Plant Archives Vol. 20, Supplement 2, 2020 pp. 1667-1671 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF SPRAYING DATES AND THE CONCENTRATIONS OF SOME MICRO-NANO FERTILIZERS ON GROWTH AND PRODUCTIVITY OF FABA BEAN (*VICIA FABA* L.)

Ali H. Noaema [1], Sundus K.J. Alhilfi[2], Ali R. K.Al-Hasany[1] and Mohammed H. Noor Aljana[1]
[1] Department of Field Crops, College of Agriculture, Al-Muthanna University, Iraq
[2] Department of Field Crops, College of Agriculture, Basra University, Iraq
Email : ali_rheem2002@yahoo.com

Abstract

During the winter season of 2018-2019, the field experiment was carried out in Al-Rumaitha district which distances about 25 km north of Al-Muthanna Governorate in one of the farmers' fields in order to know the effect of dates and concentrations of spraying with micro-nanoparticles and the extent of their impact on the growth and productivity of peas, using the RCBD system and split plot design with three replicates. The experiment including 2 factors, first one factor was the spray dates put in the main plote, which are (stage 3-5 leaves, the beginning of flowering and at 50% flowering), while the second factor which was the spray concentrations with the micro-nano fertilizers (zero, 750, 1500 mg. liter^{-1}) put in the sub plot. The results showed there was a significant effect of the spraying dates with micro-Nano fertilizers, the third date increased a number of pods per plant and total yield of seeds without a significant difference with the second date, and they gave mean 11.89 and 11.83 pods. plant^{-1}, 4927 and 4884 kg. ha^{-1} respectively, then no significant differences between spraying dates on the number of branches, plant height, and the number of seeds in the pod. The results also showed a significant increase when increasing concentrations of spraying with micro-nano fertilizers, the concentration 1500 mg. l^{-1} gave the highest average of numbers of branches, pods, seeds, plant height and total plant yield reached 78.34 cm, 5.11 branches. plant^{-1}, 13.11 pods. plant $^{-1}$, 4.72 seeds. pod^{-1} and 5150 kg. ha^{-1} on a sequence. The interaction between spraying dates and concentrations of micro-nano fertilizers showed a significant difference in total seed yield, the combination (D3 x M2) represented by the third date with spraying the highest concentration of fertilizer gave the highest total seed yield at 5417 kg. h^{-1}.

Keywords: Dates, Micro-Nano Fertilizers, Faba Bean, *Vicia faba* L.

Introduction

Faba bean crop occupies a great importance on the international level, as an important food source for humans and animal feed, and its seeds contain high levels of protein up to 38% in addition to carbohydrates, which reaches from 40-46%, and also contain many important vitamins, amino acids and mineral elements (Khalil *et al*., 2015). In addition to the importance of faba beans in improving the chemical and physical properties of soils as a result of the biological effect of it resulting from the activity of rhizobia bacteria, which it contributes to the process of nitrogen fixation in the soil and also used as green organic fertilizer in poor soils (Chafi and Bensoltan, 2009).

One of the modern methods that aim to improve and increase agricultural production is nanotechnology, which is one of the most promising and economic applications in the agricultural field because it can raise and improve the level of productivity of crops by increasing absorption of nutrients and water and then improving the quantity and quality of crops with the lowest economic cost (Alrubeai and Al-Jubouri, 2012). Foliar fertilization is a successful and complementary method for ground fertilization because it secures the plant's nutrient requirements in the critical stages of plant growth that are difficult for the roots to provide in addition to being an easier and economical method (Ali *et al*., 2014). spraying the micronutrients on the leaves is a method by which plants obtain their needs from these elements during the different stages of growth, and the ideal date for spraying with paper nutrients is one of the important factors to determine the date when the plant will be the fastest response and more efficient to equip it with all its full nutrient needs at that point (Alag, 2015).

This research aims to determine the constrictions and the appropriate date of addition of micro-nanoparticles that contribute to improving growth and productivity of bean crop.

Materials and Methods

During the winter season of 2018-2019, the field experiment was carried out in Al-Rumaitha district which distances about 25 km north of Al-Muthanna Governorate in one of the farmers' fields in order to know the effect of spraying dates and concentrations of micro-nano fertilizers on growth and productivity of fab bean, using the RCBD system and a split-plot design with 3 replicates. The experiment including 2 factors, first one was the spray dates put in the main plot, which are (stage 3-5 leaves, the beginning of flowering and at 50% flowering) a symbol for it (D1, D2, D3) on the sequence, while the second factor put the concentrations of spraying with micro-nano fertilizers in the sub-plots, which are (zero, 750, 1500 mg. l^{-1}) and its code symbol (M0, M1, M2) on the respectively. Soil service operations were carried out, the field was divided into three sectors, then each sector was divided into 9 experimental units with an area of (2.25 x 3) m^2 and left a distance of 1 m between the experimental each experimental unit contained three furrows with a distance of 75 cm between each one and 20 cm between holes. Phosphate fertilizer was added near the hole before planting, triple superphosphate fertilizer was used (46% P), and 40 kg. ha^{-1} of urea fertilizer (46% N) was added after 15 days of planting in a fixed amount for all experimental units (Abedi, 2011). The seeds were planted on 10/16/2018 (Al-Tawki, 2015) with 3 seeds in the hole; Turkish variety of faba bean (Luz de otono) was used in the experiment.

