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EFFECT OF TIMING OF FIRST IRRIGARTION AND APPLICATION OF ZINC AND MANGANESE ON GROWTH AND YIELD OF FABA BEAN (VICIA FABA, L) GIZA BLANCA CULTIVAR.

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ABSTRACT: Micro-nutrients application namely zinc and manganese applied to faba bean plants (Giza Blanca cv.) by coating seeds prior to sowing under various water regimes were investigated in field experiments during successive seasons 1999/2000 and 2000/2001 at Nubaria Experimental Station, Agricultural Research Center (ARC). The first irrigation (El-Mohaya) was applied at three different intervals (two , four and six weeks from sowing irrigation). Doses of 0.00, 0.15 and 0.30 g/kg seeds of both Zn-EDTA and Mn-EDTA were used. Faba bean plants were monitored for their growth, yield and seed quality characteristics, whereas, the obtained results revealed that growth characters (number of branches/plant, number of leaves/plant, dry weights of stem and leaves) were significantly affected by water regime and micro-nutrients application as well. As faba bean plants gradually suffered from water deficit by delaying first irrigation from two to four and six weeks intervals, all growth and yield characters were dramatically reduced, hence, the greatest growth and yield of faba bean plants were obtained when first irrigation was applied after two weeks from sowing irrigation. On the other hand, The most pronounced values of growth parameters were obtained from plants received 0.30 g Zn + 0.15 g Mn/kg seeds. Moreover, the same treatment showed the most positive effect on root length, dry weight of root, number of nodules formed on roots and dry weight of formed nodules. Therefore, number of pods/plants at harvest were increased when plants received 0.30 g Zn + 0.15 g Mn/kg seeds when compared to control treatment.

INTRODUCTION

Faba bean (*Vicia faba,* L.) is the most important food legumes crop for human nutritive and improvement of soil characters in the newly reclaimed land of Nubaria region, Egypt. Cultivated area is 333,693 feddan in 2000 yielding 439,425 ton. Many physiological processes which necessary for crop growth are affected by water supply, meaning that good growth required an amount of water available to plants and sufficient to meet the crop demand. Plants subjected to drought from initiation of pod set to full pod set produced 32% less total dry matter and 45% less seed yield than the irrigated control plants (Xia, 1997). Also flowering duration was shortened especially before peak flowering stage as a response to water stress. Not only flowering, pod-set and pod-filling stages are the sensitive stages to drought, but also the vegetative period from the beginning to the peak of pod formation is highly sensitive stage to water stress, whereas, it was found that water deficiency at this stage decreased biomass and therefore seed yields (Grashoff, 1990). Early podding stage of development was the most sensitive stage to water deficit in faba bean; causing reduction in seed yields of at least 50%. As water deficits developed, leaf water potential decreased, leaves lost turgid and leaf area reduced dramatically due to wilting, leaflets were unable to expand and stomatal conductance decreased. Leaf size was also reduced permanently, especially with stress at podding (Mwanamwenge et al 1999). Applying irrigations during and after flowering gave statistically significant yield increases and greater efficiency of water use at post flowering applications (Abd-El-Fattah et al l997 and Knott 1999). Delaying date of first irrigation caused decreases in seed yield (Linsalata et al 1990). On the other hand, when early drought as compared with late drought, reduced dry matter but later drought slightly reduced yield (Gej 1992). Interest in seed coating technique with micro-nutrients was stimulated by reports of (Abdel-Aziz et al 1987 and El-Gayar et al 1988). Who pointed out the superiority of applying micro- nutrient coated on seed .They added that, the high *Vicia faba* seed yields were obtained by applying a mixture of micro-nutrients. When micro-nutrient applied to the seeds as the only way to add the crop micro-nutrient requirement, it gave pronounced yields. Faba bean increased almost 2-fold, yield increased from 1.48 t / ha to 2.21 t/ha (Santos and Estefanel 1986). Manganese and zinc application increase vegetative growth, flowering, number of plants, number of pods, number of seeds, seed yield and straw yield, (Lewis and Hawthorne 1996). Meanwhile, rates of application of these micro-nutrients should be selected carefully since higher dose caused a decrease in yield (Azer et al 1992). There are literatures assumed a considerable role of zinc and manganese in reducing flower and pod loss and enhance the plant metabolism towards producing high yield. The present investigation proposed to study time of first irrigation and micronutrients application (zinc and manganese) on growth, pod setting, yield and yield component of faba bean cv. (Giza Blanca).

