bi-interaction between the mineral and nano-fertilizers and the chemical and the cultivars

ISSN 2072-3857

and the triple interactions on the weight of 100 seeds. The results showed that the highest level of chemical F2 was excelled in the weight of 100 seeds for both locations, giving the highest averages of 167.92 and 167.93 grams, while the control treatment F0 gave the lowest averages of 149.27 and 149.74 grams. The reason for the increase in the weight of 100 seeds may be due to the addition of fertilizer. Chemically, NPK, nitrogen is involved in the formation of the nucleic acids RNA and DNA necessary to build proteins in the plant. This result agreed with what was indicated by Jassim et al. (2015), who found an increase in seed weight when compound fertilizer was added to the broad bean crop. The results indicated that the highest concentration of nanoN2 in both locations was excelled on the weight of 100 seeds, as it gave the highest averages of 164.25 and 163.65 g, while the control treatment N0 gave the lowest averages for this traits , which amounted to 152.90 and 154.29 g, respectively, for both locations. This may be due to The reason for this is the effect of nanofertilizer in increasing the leaf area and the chlorophyll content of the leaves, which was reflected positively in the efficiency of photosynthesis and increasing the plant storage that is later transferred to the developing seeds and thus leads to their filling and increasing their size. This result agreed with what Aziz arrived at, which showed that there was a significant increase. In the weight of 100 seeds when adding nanofertilizer to the bean crop. The cultivar (V3) also recorded a significantly excelled in the weight of 100 seeds, giving the highest average of 159.22 grams in the first location, while the cultivar (V2) achieved the highest average of 162.50 grams in the second location. The reason for the cultivar's superiority may be due to the increase in the percentage of protein in its seeds. It was agreed that This result is in line with what was indicated by [19] who showed the presence of a significant excel between the types. The interaction between chemical and nano-fertilizer was significant for both locations. The combination (F2×N2), represented by the highest level of chemical F2 with the highest concentration of nano-N2, gave the two highest averages of 174.78 and 173.95 g, while the combination (F0×N0) gave the two lowest averages in weight. The 100 seeds reached 145.14 and 146.46 grams, respectively, for both locations. The interaction between chemical fertilizer and cultivars had a significant effect on the weight of 100 seeds for both locations, as the combination (F2×V2) gave the two highest averages for this trait, amounting to 170.01 and 173.11 g, respectively, while the combination (F0×V2) gave the lowest average, amounting to 148.01 grams at the location. The first, while the combination

ISSN 2072-3857

(F0×V1) recorded the lowest average of 148.57 grams in the second location. The interaction between the nanofertilizer and the cultivars was significant in this characteristic for the first location only, as the combination (N2×V2) gave the highest average weight per 100 seeds, amounting to 167.02 g, while the combination (N0×V2) achieved the lowest average, amounting to 151.50 g. The triple intervention also gave a significant effect on this trait and for both locations. The combination consisting of the level and highest concentration of both chemical and nano with the (V2) cultivar (F2×N2×V2) gave the two highest average weights of 100 seeds, reaching 177.32 and 175.40 grams, respectively. While the combination (F0×N0×V2) recorded the lowest average, amounting to 140.35 grams, in the second location, the combination (F0×N0×V1) gave the lowest average, amounting to 145.10 g.

Table (6) The effect of chemical and nanofertilization on the weight of 100 seeds (g) for the first location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
150.40	152.87	150.24	148.08	F_0	V1
157.17	161.05	157.88	152.58	F_1	
164.78	173.31	161.14	159.90	F_2	
148.01	158.24	145.43	140.35	F_0	V2
158.23	165.51	159.22	149.95	F_1	
170.01	177.32	168.51	164.20	F_2	
149.42	151.23	150.03	147.00	F_0	V3
159.28	165.01	161.72	151.10	F_1	
168.96	173.71	170.24	162.92	F_2	
1.16	1.81			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
157.45	162.41	156.42	153.52	V1	
158.75	167.02	157.72	151.50	V2	
159.22	163.32	160.67	153.67	V3	
0.68	0.98			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer × nano fertilizer				
149.27	154.11	148.57	145.14	F0	
158.22	163.86	159.61	151.21	F1	
167.92	174.78	166.63	162.34	F2	
0.75	1.09			LSD (0.05)	
average nano fertilizer					
0.59	164.25	158.27	152.90	LSD (0.05)	