Plants removal to one plant in the hole after the plant height reached a rate of 10-15 cm, weeding and irrigation processors were done whenever required. The spraying process was carried out whenever required. The spraying process was carried out with fertilizer containing a mixture of micro-nano fertilizers which produced by the Turkish company (Agrisener) was contains boron with a percentage of (0.2%), copper (0.5%), iron (6%), manganese (6%), molybdenum (0.2%) and zinc (6%). spraying was carried out in the morning by the dorsal sprinkler, and diffuser material was added in order to reduce the tension Surface watering, increasing the efficiency of the spray solution and ensuring complete wetness of the leaves.

Statistical data were analyzed by the statistical program (Genestat) according to the design used, and the arithmetic mean was compared under the 5% probability level and according to L.S.D test (Al-Rawi and Khalaf Allah, 2000).

Compound samples were taken from the soil with a depth of (0 -30) cm before planting, and laboratory analyzes were performed to find out their properties chemical and physical, which are shown in Table 1.

Table 1 : Chemical and physical properties of soil pre-planting

Feature		Amount	Units
pH		7.5	
E.C		3.13	Desimines M^{-1}
CEC		20.7	Centimeter (+) kg^{-1}
N		19	mg kg^{-1} soil
P		7.7	mg kg^{-1} soil
K		173	mg kg^{-1} soil
Soil content	sand	225	Kg kg^{-1}
	Silt	430	
	Clay	345	
Soil texture		Silty clay loam	

Results and Discussion

Plant height (cm)

The results of the plant height data in Table (2) indicated that the leafy feeding with the micro-nano fertilizers produced a significant increase in height plant rate of faba bean crop, as the results presented the highest spray concentration (M2) was higher in gave the highest mean for this trait of 78.34 cm and also the second concentration (M1) significantly different than control treatment, which gave the lowest average height of the plant reached 64.58 cm, that the increase plant height may be due to role of the smallest elements in improving plant growth through its contribution to many biochemical processes and this contributes to raising the efficiency of photosynthesis and increasing its products Which will prevent Positively increase the height of the plant, this result agreed with what got (Al-Hasany *et al.*, 2019a).

As for the spraying dates and the interaction between the dates and concentrations of spraying with micro-nano fertilizers, no significant differences appeared in plant height (Table 2).

Number of branches in plant (branch. plant $^{-1}$)

Table (3) showed that spraying faba bean plants with micro-Nano fertilizers produced to the significant increase in number of branches per plant, the highest concentration (M2) gave the highest average of 5.11 branches. $plant^{-1}$, which didn't significantly differ from second concentration (M1), which was recorded to an average at 4.78 branches. $Plant^{-1}$, and may be the comparison treatment (M0) gave the lowest average to 4.13 branch. $plant^{-1}$ and the reason for the increase in number branches due to the important role of the small elements in transporting the processed materials by the process of representation to the effective growth areas in the plant, and this result is consistent with (AL Duleimi and AL Fahdawi, 2015).

No significant differences were observed for spraying dates, as well as for the interaction between concentrations and spraying times of micro-nutrients in the number of branches in plant (Table 3).

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

The results in Table (4) show the presence of significant differences by increased concentrations of micro-nano fertilizers in spraying, as the concentration (M2) gave highest average number pods per plant reached 13.11 pods. $plant^{-1}$, while the treatment of non spray gave the lowest average of this feature 8.29 pods. $plant^{-1}$. Perhaps the reason for the increase the number pods is the role of the micronutrients in stimulating the internal growth hormones formed by the plant that contribute to the hormonal balance of plants (Jassem, 2007). This balance leads to an increasing number of pods in plant, these results agreeing with (Al-Hasany *et al*, 2018). Table (4) shows that the third spray date of D3 was a significant superiority in number pods per plant and gave the highest mean of 11.89 pods. $plant^{-1}$, which didn't significantly differ from the second date D2, which gave 11.83 pods. $plant^{-1}$, while the first spray date D1 gave the lowest average number pods in plant at 9.17 pods. $plant^{-1}$, these results are consistent with what indicated by (Hassan, 2019). As for the interaction between the concentrations and spray dates of the micro-nano fertilizers in table (4) shows that there are no significant differences for the interaction in the number of pods in plant.