MATERIALS AND METHODS

Six field experiments were carried out during the two successive seasons 1999/2000 and 2000/2001 at Nubaria Research Station, to study the effect of first irrigation intervals, and micro-nutrients application (zinc and manganese) on faba bean growth, pod setting, yield and yield components.

Plant material

Faba bean (*Vicia faba*,L.) Giza Blanca cultivar was submitted by Food Legumes Research Section, Field Crops Research Inst. Seeds were planted at October, 16 and October, 8 during the two seasons 1999/2000 and 2000/2001, respectively. All cultural recommended practices for faba bean planting at Nubaria region were followed.

Experimental factors

A-Irrigation

Three separate irrigation treatments were carried out using three different intervals between the sowing irrigation and the first irrigation (El-Mohaya). These intervals were two, four, and six weeks after the sowing irrigation and the first irrigation. All faba bean of the three different irrigation treatments received successive irrigations after the first irrigation till harvest as recommended in Nubaria region, whereas, plants were irrigated every four weeks.

B- Zinc and Manganese fertilizer application

Zinc and Manganese fertilizer were added by seed coating at three rates of 0.00 (Zn_0), 0.15 (Zn_1) and 0.30 (Zn_2) g/kg seeds in form of zinc-EDTA (14%).

Seed coating

Both zinc and manganese fertilizers were added to seeds, whereas, amounts of each treatment was figured, weighted based on the weights of seeds used in sowing each experimental plot and mixed thoroughly with seed in the presence of water contained 4 drops of the adhesive material (Triton B) at rates of 10 ml/kg seeds. Seeds were air dried.

Characters studied

During vegetative growth, two samples in three replicates each were taken (average of 5 plants each replicate) after 75 and 105 days from sowing in both seasons. Whereas, the following characters were determined:

1- Number of branches/plant.
2- Number of leaves/plant.
3- Dry weight of stem/plant (g).
4- Dry weight of leaves/plant (g).
5- Root length (cm)
6- Root dry weight/plant (g). (after 75 days from sowing).
7- Number of nodules/plant (after 75 days from sowing).
8- Nodules dry weight/plant (g). (after 75 days from sowing).
9- Number of pods/plant (after 75 days from sowing).
10- Dry weight of pods/plant (g) (after 75 days from sowing).

At maturity, plants were collected manually from each individual plot and the following characters:

1- Number of branches/plant.

2- Number of pods/plant.

3- Seed yield (ardab/feddan).

4- Straw yield (tons/feddan) .

Statistical analysis

Three separate experiments were conducted each handled an irrigation regime of the three irrigations regimes used in this investigation. Combination of three doses of Zn application and three doses of Mn application were arranged in complete block design with four replicates. Each experiment data were conducted and subjected to the proper statistical analysis of complete block randomized design, then combine analysis was performed according to Snedecor and Cochran (1969). And combine values of both seasons 1999/2000 and 2000/2001 were used for means comparison. LSD at level (5%) was used according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Number of branches/plant

Number of branches/plant were reduced as the first irrigation was delayed up to four weeks and reached its maximum reduction with plants received the f56irst irrigation after six weeks (Table 1). Number of branches per plant significantly affected by applying (Zn + Mn) as shown in Table (1), whereas, the maximum amounts of Zn + Mn applied as seed coating (0.30 g Zn + 0.30 g Mn /kg seed) gave the greatest number of branches/plant after 75 days from sowing. Plants produced from seed coated with 0.30 g Zn + 0.15 g Mn/kg seed gave the maximum value of number of branches/plant after 105 days from sowing. Increasing number of branches can be attributed to the beneficial effects of Zn and Mn application. Both Zn and Mn were found to stimulate cell division and RNA content, hence, endogenous hormone may be also stimulate under the level of Zn + Mn application (Jasinska and Kotecki, 1989).

Table (1): Effect of time of first irrigation and Zn + Mn application on number of branches and dry weight of stem (g) faba bean plants after 75 and 105 days from sowing).

