



RESPONSE OF THREE VARIETIES OF BROAD BEAN (*Vicia faba* L.) TO NP MINERAL FERTILIZER

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ABSTRACT

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To solve the problem of the shortage broad bean crop production in the governorate of Nineveh. The study was carried out between the Horticulture Department, College of Agriculture and forestry, University of Mosul, and the Director of Nineveh Agriculture, to know the effect of two factors: first factor was three varieties of broad beans (local, Spanish and Italian) ,the second factor was three levels of mineral fertilizer NP (0. 300 and 400 kg. ha⁻¹) . The experiment consist of nine treatments. It designed according to Randomized Complete Block Design with Split-plot arrangement with three replicates. Analysis of variance carried out according to Duncan's multiple range test at 0.05. Results showed the Spanish variety gave significant superiority in the number of pods, seeds, and seed yields compared to the other varieties except for the number of pods that did not differ significantly with the local variety. 300 and 400 kg. ha⁻¹ levels of mineral fertilizer caused a significant increase in all studied parameters but there was no significant effect between 300 kg. ha⁻¹ and control. Most effects of interaction treatments showed similar effects as a single factor for every mentioned characters.

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INTRODUCTION

Broad bean (*Vicia faba* L.) plant is one of the important crops of vegetables in terms of food and health and the importance of this plant comes because its green or dry seeds contain a large amount of protein and essential amino acids such as arginine and lysine in addition to the richness of seeds with carbohydrates, vitamins and minerals beneficial to health and bone building (Yacoub and Namr, 2011).

Many methods and means have been used to raise production efficiency among these methods the selection of the appropriate variety within the production area is considered one of the main factors for increasing the yield and for the various types of crops in general. The results of Mitiku and Wolde (2015) showed that the varieties of broad bean varied among them significantly in many studied traits, such as plant height, number of pods per plant, number of seeds per pod, weight of 100 seeds, the individual plant yield , total seed yield and biological yield when they study 8 different varieties of broad bean in Ethiopia.

Rasheed (2018) observed significant increase in the pods weight, total yield, number of seeds per pod and weight of seeds per plant in Elisa variety of broad bean compared to Aguadolce variety of broad bean. Allela *et al.*, (2019) found that the local variety of broad bean gave a significant increase in plant height as compared to Turkish and French. On the other hand, French variety showed the heights value in the yield of pods per plant as comparison to other varieties. Fadhil *et al.*, (2020) reached a significant increase in plant height, pods number and total yield of pods when using French variety as compared to Turkish variety while Turkish variety was significantly superiorly as compared to other varieties in the seed weight per pod.

Mineral nutrition using compound fertilizers is the essence of plant life and one of the basics of increasing the quantity and quality of all vegetable crops, especially fertilizers containing nitrogen and phosphorus, for the great physiological roles that these two elements play in terms of plant growth and development (Allela *et al.*, 2019). Hashemabadi (2013) found that broad bean plants which treated with phosphorus fertilizer (P_2O_5) at four levels (0, 40, 80 and 120 $k.h^{-1}$) showed significant increase in plant branch number, pods number, seeds number, weight of seeds and total yield especially when using 80 and 120 $k.h^{-1}$ of fertilizer. An experiment carried out by Abou-Amer *et al.*, (2014), the experiment included a study of the effect of mineral fertilizer NP at one level N fertilizer that is 60 $kg.acre^{-1}$ plus four levels of phosphorus P_2O_5 which are 0, 30, 45 and 60 $k.acre^{-1}$. These results showed that the highest significant values in the characteristics of the number of pods, the number of branches, the weight and the number of seeds of the pods $plant^{-1}$ when using the fertilizer, nitrogen added to level 60 $kg.acre^{-1}$ of P_2O_5 . Jawad *et al.*, (2016) achieved a significant increase in plant height and total seed yield for broad bean plants grown in the field equipped with 75 kg of urea fertilizer (46% nitrogen) to compared to the control treatment. The vegetative growth and all studied yield characteristics in the broad bean plants that were supplemented with phosphorus at levels (10, 20, 30 and 40 $k.h^{-1}$) increased significantly compared to the control plants. (Alemayehu and Shumi, 2018).