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

The results clear in Table (5) indicated that the increase in the concentrations of micro-nano fertilizers in the spray solution led to an increase the number of seeds in pod, the highest concentration (M2) gave the highest average of 4.72 seed. pods-1, which didn't significantly differ from the second concentration (M1), which gave 4.70 seed. $pods^{-1}$, while the comparison treatment gave the lowest average of 4.32 seed. $pods^{-1}$. Perhaps the reason for this is that spraying the microelements on the plant improves the absorption of

nutrients and leads to an increase in their accumulation in the root and vegetative system and thus leads to an increase in the process Photosynthesis and thus increase the efficiency of material transmission in plant parts and this leads to increase number of seeds in pod, and this result is consistent with (Al-Hasany *et al.*, 2019b).

As for the spraying dates and the interaction between the concentrations and the spraying dates of the micro nano fertilisers, no significant differences appeared in this trait (Table 5).

Total seed yield (kg. ha^{-1})

Results in Table (6) showed an increase total seed yield by increasing a concentrations of micro-nano fertilizers in the spraying, as it gave a highest concentration (M2) highest average of 5150 kg. ha^{-1} and an increase of 23.26% over the comparison treatment, which gave a lowest average at 4174 kg. ha^{-1}. Perhaps the reason for increasing the seed yield is due to increase the number of podsin plant (Table 4) and the increase in the number of seeds per pod (Table 5), which reflected positively on the total seed yield and this results agreeing with (Al-Hasany, 2018).

The results clear in Table (6) indicated the superiority of sprinkling by the third date in the total seed yield and gave the highest average of 4927 kg. ha^{-1}, which didn't significantly differ from the second date, which gave 4884 kg. ha^{-1} and significantly differed from the first date, which gave the lowest average It reached 4363 kg. ha^{-1}. Perhaps the reason for this increase is that spraying during the flowering stages provides the nutrients that increase the efficiency of the photosynthesis process and then increase its products, and this reflects positively on increasing the yield, or the reason is due to increase the number of podsin plant (Table 4) which Increased total seed yield, these findings are consistent with (ALzubaidy, 2014).

Table (6) shows that there is an interaction between the dates and concentrations of spraying by nano-micro fertilizers in the total seed yield, as the combination (D3 x M2) gave a highest mean for this feature was 5417 kg. ha^{-1}, while the combination (D1 × M0) gave a lowest average of the total seed yield reached 4151 kg. ha^{-1}.

Table 2 : The effect of spray dates and concentrations with micro-nano fertilizer and their interaction in plant height (cm).

D / M	D			Mean
	D_1	**D_2**	**D_3**	**M**
M_0	61.87	65.00	66.87	64.58
M_1	70.60	71.97	75.73	72.77
M_2	75.90	82.20	76.93	78.34
Mean D	69.46	73.06	73.18	
L.S.D $_{0.05}$	D	M	D × M	
	N.S	3.60	N.S	

Table 3 : The effect of spray dates and concentrations with micro-nano fertilizer and their interaction on Number of branches in plant (branch. plant $^{-1}$)

D / M	D			Mean
	D_1	**D_2**	**D_3**	**M**
M_0	4.20	4.26	3.93	4.13
M_1	4.73	5.00	4.63	4.78
M_2	4.86	5.46	5.00	5.11
Mean D	4.60	4.91	4.52	
L.S.D $_{0.05}$	D	M	D × M	
	N.S	0.34	N.S	

Table 4 : The effect of spray dates and concentrations with micro-nano fertilizer and their interaction in the number of pods in plant (pod-1)

D / M	D			Mean
	D_1	**D_2**	**D_3**	**M**
M_0	6.87	8.83	9.17	8.29
M_1	9.67	12.17	12.67	11.50
M_2	11.00	14.50	13.83	13.11
Mean D	9.17	11.83	11.89	
L.S.D $_{0.05}$	D	M	D × M	
	2.37	1.31	N.S	

Table 5 : The effect of spray dates and concentrations with micro-nano fertilizer and their interaction on the number of seeds in pod (seed. Pod^{-1})

D / M	D			Mean M
	D_1	D_2	D_3	
M_0	3.93	4.63	4.40	4.32
M_1	4.16	4.93	5.00	4.70
M_2	4.50	4.73	4.93	4.72
Mean D	4.20	4.76	4.77	
L.S.D $_{0.05}$	D	M	D × M	
	N.S	0.24	N.S	

Table 6 : The effect of spray dates and concentrations with micro-nano fertilizer and their interaction on total seed yield (kg. ha^{-1}).