Characters	Number of branches (after 75 days from sowing)				Number of branches (after 105 days from sowing)				Dry weight of stem (g) (after 75 days from sowing)				Dry weight of stem (g) (after 105 days from sowing)			
	Date of the first irrigation (El-Mohaya) from sowing (weeks after sowing)															
Treatment	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**
Zn_0Mn_0	7.0	6.9	5.5	**6.5**	6.8	6.4	5.3	**6.2**		13.4	12.9	**14.1**	48.9	46.2	40.4	**45.2**
Zn_0Mn_1	6.1	6.7	5.5	**6.1**	6.8	6.5	5.8	**6.4**	13.6	11.8	11.2	**11.8**	67.2	65.4	45.3	**59.3**
Zn_0Mn_2	7.5	6.2	6.0	**6.6**	7.0	8.2	6.6	**7.3**	18.9	14.2	12.2	**15.2**	70.3	66.2	54.0	**63.5**
Zn_1Mn_0	7.6	6.6	6.2	**6.8**	8.9	8.5	6.2	**7.8**	18.8	17.7	11.9	**16.1**	71.8	65.8	54.2	**63.9**
Zn_1Mn_1	6.7	6.7	6.6	**6.6**	9.8	9.5	7.5	**8.9**	18.2	18.4	12.6	**16.4**	83.9	74.3	67.6	**75.3**
Zn_1Mn_2	7.6	7.3	6.1	**6.9**	7.7	6.8	7.0	**7.2**	20.4	20.6	13.6	**18.3**	73.2	54.2	46.4	**58.0**
Zn_2Mn_0	6.7	7.4	6.1	**6.7**	7.8	8.5	7.0	**7.8**	17.7	18.9	12.2	**16.3**	76.4	71.5	55.9	**67.9**
Zn_2Mn_1	8.0	7.3	6.2	**7.2**	9.5	9.0	8.7	**9.0**	23.5	16.9	13.2	**17.8**	88.6	77.9	68.8	**78.4**
Zn_2Mn_2	8.5	7.8	6.1	**7.5**	8.5	8.6	8.6	**8.6**	26.3	23.6	13.6	**21.1**	61.1	74.4	57.1	**64.2**
Mean	**7.3**	**6.9**	**6.0**	6.8	**8.1**	**8.0**	**6.9**	7.7	**19.3**	**17.3**	**12.6**	14.9	**71.3**	**66.2**	**54.4**	64.0
L.S.D. 0.05																
Irrigation				0.24				0.30				0.68				1.52
Fertilization				0.41				0.52				1.17				2.63
Interaction				0.71				0.91				2.03				4.56

Dry weight of stem

As faba bean plants exposed to water deficit by delaying first irrigation up to four or six weeks from sowing irrigation, dry weight of stem showed continuous dramatic reduction after 75 days and 105 days from sowing (Table 1). Although applying 0.30 g Zn + 0.30 g Mn /kg seed gave the maximum dry weight stems after 75 days from sowing, plants received 0.30 g Zn + 0.15 g Mn /kg seeds gave the maximum stem dry weight after 105 days from planting.

Number of leaves/plant

Number of leaves per plant irrigated after four or six weeks from sowing were lower as compared to those irrigated after two weeks from sowing, even if these plants received the most pronounced Zn + Mn application (Table 2). It is concluded that water availability affects the availability of many plant nutrients by its effects on the solubility and precipitation of salt, this effect is more pronounced for mineral elements in calcareous soil. As the soil dries, the concentration of soluble salts in the soil solution increases (Taylor, 1983). Data presented in Table 2, revealed that number of leaves / plant reduced as plants suffered from water deficit up to six weeks before receiving the first irrigation, that was true after 75 and 105 days from sowing. Due to the slight reduction occurred in number of branches/plant when first irrigation was delayed from two to four weeks. Therefore, such plants, which suffered from water deficit (up to six weeks after sowing irrigation) are expected to have lower photosynthetic potential. These findings are in agreement with those obtained by (Grashoff, 1990). There were a significant increase in number of leaves/plant as Zn + Mn were applied to plant from early vegetative stage (Table 2), values of 68.7 and 93.3 were obtained after 75 and 105 days from sowing respectively, as application of (0.30 g Zn + 0.15 g Mn/kg seeds) was used.

Table (2): Effect of time of first irrigation and Zn + Mn application on number of leaves and dry weight of leaves (g) after 75 and 105 days from sowing) per faba bean plant.