ISSN 2072-3857

Table (7) The effect of chemical fertilizer and nano fertilizer on the weight of 100 seeds (g) for the second location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
148.57	151.40	149.20	145.10	F_0	V1
159.66	161.24	159.18	158.57	F_1	
162.17	173.22	162.37	150.91	F_2	
151.91	156.49	151.62	147.61	F_0	V2
162.48	168.60	160.99	157.84	F_1	
173.11	175.40	175.40	168.54	F_2	
148.74	150.01	149.54	146.69	F_0	V3
157.56	163.31	158.90	150.47	F_1	
168.52	173.23	169.44	162.89	F_2	
1.19	2.29			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
156.80	161.95	156.92	151.52	V1	
162.50	166.83	162.67	158.00	V2	
158.27	162.18	159.29	153.35	V3	
0.98	N.S			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer ×nano fertilizer				
149.74	152.63	150.12	146.46	F0	
159.90	164.38	159.69	155.63	F1	
167.93	173.95	169.07	160.78	F2	
0.66	1.31			LSD (0.05)	
average nano fertilizer					
0.82	163.65	159.63	154.29	LSD (0.05)	

Total seed yield (ton ha^{-1})

The results of the statistical analysis indicated a significant effect of chemical and nanofertilizers, cultivars, and binary and triple interactions on the total seed yield for both location.

It was observed that there was a significant increase in seed yield with increasing chemical level for both location, as the F2

ISSN 2072-3857

level gave a significantly excelled in seed yield amounting to 11.94 and 12.36 tons ha^{-1}, while the control treatment F0 gave the two lowest averages for this trait, amounting to 5.21 and 5.25 tons ha^{-1}, The reason for this may be due the addition of chemical fertilizers, which led to an increase in the number of pods, the number of seeds, and an increase in the weight of 100 seeds, thus increasing the total seed yield. This result agreed with what was reached by [2], who showed that there was an increase in the total yield when adding NPK on the bean crop.Seed yield began to increase significantly in its averages with increasing nano concentration for both location, as the higher N2 concentration gave the two highest averages for seed yield, amounting to 10.45 and 10.69 tons ha-1, while the control treatment (no spraying) N0 recorded the two lowest averages for this trait, amounting to 6.26 and 6. 49 tons ha-1, and the reason for this may be that the increase due to the effect of these concentrations in the seed yield traits was the result of an increase in the number of pods in the plant,. It is clear from the results that there is a significantly excelled between the cultivars in increasing the total amount of seeds for both location, as the cultivar (V1) achieved the two highest averages for this trait, amounting to 9.11 and 9.45 tons ha^{-1}, while the cultivar (V2) gave the two lowest averages, amounting to 8.06 and 8.13 tons.ha^{-1}, This result agreed with what was indicated by [14] who showed that there were significant differences between the classes.

As for the effect of the interaction between chemical and nano-fertilizers, the combination (F2×N2) was excelled for both location, giving the highest averages of 14.41 and 15.00 tons ha^{-1}, while the combination (F0×N0) gave the two lowest averages for total seed yield, amounting to 3.52 and 3.50. tons ha^{-1}, respectively.It was also shown that there was a significant effect of the interaction between chemical fertilizer and cultivars in this trait for both location, as the cultivar (V1) and the highest level of mineral F2 excelled in the combination (F2×V1), giving the two highest averages of 12.50 and 13.20 tons ha^{-1}, while the cultivar recorded (V2) With no fertilization with the chemical F0 combination (F0×V2), the two lowest averages for total seed yield reached 4.97 and 5.02 tons ha^{-1}, respectively.The interaction between the nanofertilizer and the cultivars led to a significant effect in increasing the total seed yield for both location, as the high concentration of nanoN2 with the cultivar (V1) excelled on the combination (N2×V1) and gave the two highest averages for this trait, reaching 11.29 and 11.76 tons ha^{-1}. While the combination (N0×V2), which is not spraying with nano-N0 with the cultivar (V2), gave the two lowest averages, amounting to 5.94 and 6.02 tons ha^{-1}, respectively, for both location. The triple intervention had a significant effect on this traits for both location, as the combination consisting of the highest level of chemical and the highest nano concentration with the Aquadulca cultivar (F2×N2×V1) gave the two highest averages for this characteristic, reaching 15.76 and 16.93 tons ha-1, while it gave The combination (F0×N0×V2), which is represented by the control treatment for metallic and nano with the type (V2), had the two lowest averages, reaching 3.29 and 3.14 tons ha-1, respectively.