The aim of this study to know the best of mineral fertilizer level that lead to increase in broad bean growth and yield and finding the best variety associated with its cultivation in the region also find the best levels of mineral fertilizer and best interaction between the varieties and fertilizer to improve and raise the productivity of broad bean crop in order to reduce the problem of the shortage broad bean crop production in the governorate of Nineveh

MATERIAL AND METHODS

The experiment was carried out at vegetable field belong to Director of Nineveh Agriculture during growing season 2019-2020. The experiment included the physiological effect of two factors. First factor consisted of three varieties of broad bean (local, Spanish and Italian), while the second factor, consisted of three levels of mineral fertilizer (DAP) 18% N 46 P (0, 300 and 400 $kg. ha^{-1}$). Therefore, this experiment included 9 treatments. The experiment was carried out according to Block Complete Randomized Design (RCRD)

with Split-plot arrangement and three replications. The land was divided into experimental units, which included 3 ridges of 4 m length and 0.75 m width per experimental unit. The seeds were planted on 18/12/2019 at a distance of 25 cm from one seed to another and in the and two seeds per hole and after full germination was the process of thinning to one plant in each hole. Drip irrigation system was used. The number of plants was 48 plants / experimental unit (144 plants per treatment.). Agricultural operations were carried out according to the recommendations used in the cultivation of broad bean to produce commercial with attention to the process of irrigation and according to the need of the plant. Statistical analysis was conducted using SAS, (2017). Analysis of variance and Duncan's multiple range test at 0.05 were applied for all research data (AL-Rawi and Khlaf Allah, 2000).

STUDIED TRAITS

1. plant height (cm. Plant⁻¹).
2. branches number.plant⁻¹.
3. pods number.plant⁻¹.
4. pods weight (g.plant-1).
5. seeds number.plant⁻¹.
6. Seeds yield (g.plant⁻¹).
7. Biological yield (g.plant⁻¹).

RESULT AND DISCUSSION

Effect of varieties on growth and yield of broad bean.

Table (1) shows the effect of varieties on vegetative growth and yield characteristics of broad bean. The effect of variety on plant height, branches number and biological yield per plant were non-significant at all varieties. Meanwhile, Spanish variety gave superior results on pods number, pods yield, seeds number and seeds yield, 22.886 pod. Plant⁻¹, 623.04 g. plant⁻¹, 102.838 seed. plant⁻¹ and 191.51 g. plant⁻¹ respectively, compared to another varieties except for the number of pods that did not differ significantly with the local variety.

Table (1): Effect of varieties on growth and yield of broad bean.

| varieties | Plant height (cm.plant ⁻¹) | Branches number.pl ant ⁻¹ | Pods number.p lant ⁻¹ | Pods yield (g.plant ⁻¹) | Seeds number.p lant ⁻¹ | Seeds yield (g.plant ⁻¹) | Biological yield (g.plant ⁻¹) |
|-----------|--|--------------------------------------|----------------------------------|-------------------------------------|-----------------------------------|--------------------------------------|---|
| Local | 114.667 a | 6.6700 a | 17.017 ab | 355.68 b | 62.547 b | 159.39 b | 1054.3 a |
| Spanish | 122.666 a | 7.4478 a | 22.886 a | 623.04 a | 102.837a | 191.51 a | 1255.4 a |
| Italian | 118.444 a | 6.3389 a | 14.422 b | 396.16 b | 66.590 b | 141.66 b | 1145.5 a |

Means followed by the same letter or letters within column are not significantly different according Duncan test at (P≤0.05)

The reason of significant differences between varieties in the studied parameters are differences in genotypes between varieties growth and response to plant environmental factors, this results agree with Tayel and

Sabreen(2011), Abbas (2012), Tamene *et al.*,(2015), Mitiku and Wolde, (2015) and Allela *et al.*,(2019).

Effect of mineral fertilizer NP on growth and yield of broad bean.