Characters	Number of leaves								Dry weight of leaves (g)							
	(after 75 days from sowing)				(after 105 days from sowing)				(after 75 days from sowing)				(after 105 days from sowing)			
	Date of the first irrigation (El-Mohaya) from sowing (weeks after sowing)															
Treatment	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**
$Zn_0 Mn_0$	72.2	69.0	60.0	**67.1**	81.9	66.2	67.9	**68.6**	11.7	9.6	9.9	**10.5**	19.9	17.2	16.6	**17.9**
$Zn_0 Mn_1$	61.9	64.7	49.9	**58.5**	73.5	65.2	61.7	**66.8**	12.2	9.7	9.7	**10.6**	18.2	18.0	17.2	**17.8**
$Zn_0 Mn_2$	55.8	60.3	61.5	**59.2**	73.0	66.4	65.9	**68.4**	10.3	10.3	9.6	**10.1**	18.5	18.5	17.7	**18.2**
$Zn_1 Mn_0$	62.0	67.6	59.2	**62.9**	73.0	81.0	72.8	**75.6**	12.3	11.6	10.3	**11.4**	18.8	21.5	18.2	**19.6**
$Zn_1 Mn_1$	60.1	65.8	62.4	**62.8**	98.8	95.0	74.6	**89.5**	12.6	12.1	11.0	**11.9**	24.6	23.5	19.6	**22.6**
$Zn_1 Mn_2$	70.5	69.7	62.4	**67.5**	81.7	74.0	54.4	**70.0**	12.4	11.7	10.8	**11.7**	20.7	18.4	16.8	**18.8**
$Zn_2 Mn_0$	69.5	68.8	56.6	**64.9**	73.0	76.7	70.5	**73.4**	13.6	11.6	11.2	**12.1**	19.4	18.6	18.4	**18.8**
$Zn_2 Mn_1$	75.8	69.9	60.5	**68.7**	107.7	99.7	72.5	**93.3**	15.3	13.6	12.4	**13.8**	26.6	25.3	18.9	**23.6**
$Zn_2 Mn_2$	70.4	78.6	45.8	**64.9**	70.4	77.9	63.6	**70.6**	15.1	13.4	9.8	**12.7**	18.1	19.2	17.5	**18.3**
Mean	**66.5**	**68.3**	**57.6**	**64.1**	**81.4**	**78.0**	**67.1**	**75.1**	**12.8**	**11.5**	**10.5**	**11.6**	**20.5**	**20.0**	**17.9**	**19.5**
$L.S.D._{0.05}$																
Irrigation				1.62				2.06				0.32				0.44
Fertilization				2.81				3.58				0.55				0.76
Interaction				4.87				6.19				0.96				1.32

Dry weight of leaves

Significant reduction was found in dry weights of leaves/plant as plants exposed to water deficit (Table 2). High rates of irrigation were found to have the greatest positive effect on faba bean growth especially during intermediate growth and development stages (Lockerman et al 1989). Data presented in (Table 2), show that leaves dry weights response to micro- nutrients applied under different systems of watering schedule, whereas, significant differences were found on leaves as affected by experimental treatments. After 75 and 105 days from sowing, the maximum dose (0.30 g Zn + 0.15 g Mn /kg seeds), was superior in producing the maximum leaves enhancing the photosynthetic potentials of plants produced under these circumstances, however, increasing the applied Mn from 0.15 g to 0.30 g /kg seeds in coating material did not gave pronounced effects on leaves. Several investigators pointed out the superiority of applying micro-nutrients coated on seed, whereas, they found that applying mixture of micro-nutrients stimulate the vegetative growth (Azer et al. 1992 and Lewis and Hawthorne, 1996).

Root Length

Data presented in Table (3), show that root length increased when first irrigation delayed from two weeks up to four and six weeks after sowing irrigation respectively. It could be concluded that when faba bean plants suffered from water deficit, root elongation may increase. It was found that, with water shortage, the greater depth and the continuing extension of rooting zone into deep soil was performed by plants (Looker, 1978), therefore plants attempted to substantially modify its root distribution to maximizing the water extraction and such root depth could have a substantial effect on the plants ability to withstand subsequent drought. The longest root was measured in plants received 0.30 g Zn + 0.00g Mn/kg seeds. Applying micro-nutrients seemed to assist plant building huge root structure since it helps increasing not only root growth but also all vegetative characteristics (Number of leaves/plant, Number of branches/plant, leaves dry .

Table (3): Effect of time of first irrigation and Zn + Mn application on root length (cm), dry weight of root (g), number of nods, and dry weight of nods (g) per faba bean plant after 75 days from sowing.