D / M	D			Mean M
	D_1	D_2	D_3	
M_0	4151	4163	4220	4178
M_1	4216	5117	5143	4825
M_2	4661	5372	5417	5150
Mean D	4343	4884	4927	
L.S.D $_{0.05}$	D	M	D × M	
	107.1	62.7	121.5	

Conclusions

Results showed that:

1- There was the significant effect of spray dates with micro-nano fertilizers, the third date increased a number of pods in plant and total yield of seeds, then no significant differences between spraying dates on numbers of branches and seed, plant height

2- There was a significant increase when increasing concentrations of spraying with micro-nano fertilizers, the concentration 1500 $mg.l^{-1}$ gave the highest average of numbers of branches and pods and seeds, plant height and total plant yield.

3- The interaction between spraying dates and concentrations of micro-nano fertilizers showed a significant difference in total seed yield, the combination (D3 x M2) represented by the third date with a highest concentration of fertilizer gave a highest mean.

References

Abedi, J.A. (2011). Directory Of Chemical And Organic Fertilizers In Iraq. General Authority For Extension And Agricultural Cooperation - Ministry Of Agriculture - Iraq P.Agron. 38(1): 1-21.

Alag, M.K. (2015). The effect of Spraying (Ms) Nutrient Solution And Boron On Growth, Yield And Quality Of (*Vicia faba* L.). Diyala J. of Agri. Sci. 7(1): 121-132.

Al-Duleimi, B.H.A. and Al-Fahdawi, A.I.A.F. (2015). Effect of potassium fertilizer and foliar application with Copper in growth and yield of broad bean *Vicia faba* L. Anbar Journal of Agri. l Sci., 13(2): 153-169.

AL-Hasany, A. R. K. (2018). Effect of foliar nutrition of proline and mixture of nutrients on growth and yield of different varieties of Broad Bean (*Vicia faba* L.). Ph.D. Thesis, Fac. of Agric. Univ of Muthanna, Iraq.

Alhasany, A.R.; Noaema, A.H. and Alhmadi, H.B. (2019b). The role of spraying copper and zinc on the growth and yield of *Vicia faba* L.. IOP Conference Series: Materials Science and Engineering 1-8.

Al-Hasany, A.R.K.; Al-Tahir, F.M. and Chllab, Y.K. (2018). Effect of spraying a nutritional, hormonal mixture to reduce the phenomenon of flowering fall in broad bean varieties (*Vicia faba* L.). J. of Res. in Ecology. l6(2): 1987-1998.

Al-Hasany, A.R.K.; Al-Tahir, F.M. and Chllab, Y.K. (2019a). Effect of spraying with proline and hormonal and nutritional mixture in the growth and yield of the Faba bean (*Vicia faba* L.). Muthanna J. of Agri. Sci., 7(2): 122-132.

Ali, N.S.; Rahi, H.S. and Shaker, A.A. (2014). Soil fertility. Scientific Book House. College of Agriculture - University of Baghdad.

Al-Rawi, K.M. and Khalaf, A.A.M. (2000). Design and analysis of agricultural experiments. Dar Al Kutub Printing & Publishing Est. University of Al Mosul. Ministry of Higher Education and Scientific Research. The Republic of Iraq, 7-13.

Alrubeai, H.F. and Al-Jibouri, A.M. (2012). Nanotechnology in Food and Agriculture. Iraqi Journal of Science and Technology, 3(3).

Al-Tawki, W.B.A. (2015). Response of genetic structures from the crop of the others (*Vicia Faba* L.) to the dates of cultivation in Muthanna Governorate. Master Thesis, Faculty of Agriculture, Muthanna University, 41-46.

ALzubaidy, A.A.A. (2014). Effect Of Potassium Fertilize Levels And Boron Spraying On Growth, Yield And Quality Of Faba Bean. . Master Thesis, Faculty of Agriculture, Baghdad University.

Chafi, M.H. and Bensoltane, A. (2009). A source of organic and biological manure for the arid region(*Vicia faba* L.). World J. Agric. Sci., 5(6): 698-706.

Hassan, R.K. (2019). Effect of the concentrations and dates of leave fertilization in the growth and yield of two varieties of Broad Bean. Master Thesis, Al-Musaib Technical College At Al-Furat Al-Awsat Technical University In Partial Fulfillment.

Jasim, A.H. (2007). Effect of foliar fertilization on growth and yield of broad bean *Vicia faba* L. Anbar Journal of Agri. Sci., 5(2): 177-182.

Khalil, N.A.; Metwally, A.M.; Magdy, M.S. and Morshedi, O.A. (2015). Cereal crops and pulses. Faculty of Agriculture. Cairo University. 186.