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EFFECT OF FIRST IRRIGARTION TIMING AND APPLICATION OF ZINC AND MANGANESE ON FLOWERING, POD SETTING AND SEED QUALITY ON FABA BEAN (*Vicia faba*, L) GIZA BLANCA CULTIVAR.

Abdelghany, A. M.[1] and Rehab A. Abdel-Rahman[2]

1- Agronomy Dept. – Faculty of Agriculture – Ain Shams University – P.O.Box 68 Hadayiek Shoubra , Cairo 11241 , Egypt .

2- Food Legumes Research Section – Field Crop Research Inst. – ARC , Giza , Egypt .

ABSTRACT

Timing of first irrigation and application of zinc and manganese applied by coating seeds of faba bean (Giza Blanca cv.) prior to sowing were investigated in six 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 Zn and Mn application were combination of 0.00, 0.15 and 0.30 g/kg seeds of both Zn-EDTA and Mn-EDTA. Faba bean plants were monitored for their flowering, pod setting and seed quality characteristics, whereas, the obtained results revealed that number of days to flowering of 50 % of total plants, number of days to flowering fillfulment, flowering period, pod shedding %, seed yield/plant (g), 100-seed weight (g), protein %, carbohydrate %, total vicine and trypsin inhibitor activity were significantly affected by timing of the first irrigation, micro-nutrients application and their interaction as well as faba bean plants gradually suffered from water deficit by delaying first irrigation from two to four and six weeks intervals, all characters were remarkably affected . Delaying first irrigation to four and six weeks, which cause faba bean plants to a situation of water shortage at early vegetative growth, induced plants to carry flowers earlier (50% of plants carried flowers) .This circumstances shortened flowering period and Increased pod shedding percentage . There was un-noticeable trend of effects produced from using micro-nutrient application and its interaction with irrigation treatments on studied flowering characters . Superiority of applying the first irrigation after 2 weeks was clear as seed yield / plant and weight of 100 - seed were remarkably increased. Total protien percentage showed gradual reduction as water stress gradually increased by delaying first irrigation from two weeks to four and six weeks. Dose of 0.15g Zn + 0.00 Mn/kg seeds gave the greatest values of protein percentage. Applying the first irrigation after six weeks stimulates the carbohydrates content to be increased in seeds while vicine content showed the lowest values. Applying micro-nutients caused vicine content to be reduced at all levels of applying if compared to control treatment. Water stress showed a possitive effect on trypsin inhibitor content, whereas , faba bean plants exposed to water stress produced seeds contained low trypsin inhibitor .

Keywords: *Faba bean , irrigation , fertilization , zinc , manganese , flowering , pod setting , seed quality.*

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. 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, moreover, 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.*, 1997 and Knott 1999). 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). 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 first irrigation timing and micro-nutrients application (zinc and manganese) on flowering, pod setting, and seed quality 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 micronutrients application (zinc and manganese) on faba bean flowering, pod setting, and seed quality .

Plant material

Faba bean (*Vicia faba*,L.) Giza Blanca cultivar was submitted by Food Legumes Research Section, Field Crops Research Inst., ARC. Seeds were planted at October 16th and October 8th during the two successive seasons 1999/2000 and 2000/2001,respectively.All recommended agicultural 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 sowing 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 fertilizers application

Zinc and manganese fertilizers 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%) and 0.00 (Mn_0), 0.15 (Mn_1) and 0.30 (Mn_2) g/kg seeds in form of mangenese-EDTA (14%).

Seed coating

Both zinc and manganese fertilizers were added to seeds, whereas, amounts of each treatment were 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

1- Number of days to flowering 50 % of total plants.
2- Number of days to fulfillment flowering stage.
3- Flowering period.
4- Pod shedding %.
5-Seed yield/plant (g).
6-100-seed weight (g).
7-Total crude protein percentage:

Seed total nitrogen content was determined using micro Kieldahl method of Association of Official Agriculture Chemists (A.O.A.C. 1975). The values of crude protein percentage were calculated by multiplying nitrogen content by 6.25.

8-Total Carbohydrates percentage:

Total carbohydrates were evaluated using Shaffer and Hartman method reported in (A.O.A.C. 1975). The results were calculated as percentage based on dry matter.

9-Total Vicine content:

Total vicine and convicine contents were extracted and determined as described by (Collier 1976). One gram of samples was weighted and 5 mls of 4% m-phosphoric-acid were added. The mixture was centrifuged, then filtered to get clear solution. Total vicine content was estimated using UV spectrophotometer (Spectronic 21) at wavelength 273 nm. The molar concentration of total vicine was determined according to the following equation:

$$A = EbC$$

Where:

A = Absorbency at 273 nm.
E = Molar absorbitivity (16.3×10^3).
b = Thickness of cuvett .
C = Molar concentration.

Total amounts of vicine and convicine was calculated as total vicine in mg/g dry sample according to the following equation:

$$\text{Total vicine mg/g} = (C \times 322)/w$$

Where:

C = Molar concentration.
w = weight of sample (g).