Characters	Root length (cm)				Dry weight of root (g)				Number of nodules				Dry weight of nodules (g)			
	Date of the first irrigation (El-Mohaya) from sowing (weeks after sowing)															
Treatment	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**
$Zn_0 Mn_0$	13.7	14.3	15.3	**14.5**	4.13	3.97	6.37	**4.83**	28.6	25.5	21.8	**25.4**	0.34	0.28	0.20	**0.27**
$Zn_0 Mn_1$	14.7	14.1	15.0	**14.6**	5.84	4.46	6.15	**5.49**	32.5	23.2	23.5	**26.4**	0.37	0.33	0.22	**0.31**
$Zn_0 Mn_2$	13.6	16.6	15.9	**15.4**	4.38	6.72	6.32	**5.81**	29.0	24.4	22.4	**25.3**	0.42	0.31	0.24	**0.32**
$Zn_1 Mn_0$	14.0	15.3	15.6	**15.0**	5.65	5.29	4.74	**5.23**	34.2	29.2	23.2	**28.9**	0.45	0.35	0.21	**0.34**
$Zn_1 Mn_1$	12.2	15.8	16.1	**14.7**	4.73	6.57	6.65	**5.98**	26.0	27.8	26.8	**26.9**	0.39	0.39	0.27	**0.35**
$Zn_1 Mn_2$	14.0	15.2	15.5	**14.9**	6.18	4.99	6.24	**5.81**	34.3	25.0	19.0	**26.1**	0.41	0.32	0.21	**0.31**
$Zn_2 Mn_0$	13.5	14.1	16.7	**17.8**	5.48	5.51	6.88	**5.95**	33.8	26.5	22.2	**27.5**	0.44	0.33	0.22	**0.33**
$Zn_2 Mn_1$	14.9	14.9	16.9	**15.6**	5.33	5.74	6.93	**5.87**	42.8	29.3	22.5	**31.6**	0.55	0.42	0.22	**0.39**
$Zn_2 Mn_2$	13.9	15.7	14.8	**14.9**	5.09	5.66	5.91	**5.56**	29.0	30.6	23.9	**27.8**	0.40	0.45	0.21	**0.35**
Mean	**13.8**	**15.1**	**15.8**	**14.9**	**5.20**	**5.43**	**6.20**	**5.60**	**32.3**	**26.8**	**22.8**	**27.3**	**0.42**	**0.35**	**0.22**	**0.33**
$L.S.D._{0.05}$																
Irrigation				0.16				0.12				1.12				0.04
Fertilization				0.27				0.21				1.94				0.06
Interaction				0.47				0.37				3.37				0.11

weight and stem dry weight). Because of manganese activate a relatively large number of enzymes including manganese-protein in photo system II (PSII) and number enzymes involving oxidative and non-oxidative decarboxylation reaction, zinc also play an important role in biosynthesis and the rate of elongation and enhance DNA and RNA metabolism and cell division as well (Coleman 1992 and Vallee and Falchuck 1993).

Dry weights of root

Data of dry weight of roots (Table 3), revealed that faba bean plants affected significantly by water deficit caused plants to form more root system. When plants suffered from water deficit up to four and six weeks interval between sowing and first irrigation respectively. Roots grown in soil subjected to drying cycles were distributed more deeply than those growing in wet soil. Jones (1963). Combined amounts of 0.15 g Zn with 0.15 g Mn /kg seeds coating on seed prior to sowing caused an increase in root dry weight. It was found that the dramatic reduction in meristem activity, cell division and extension, probably abnormalities of cell wall synthesis and growth of root tips are associated with micro-nutrient deficiency.

Number of nodules /plant

Data presented in (Table 3), revealed that delaying the first irrigation from two weeks after sowing to four or six weeks caused a gradual reduction in number of nodes/plant. As faba bean exposed to water stress, the plant efficiency to form nodules is affected. Moisture stress is known to be inhibitory factor on root-hair infection with Rhizobium, however, with increasing water supply, nodules showed a more open structure with a better-developed air-space system and more obvious connections between these and the soil atmosphere. (Gallacher and Sprent, 1978). Data presented in (Table 3), revealed the great influence of micro-nutrients and water stress as well on number of nodules formed on root of vicia faba plants. Applying amount of 0.30 g Zn + 0.15 g Mn /kg seeds coating on seeds increased the number of nodule formed on roots of plants of such treatment. Meanwhile, increasing amount of Mn in coating material from 0.15 g to 0.30 g/kg seeds added to 0.30 g Zn/kg seeds showed a inhibitory effects on number of nodules. These finding are matchable with those obtained by (Azer et al 1992). Since they decleared that higher rates than 0.15g/kg seeds gave a negative effect on growth, they added that rates of application of these micro-nutrients should be selected carefully since higher dose caused yield to be decreased.