ISSN 2072-3857

Table (8) The effect of chemical and nanofertilization on trait of total seed yield (ton ha^{-1}) for the first location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
5.41	6.69	6.13	3.40	F_0	V1
9.43	11.43	10.01	6.85	F_1	
12.50	15.76	12.87	8.87	F_2	
4.97	6.03	5.60	3.29	F_0	V2
8.30	10.31	8.56	6.05	F_1	
10.92	12.90	11.38	8.47	F_2	
5.25	6.23	5.67	3.87	F_0	V3
8.69	10.14	8.94	6.98	F_1	
12.40	14.59	14.06	8.55	F_2	
0.39	0.64			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
9.11	11.29	9.67	6.37	V1	
8.06	9.74	8.51	5.94	V2	
8.78	10.32	9.56	6.46	V3	
0.26	0.36			LSD (0.05)	
averageالكيماوي	Chemical fertilizer × nano fertilizer				
5.21	6.31	5.80	3.52	F0	
8.81	10.63	9.17	6.63	F1	
11.94	14.41	12.77	8.63	F2	
0.24	0.38			LSD (0.05)	
average nano fertilizer					
0.21	10.45	9.25	6.26	LSD (0.05)	

ISSN 2072-3857

Table (9) The effect of chemical fertilizer and nano fertilizer on the total seed yield (ton ha^{-1}) for the second location 2022-2023

cultivars×Chemical fertilizer	nano fertilizer			Chemical fertilizer	cultivars
	N2	N1	N0		
5.51	6.78	6.17	3.58	F_0	V1
9.64	11.58	10.19	7.17	F_1	
13.20	16.93	13.09	9.58	F_2	
5.02	6.12	5.79	3.14	F_0	V2
8.33	10.04	8.88	6.08	F_1	
11.05	12.86	11.45	8.85	F_2	
5.21	6.29	5.56	3.79	F_0	V3
8.89	10.40	8.99	7.28	F_1	
12.83	15.21	14.29	9.00	F_2	
0.44	0.71			LSD (0.05)	
average cultivars	cultivars × nano fertilizer				
9.45	11.76	9.82	6.78	V1	
8.13	9.67	8.71	6.02	V2	
8.98	10.63	9.61	6.69	V3	
0.40	0.46			LSD (0.05)	
average Chemical fertilizer	Chemical fertilizer × nano fertilizer				
5.25	6.40	5.84	3.50	F0	
8.95	10.67	9.35	6.84	F1	
12.36	15.00	12.94	9.14	F2	
0.21	0.39			LSD (0.05)	
average nano fertilizer					
0.24	10.69	9.38	6.49	LSD (0.05)	

References:

1. A.M.Aboyosf,R.A.Abou El-Khair M.O.El- Mothtasem And S.S Shawer (2020). Lmpacts Of Nano –Fertilizers And Chemical Fertilizers On Plant Growth And Nutrient Uptake By Faba Bean (Vicia Faba L.) Plant Al-Azhar Journal Of Agricultural Research (7) No(1) June(2022).