10-Trypsin inhibitor activity assay:

The trypsin inhibitor was extracted from 1 g sample using 4% sodium phosphate buffer adjusted at pH 7 .The mixture was centrifuged, the supernatant was then filtered to get clear solution. Trypsin inhibitor activity was determined in the supernatant using UV spectrophotometer (Spectronic 21) at wave length 280 nm according to Roy and Bhat (1974) .The results were calculated as the number of trypsin units inhibited by milligram dry sample.

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 collected and subjected to the proper statistical analysis of complete randomized block design, then combine analysis was performed according to Snedecor and Cochran (1969). Mean of combine values of both seasons 1999/2000 and 2000/2001 were used for means comparison using LSD at level (5%) according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Number of days to flowering 50% of total plants:

Delaying the first irrigation from two weeks intervals after sowing irrigation to four and six weeks, induced flowering stage to occur earlier , whereas plants received the first irrigation after two weeks take 74.8 days to 50 % of total plant population to carry flowers, this period was shortened to 73.3 days when plants received this irrigation after 4 weeks from sowing . Similary, exposing faba bean to water deficit as the first irrigation delayed to six weeks caused this duration to be shortened to 70.9 days, (Table 1).

Table (1):Effect of first irrigation timing and micro-nutrient application on number of days to flowering 50 % of total plants and number of days to flowering fulfillment.

Characters	number of days to flowering 50 % of total plants				number of days to flowering fulfillment.			
	Date of the first Irrigation (El-Mohaya) from sowing							
Treatment	After 2 weeks	After 4 weeks	After 6 weeks	Mean	After 2 weeks	After 4 weeks	After 6 weeks	Mean
Zn 0 Mn 0	74.0	73.3	71.1	72.8	114.0	111.5	108.0	111.2
Zn 0 Mn 1	74.5	72.8	71.5	72.9	115.4	113.4	106.6	111.8
Zn 0 Mn 2	74.7	73.4	71.0	72.8	114.8	111.8	108.5	111.0
Zn 1 Mn 0	75.5	73.9	70.5	73.3	111.9	109.2	106.6	109.3
Zn 1 Mn 1	75.0	73.2	71.7	73.2	115.5	108.6	107.3	110.5
Zn 1 Mn 2	75.6	73.4	70.8	73.3	114.3	108.1	108.4	109.6
Zn 2 Mn 0	74.5	72.8	70.8	72.7	112.5	111.2	107.8	109.5
Zn 2 Mn 1	75.3	73.8	71.0	73.4	115.1	112.2	108.0	111.8
Zn 2 Mn 2	74.6	73.0	70.2	72.5	113.7	108.5	105.8	109.3
Mean	74.8	73.3	70.9	72.9	114.1	110.5	107.0	110.5
L.S.D.0.05								
Irrigation				0.41				0.37
Fertilization				0.72				0.64
Interaction				1 24				1.11

Meaning that as faba bean exposed to water deficit, days to flowering shorened and plants initiate producing flowering earlier. Days to 50 % flowered plants ranged from 72.5 to 73.4 when application of 0.30 g Zn + 0.30 g Mn / kg seeds and 0.30 g Zn + 0.15 g Mn / kg seeds were used, respectively. The most shortest period to flowering stage obtained when faba bean plants received first irrigation after 6 weeks from sowing and application of 0.30 g Zn + 0.30 g Mn /kg seeds were used .

Number of days to flowering fillfulment:

Water deficit effects not only number of days to observe 50 % of total plants carrying flowers but also to the total days required to accomplish the flowering period domenstrating the same trend as noticed in number of days to flowering 50% of total plant population, whereas, water deficit shortened period of flowering accomplishment. Faba bean plants accomplished flowering period after 114.1 days from sowing when first irrigation applied after two weeks from sowing irrigation, these periods were shortened by 3.6 days if compared with when first irrigation was delayed to four weeks from sowing irrigation, and were shortened by 7.1 days if compared with when first irrigation was delayed to six weeks from sowing irrigation (Table 1). These findings reveale that exposing faba bean plants to water deficit not only accelerate flowering period to be initiated rapidly but also to be accomlished earlier. The faba bean plants may shoterend all growth stages including flowering stage as suffered from water deficit, these physiological phenomenon may help plants to tolerate the unfavourable effects of water deficit. However, number of days to flowering accomplishment ranged in a narrow range . Values recorded ranged between 109.3 days when applications of 0.15 g Zn + 0.00 g Mn & 0.30 g Zn + 0.30 g Mn /kg seeds were used to 111.8 days 0.00 g Zn + 0.15 g Mn & 0.30 g Zn + 0.15 g Mn /kg seeds were used. These findings illustrate the un-noticable effect of micro-nutrients application on days to accomplish flowering stage of faba bean plants . Plants received 0.30g Zn + 0.30 g Mn / kg seeds and irrigated after 6 weeks from sowing irrigation gave the most shortest period to accomlish flowering stage (106.6 days) . On the other hand , plant received 0.15 g Zn + 0.15 g Mn / kg seeds and irrigated after 2 weeks from sowing gave the longest period to accomplish flowering stage .