Dry weights of nodules/plant

Although gradual water deficit caused ans increase in root length and dry weights, number of nodes as well as dry weight of nods/plant showed gradual decrease (Table 3). Therefore, increasing root hairs did not stimulate the bacteria infection under condition of water shortage. The greatest dry weight obtained when such treatment (0.30 Zn + 015 Mn g/kg seeds) used, these findings may be due the greatest number of nods/plant obtained with the same treatment.

Number of pods/plant

Water regime and rate and timing of irrigation plays an important role in regulating flower sheeding. Water deficit at different times during all growth periods increased flower shedding, the most pronounced when stress was applied to plants during flowering. Meanwhile, results obtained in this study (Table 4), declared that suffering faba bean plants from water deficit during the early vegetative growth caused a significant reduction in number of pods per plant. The reduction occurred when plants watered after six weeks from sowing (20.3). Similar results of water deficit flower and pod shedding were pointed out by (Grashoff 1990 and Pilbeam et al 1990). It is evident that loss of yield potential can occur at several phases of reproductive growth and these must be identified and investigated individually. Flower shedding in *Vicia faba* is the most important factor contributes in loss of yield potential. Therefore, stabilizing and reducing the level of flower shedding would be an important step towards stabilizing and raising yields. Many environmental factors affecting flower and fruit abortion, the most important of that are the nutrient balance especially micro-nutrients which play an important role in reproductive stages and water supply since water deficit was found to have a great effect on flower and fruit abortion. Additionally, pod abortion can be attributed to failure of yield potential, consequently, remaining pods on faba bean plants was taken as final result of all factors affect flower shedding, pod set and pod abortion. Treatments selected in this investigation showed highly significant effects on number of pods/plant after 105 days from sowing (29 days from first flower stage), since maintaining high number of remaining pods was the main target to maximize the yield. The maximum number of pods/plant was given by 0.30 g Zn +0.15 g Mn /kg seeds treatment (26.8). It could be concluded that applying micro-nutrients coated on seeds at rate of 0.30 g Zn + 0.15 g Mn /kg seeds, maintain great number of pods/plant.

Table (4): Effect of time of first irrigation and Zn + Mn applaction on number of pods and dry weight of pods (g) per faba bean plat after 105 days from sowing.

Characters	Number of pods				Dry weight of pods			
	Date of the first irrigation (El-Mohaya) from sowing (weeks from sowing)							
Treatment	two	four	six	Mean	two	four	six	Mean
٠ Mn ٠Zn	21.3	20.3	15.2	**18.9**	61.8	47.6	45.1	**51.5**
١ Mn ٠Zn	21.6	20.5	18.5	**20.2**	65.8	61.8	52.5	**60.1**
٢ Mn ٠Zn	22.7	20.0	16.8	**19.8**	62.1	45.3	45.8	**51.1**
٠ Mn ١Zn	24.5	24.0	18.7	**22.4**	96.6	79.3	52.7	**76.2**
١ Mn ١Zn	29.9	25.4	22.2	**25.8**	139.2	118.5	67.2	**108.3**
٢ Mn ١Zn	22.6	21.8	21.7	**22.1**	83.1	68.6	58.2	**69.9**
٠ Mn ٢Zn	22.5	24.3	21.5	**22.8**	96.5	109.6	58.6	**88.3**
١ Mn ٢Zn	28.8	27.1	24.5	**26.8**	172.9	133.3	67.3	**124.5**
٢ Mn ٢Zn	22.7	24.3	23.5	**23.5**	94.9	67.4	53.3	**71.9**
Mean	**24.1**	**23.1**	**20.3**	**22.2**	**97.0**	**81.3**	**55.6**	**77.9**
٠,٠٥ L.S.D.								
Irrigation				0.81				3.25
Fertilization				1.41				5.63
Interaction				2.44				9.75

Dry weight of pods/plant

Data presented in (Table 4), revealed that plants subjected to drought by delaying the first irrigation from two weeks to four and six weeks after sowing showed a decrease in dry weight of pods/plant, whereas, dry weight of pods decreased frop 97.0 g to 81.3 and 55.6 g after two, four and six weeks from sowin respectively (Mwanamwenge et al 1999). Dry weight of pods/ plant response similarly as number of pods/plant, dry weight/plant as affected by micro-nutrients applied. This result declared the superiority of applying 0.30 g Zn + 0.15 g Mn /kg seeds over other Zn and Mn combinations used in this investigation. It was found that seed coating with micro-nutrients resulted in increasing number of pods/plant and gave higher values than the control (Azer et al 1992).