The results in Table 2 indicate to the effect of mineral fertilizer NP on the vegetative growth and yield characteristics. The addition of fertilizer at 300 and 400 kg. ha⁻¹ led to a significant increase in all vegetative growth and yield characteristics compared to the control whereas, there was not significant difference between control treatment and 300 kg. ha⁻¹ in plant height. 300 kg. ha⁻¹ had the highest values in the number of branches, yield of pods, seed yield, and biological yield per plant, 7.9400 branch.plant⁻¹, 566.34 g.plant⁻¹, 204.98 g.plant⁻¹ and 1473.80 g.plant⁻¹. On the other hand, 400 kg. ha⁻¹ treatment gave the highest values in plant height, number of pods and seeds number per plant, 125.111 cm.plant⁻¹, 23.108 pods.plant⁻¹ and 93.028 seed.plant⁻¹.

Table (2): Effect of NP fertilizer on the studied traits of broad bean.

| NP fertilizer (ton.ha ⁻¹) | Plant height (cm.plant ⁻¹) | branches number.plant ⁻¹ | pods number.plant ⁻¹ | pods yield (g.plant ⁻¹) | seeds number.plant ⁻¹ | Seeds yield (g.plant ⁻¹) | Biological yield (g .plant ⁻¹) |
|---------------------------------------|--|-------------------------------------|---------------------------------|-------------------------------------|----------------------------------|--------------------------------------|--|
| 0 | 111.778 b | 4.6311 b | 10.632 b | 317.10 b | 47.217 b | 84.01 b | 682.43 c |
| 300 | 118.889 ab | 7.9400 a | 20.584 a | 566.34 a | 91.730 a | 204.98 a | 1473.80 a |
| 400 | 125.111 a | 7.8855 a | 23.108 a | 491.44 a | 93.028 a | 203.58 a | 1299.00 b |

Means followed by the same letter or letters within column are not significantly different according Duncan test at (P≤0.05)

The significant effect of mineral fertilizer NP on growth and yield of broad bean, could be due to the physiological role of nitrogen and phosphorous. As the nitrogen ion it is involved in the synthesis of proteins, enzymes and free amino acids, enters the synthesis of some hormones, participates in the synthesis of some vitamins, participates in the synthesis of organic alkalis, participates in the synthesis of conjugates of enzymes like NAD⁺ and NADP⁺. As for the phosphorus ion it is co-activates polysaccharides such as Glucose-6-p, Glucose-1-p, and Fructose-1-6-p., also enters in the synthesis of important phospholipids in cellular membranes and in the synthesis of energy-carrying compounds such as ATP (Acetyl phosphate), and nucleic acids, RNA, DNA, participate in the synthesis of nucleoproteins and in the synthesis of accompaniments enzymes such as FAD, NADP⁺, NAD⁺ and works on the regulation of PH. It plays an important role in increase the number of flowers and fruit set branching (Muhammad,1985).

Effect interaction between cultivars and NP mineral fertilizer on growth and yield traits.

The results of Table (3) shows that an Italian cultivar which treated with 400 kg.ha⁻¹ of fertilizer recorded the highest value in the plant height 131.333 cm.plant⁻¹ which differed only significantly with the treatment of bilateral interaction between plants of comparison for the local variety interaction. At the same time, the interaction treatment between the Spanish variety and 400

kg.ha⁻¹ fertilizer gave significant increase in the branches number, pods number, pods yield, seeds number, seeds weight and biological yield 9.5533 branche.plant⁻¹, 29.107 pod.plant⁻¹, 662.73g.plant⁻¹, 125.43 seed.plant⁻¹, 249.10 g.plant⁻¹ and 1523.1 g.plant⁻¹).