ISSN 2072-3857

2. Abbas Saddam Hussein (2012). Performance analysis of genotypes in beans under the influence of different levels of NPK fertilization. College of Agriculture - Al-Qasim Green University. Kufa Journal of Agricultural Sciences. Volume 4. Issue 2.
3. Abdul Qadir, Omar Al-Mawjoud, Saleh Muhammad Ibrahim Al-Jubouri, and Laith Mazen Hadi. 2020. The effect of nano-hydroxy fertilizer and nitrogen and urea controls on the growth and yield of two cultivars of faba beans (Vicia faba L.). Al-Furat Journal of Agricultural Sciences. 12(2): 220-227.
4. Al-Hassani, Ali Rahim Karim (2018). The effect of foliar nutration with proline and a mixture of nutrients on the growth and yield of faba bean (Vicia Faba L.) cultivars. Doctoral thesis, Department of Field Crops, College of Agriculture. Al-Muthanna University.
5. Alkafaji,Maitham Hussien,Al.Kaby,Aman Hameed And Lhsany,Ali (2020)
6. Al-Touki, Warqa Baqir Aliwi. (2015). Response of genotypes of the bean crop Vicia faba L. to planting dates in Muthanna Governorate. Master's thesis, College of Agriculture - Al-Muthanna University.
7. Anonymouse (2009). Nano Technology In Agriculture And Technology In Agriculture .Journal Of Agriculture And Technology .(In Persian) :114:54-655.
8. Awhid, Bassam Muften, Jbeil, Walid Abdel Reda and Jassim, Kifah Abdel Reda. (2015) response. Cultivars of the bean crop (Vicia faba L.) according to levels of NPK complex fertilizer.
9. Bashour, Issam, Muhammad Al-Fouly, Antoine Al-Sayegh, Dilek Anak, Hanafi Abu Al-Haqq, Ness Baba Doubles, and Nizar Ahmed. 2007. Guide to the use of fertilizers in the Near East. FAO. Rome. p. 9.
10. F.A.O2020 . Food And Agriculture Organization Of The United Nation Faostat.
11. Ghulam, Said ; Khan, Muhammad Jamil ; Usman Khalid And Shakeebullah (2012) , Effect Of Different Rates Of Pressmud On Plant Growth And Yield Of Lentil In Calcareous Soil ,Sarhad J. Agric. Vol.28, No.2.
12. Gomaa,M,.Abuo Zeid.A.Z.A And Salim, B (2016). Response Of Some Faba Bean To Fertilizer Manufactured By Nanotechnology .J. Adv .Agric .Res.Vol.21(3): 384-399.
13. Havlin ,J.L.Beaton,J.D.Tisdal,S.L . And Nelson ,W.L.2005,Soil Fertility And

ISSN 2072-3857

Fertilizers AN Introduction To Nutrient Managememt 7th Ed. Preutice Hall.New Jersey .

14. Imran, Amir Nihad (2023). The effect of organic and biological fertilizer on the growth and yield of two types of beans. Master's thesis. College of Technology/Al-Musayyib. Al-Furat Al-Awsat Technical University. Iraq .
15. Jassim, Ali Hussein and Amir Sadiq Obaid. (2013). The effect of spraying some foliar fertilizers and their interaction with boron on the concentration of some nutrients in the leaves of the bean plant (Vicia faba L.) Al-Furat Journal of Agricultural Sciences, Volume (4) Issue (5): 56-63.
16. Jassim, Ali Hussein, Enab, Hoda Ahmed and Abd, Hamid Musa. (2015). The effect of adding organic and chemical fertilizers and their interaction with foliar fertilizers on the yield of beans (Vicia Faba L.).
17. Khalil, Nabil Ali, Al-Mutawali Abdullah Al-Mutawali, Magdy Muhammad Shafiq, and Wajiya Abdel-Azim Al-Murshedy. (2015). Cereal crops and legumes. faculty of Agriculture . Cairo University . p. 186. Arab Organization for Agricultural Development - Khartoum. (2016). Arab Agricultural Statistics Yearbook. Volume (36): p. 50.
18. Mekky R.Hthabet M.M.,Rodriguez-Perez CM.,Elnaggar D.M.Y., Mahrous E.A., Segura Carretero A.,Abdel-Sattar E.2020 Comparathve Metabolite Profiling And Antioxidant Potentials Of Seed And Sprouts Of Three Egyptian Cultivars Of Vicia Faba L. Food Research International 136,109537
19. Negash, T. T., Azanaw, A., Tilahun, G., Mulat, K., And Woldemariam, S. S. (2015). Evaluation Of Faba Bean (Vicia Faba L.) Cultivars Against Chocolate Spot (Botrytis Fabae) In North Gondar, Ethiopia. African Journal Of Agricultural Research, 10(30), 2984-2988.

ISSN 2072-3857