Number of branches/plant

Response of number of branches/plant at harvest due to first irrigation intervai and micro-nutrients application presented in (Table 5), whereas, number of branches reduced significantly as faba bean suffer from water stress when first irrigation delayed from two to four and six weeks after sowing irrigation. It could be concluded that activity of lateral bud especially on plant stem responsible in producing stem branches was negatively affected by water stress. Number of branches/plant increased by applying both Zn and Mn coated on seed prior sowing .The maximum increase was found when seeds coated with 0.30 g Zn + 0.15 g Mn /kg seeds. Applying micro-nutrient showed stimulation effects on vegetative characters and therefore on biomass produced and translocated in different plant organs, giving a pronounced plant canopy if compared with plants received zero application of micro-nutrients. Similar conclusions were pointed out by (Khade et al 1989).

Table (5): Effect of time of first irrigation and Zn + Mn application on number of branches per plant, number of pods per plant, Seed yield (ardab/fed.) and straw yield (T./fed.)of faba bean plant at harvest.

Characters	Number of branches				Number of pods				Seed yield (ardab/fed.)				straw yield (T./fed.)			
	Date of the first irrigation (El-Mohaya) from sowing (weeks after sowing)															
Treatment	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**	two	four	six	**Mean**
$Zn_0 Mn_0$	7.7	7.6	6.0	**7.0**	18.2	15.7	12.8	**15.6**	9.462	7.519	7.421	**8.134**	5.61	5.19	2.96	**4.59**
$Zn_0 Mn_1$	7.7	8.0	6.3	**7.2**	16.3	16.3	14.6	**15.7**	10.362	9.848	7.706	**9.306**	6.20	6.29	3.64	**5.38**
$Zn_0 Mn_2$	7.6	7.6	7.0	**7.4**	19.3	17.4	15.6	**17.5**	8.841	8.293	6.849	**7.994**	5.37	4.31	4.04	**4.58**
$Zn_1 Mn_0$	8.4	8.4	6.4	**7.7**	19.7	15.9	14.5	**16.7**	11.033	10.686	9.980	**10.566**	6.24	6.25	3.77	**5.37**
$Zn_1 Mn_1$	8.9	8.3	7.8	**8.4**	22.2	19.3	17.2	**19.6**	12.693	12.085	10.677	**11.818**	7.05	6.23	4.25	**5.85**
$Zn_1 Mn_2$	8.0	7.5	7.7	**7.6**	20.9	18.0	15.3	**18.0**	12.878	10.334	8.931	**10.714**	5.37	5.51	2.91	**4.60**
$Zn_2 Mn_0$	8.6	7.4	8.1	**8.1**	19.2	18.6	16.7	**18.2**	11.852	10.942	8.789	**10.528**	7.47	3.98	3.45	**4.97**
$Zn_2 Mn_1$	9.7	8.3	8.9	**9.0**	23.1	19.2	17.3	**19.9**	13.702	11.856	10.408	**11.988**	8.59	6.33	6.31	**7.08**
$Zn_2 Mn_2$	9.0	8.2	8.8	**8.7**	19.3	17.3	15.4	**17.4**	12.249	10.587	9.527	**10.788**	6.13	4.54	5.84	**5.50**
Mean	**8.4**	**7.9**	**7.4**	**7.9**	**19.8**	**17.5**	**15.5**	**17.6**	**11.452**	**10.239**	**8.921**	**10.204**	**6.45**	**5.41**	**4.13**	**5.33**
L.S.D.0.05																
Irrigation				0.22				0.73				0.40				0.21
Fertilization				0.38				0.42				0.23				0.36
Interaction				0.66				1.30				0.69				0.62

Number of pods/plant

Number of pods/plant had significant reduction due to suffering faba bean plants to water stress, whereas, applying first irrigation after two weeks from sowing gave the greatest number of pods/plant (19.8) in Table (5). The increasing of number of pods/plant when plants received 0.30 g Zn + 0.15 g Mn/kg seeds (19.9) applied by coating on seeds prior to sowing was a result of the useful effects of such treatment in reducing flower. Applying such amounts of micro-nutrient caused number of pods/plant to be increased. Bud abortion is a problem associated with assimilate production, whereas, pod abortion is the result of failure of development of vascular transport pathways. Flower shedding in Vicia faba is the single most important factor preventing the realization of the known yield potential, the crop exhibits a high level of flower shedding not attributable to failure of pollination, and this is exacerbated by a wide range of environmental stresses. Stabilizing and reducing the level of flower shedding would be an important step towards stabilizing and raising yields (Hebblethwaite, 1981). These results may be due to activation role of Zn + Mn in plant metabolism which have beneficial effects on reducing number of flowers and pods aborted during reproductive period. Many investigations have pointed out that seed coating as a fertilization technique resulted in higher number of pods/plant. (Gangwar and Singh, 1986).