Table (3): Effect of interaction between Cultivar and NP fertilizer on the studied traits of broad bean.

| varieties | NP fertilizer (ton.ha ⁻¹) | Plant height (cm.plant ⁻¹) | branches number.plant ⁻¹ | pods number.plant ⁻¹ | pods yield (g.plant ⁻¹) | seeds number.plant ⁻¹ | Seeds yield (g.plant ⁻¹) | Biological yield (g.plant ⁻¹) |
|-----------|---------------------------------------|--|-------------------------------------|---------------------------------|-------------------------------------|----------------------------------|--------------------------------------|---|
| Local | 0 | 103.000 b | 4.3600 d | 8.513 cd | 112.46 e | 25.13 e | 49.35 f | 508.2 c |
| | 300 | 118.333 ab | 7.6567 bc | 15.540 bc | 478.95 bc | 77.93 bc | 221.53 ab | 1384.4 ab |
| | 400 | 122.667 ab | 7.9933 ab | 26.997 a | 475.63 dc | 84.58 bc | 207.30 a-c | 1270.2 ab |
| Spanish | 0 | 118.333 ab | 4.8467 d | 16.330 bc | 570.53 ab | 74.45 b-d | 113.12 de | 743.7 c |
| | 300 | 128.333 a | 7.9433 ab | 23.220 ab | 635.87 a | 108.63 ab | 212.30 a-c | 1499.5 a |
| | 400 | 121.333 ab | 9.5533 a | 29.107 a | 662.73 a | 125.43 a | 249.10 a | 1523.1 a |
| Italian | 0 | 114.000 ab | 4.6867 d | 7.053 d | 268.30 d | 42.07de | 89.55 ef | 795.4 c |
| | 300 | 110.000 ab | 8.2200 ab | 22.993 ab | 584.20 ab | 88.63 bc | 181.10 bc | 1537.5 a |
| | 400 | 131.333 a | 6.1100 cd | 13.220 cd | 335.97 cd | 69.07 cd | 154.33 cd | 1103.7 b |

Means followed by the same letter or letters within column are not significantly different according Duncan test at (P≤0.05)

CONCLUSIONS

It is concluded in this study that the best variety that can be adopted in the governorate of Nineveh is the Spanish variety, due to its significant superiority in the number of pods, their weight, the number and weight of seeds compared to other varieties. Also, both levels of mineral fertilizer showed significant increases in most of the studied characteristics compared to the control treatment. The best treatment of interaction was the Spanish variety with 400 kg.ha⁻¹. Therefore, to solve the problem of lack production of broad bean in the governorate of Nineveh, we recommend using the Spanish variety with 400 kg.ha⁻¹ of mineral fertilizer NP in order to get highest production of broad bean

استجابة ثلاثة أصناف من الباقلاء (*Vicia faba* L.) للسماد المعدني NP

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 (1) قسم البستنة وهندسة الحدائق/كلية الزراعة والغابات/جامعة الموصل العراق
 (2) مديرية زراعة نينوى
 (3)

الخلاصة

لحل مشكلة نقص انتاج محصول الباقلاء في محافظة نينوى. نفذ بحث مشترك بين قسم البستنة في كلية الزراعة جامعة الموصل ومديرية زراعة نينوى. تضمن البحث دراسة تأثير عاملين: الاول ثلاثة اصناف من الباقلاء هي محلي واسباني وايطالي والعامل الثاني ثلاثة مستويات من السماد المعدني NP هي 0 و 300 و 400 كغم.هكتار⁻¹ وبذلك تضمنت التجربة تسعة معاملات عملية. نفذ البحث في الحقل باستخدام نظام القطع المتشقة split-plots ضمن تصميم القطاعات العشوائية الكاملة (R.C.B.D) كررت كل معاملة ثلاث مرات. اظهرت النتائج تفوق نباتات الصنف الاسباني معنويا في كل من صفات عدد القرون والبذور وحاصل البذور بالمقارنة مع بقية الاصناف. ادى استخدام السماد المعدني بمعدل 300 و 400 كغم. هكتار⁻¹ الى زيادة معنوية في جميع الصفات المدروسة باستثناء صفة ارتفاع النبات التي لم تتأثر معنويا عند استخدام المستوى 300 كغم. هكتار⁻¹ فقط قياسا الى معاملة

المقارنة. تماشى تأثير التداخل الثنائي بين عاملي الدراسة مع التأثير المعنوي المنفرد لكل عامل من عاملي الدراسة في اغلب الصفات المدروسة.
الكلمات المفتاحية: السماد المعدني، الحاصل، الباقلاء، نينوى.

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