Seed yield (ardab/feddan)

Data presented in (Table 5), revealed that, seed yield (ardab/feddan) was significantly reduced by delaying first irrigation and the greatest seed yeild values obtained (11.452), ardab/fed. after two weeks from sowing. Although faba bean exposed to drought at early vegetative stage, later stages of biomass production, flowering, pods filling were remarkable affected in turn. The results of this investigation are generally agreement with these obtained by (Khade et al 1989 and Xia, 1994). Fertilizer treatments significantly affect seed yield (Table 5), whereas, combination of 0.30 g Zn +0.15 g Mn/kg seeds gave the highest values of seed yield. These results may attribute to the increase reported on number of pods. These findings revealed the importance of applying micro-nutrient coating on seed. Similar trend was reported by (Santos and Estefanel 1986 and Hegazy et al 1992).

Straw yield (ton/feddan)

Straw yield was lowered as faba bean suffered from water deficit (Table 5). These results suggested that delaying first irrigation from two to four and six weeks intervals caused a remarkable decrease in number of irrigation received by faba bean plants during the whole season, which in turn expose these plant to water deficit, such conditions had a negative effects on plant growth and yield obtained. Results presented in (Table 5), revealed the dramatic effects of water deficit on straw yield. Similar results were obtained by (Farag and Shamma, 1994). Applying micro-nutrients seed prior to sowing which enhance faba bean growth and gave pronounced yield caused straw yield to be increased accordingly as plant growth increased. Treatment such as coating seed with 0.30 g Zn + 0.15 g Mn /kg seeds which produced faba bean plants characterized by great growth parameters led to produce greatest straw yield. Similar results were documented by (Gangwar and Singh, 1986). Zinc and manganese application using coating method technique was found to increase vegetative growth and in turn straw yield.

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مجلة الأزهر للبحوث الزراعية
العدد(٣٥) يونيو ٢٠٠٢

تأثير ميعاد ريه المحاياه و إضافة الزنك و المنجنيز على نمو و محصول الفول البلدي صنف جيزة بلانكا

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أقيمت ستة تجارب حقلية خلال موسمي ١٩٩٩/٢٠٠٠ بمحطة البحوث الزراعية بالنوبارية لدراسة تأثير ميعاد ريه المحاياه والتسميد بالعناصر الصغرى (الزنك و المنجنيز) بطريقة تغليف البذرة على النمو، عقد القرون، المحصول و جودة البذور لمحصول الفول البلدي صنف جيزة بلانكا وكانت المعاملات هي إعطاء ريه الحاياه (الرية الأولى)بعد أسبوعين و أربع أسابيع و ستة أسابيع من ريه الزراعة. و كانت مستويات الزنك والمنجنيز ٠,٠٠ ، ٠,١٥ ، ٠,٣٠ جم زنك /كجم بذور فى صورة مخلبية و أوضحت النتائج أن النمو الخضري(طول النبات ، عدد الأفرع ، عدد الأوراق ، الوزن الجاف للأوراق ، الوزن الجاف للسيقان) لمحصول الفول البلدي تأثر تأثيرا كبيرا بتأخير فترة الري بين ريه الزراعة و أول ريه حيث زاد النمو الخضري وزادت مكونات المحصول(عدد القرون ، محصول الفدان من البذور، محصول الفدان من القش) عند إعطاء ريه المحاياه بعد أسبوعين من ريه الزراعة وكلما زادت فترة الجفاف قل المحصول ومكوناته .

و أظهر التسميد بطريقة تغليف البذرة بالعناصر الصغرى بمعدل ٣و. جم زنك +١٥و. جم منجنيز/كجم بذرة زيادة فى محصول البذور و القش للفدان.

و كذلك تأثير طول الجذر و الوزن الجاف له و عدد العقد البكتيرية و وزنها الجاف تأثيرا معنويا حيث زاد طول الجذر و وزنه الجاف بطول فترة الرى ، و أعطت معاملة التسميد بمستوى ٠,٣٠ جم زنك + ١٥.٠جم منجنيز /كجم بذور نفس التأثير . زاد عدد القرون عند الحصاد عند إعطاء ريه المحاياه بعد أسبوعين من ريه الزراعة و معاملة التسميد بمستوى ٣٠.٠ جم زنك + ٠,١٥جم منجنيز /كجم .