Flowering period:

Flowering period as an indication to flowering stage response to water regime and micro-nutrients application was considered. Data presented in Table (2) domestrate the effects of exposing faba bean plants to water deficit by delaying the first irrigation from two to four and six weeks, whereas, increasing water deficit caused the flowering period to be shortened . However, values estimated showed a reduction in flowering period from 2.1 and 3.2 days as first irrigation was delayed from two weeks to four and six weeks, respectively. It could be concluded that exposing faba bean plants to water stress caused plants to accomplish the reproductive period and earlier plants reached the maturity which may tolerate the water deficit conditions.

However, the values determined show only differences ranged from 3.2 days, meaning that response of flowering period was very slight. On the other hand, micro-nutrient application showed unconstant effects on flowering period, whereas, there was no detectable effects could be noticed. However, the shortest flowering duration was 35.9 observed when application of 0.15 g Zn + 0.00 g Mn /kg seeds was used.

Table (2):Effect of first irrigation timing and micro-nutrient application on flowering period and pod shedding %.

Characters	flowering period				pod shedding %			
	Date of the first irrigation (El-Mohaya) from sowing							
Treatment	After 2 weeks	After 4 weeks	After 6 weeks	Mean	After 2 weeks	After 4 weeks	After 6 weeks	Mean
Zn 0 Mn 0	40.0	38.2	36.8	38.3	13.5	25.9	31.6	23.7
Zn 0 Mn 1	40.8	40.7	35.2	38.9	20.6	21.5	25.9	22.7
Zn 0 Mn 2	40.0	38.3	35.5	37.4	17.2	17.6	20.9	18.6
Zn 1 Mn 0	36.5	35.2	36.2	35.9	20.9	26.3	24.6	23.9
Zn 1 Mn 1	40.5	35.5	35.5	37.1	19.2	23.2	16.7	19.7
Zn 1 Mn 2	38.7	34.8	35.7	36.4	20.3	24.3	26.6	23.6
Zn 2 Mn 0	38.0	38.3	37.0	37.7	18.3	23.8	27.8	23.3
Zn 2 Mn 1	39.8	38.3	37.0	38.4	16.8	20.1	26.5	21.2
Zn 2 Mn 2	39.3	35.5	35.6	36.8	13.5	25.5	27.7	22.2
Mean	39.3	37.2	36.1	37.5	17.8	23.1	25.4	22.1
L.S.D.0.05								
Irrigation				0.28				2.83
Fertilization				0.49				4.90
Interaction				0.86				8.50

Pod shedding percentage:

Data presented in Table (2) represent the effect of water regime and micro-nutrients application on faba bean pod shedding during the stage of pod setting to harvest. Exposing faba bean plants to water deficit by delaying the first irrigation up to four and six weeks caused pod shedding percentage to be increased up to 23.1 and 25.4 % respectively , meanwhile , value of 17.8 % of pod shedding percentage estimated on plants received the first irrigation after two weeks from sowing irrigation. Therefore, it could be concluced that delaying the first irrigation of faba bean caused pods to be droped more. Also, it is noticed that although the period of exposing faba bean plants to water deficit was early at the beginning of vegetative period, it affects the plant up to the pod setting and pod filling periods, whereas, greater percentage of pod shedding was observed when plants exposed to water deficit during vegetative period. This phenomenon may lead us to understand that the whole physiological process of the plant through the different stages are conjiont with each other and what happened to a plant through a certian stage would effect the upcoming stages. Application of micro-nutrients to faba bean plants did not show a specific trend on pod shedding percentage, whereas, the lowest shedding percentage was observed on plants received 0.15 g Zn + 0.15 g Mn/kg seeds. Therefore, data revealed that the more effective experimental factor affect pod shedding percentage was time of first irrigation, while micro-nutrient application did not show a significant specific trend.

Seed yield/plant:

Seed yield/plant was greatly influenced by suffering faba bean plants from water deficit, whereas, data presented in (Table 3), show that gradual increase of water deficit occurred by delaying first irrigation from two weeks to four and six weeks intervals caused gradual decrease in plant seed yield from 73.4 to 71.5 and 64.2 g , respectively . It is concluded that shortening period between sowing irrigation and first irrigation to two weeks is favorable irrigation regime accompanied by a greater biomass, meaning that, increasing number of Irrigation caused vegetative characters to be increased and therefore, seed yield increased. Similar results were obtained by (Salih 1992; Gendy *et al.*, 1995 and Amede *et al.*, 1999). Exposing faba bean to drought caused pod setting /plant and seed yield/plant to be reduced, and such condition dramatically affect flowering, pod set and pod filling stages even when plants suffered from drought during earlier stage. As discussed previously, results assumed a considerable role of zinc and mangenese in reducing flower and pod loss and enhancing the plant metabolism towards producing high yield. Because of high pod setting /plant and consequently high number of seeds/plants characterized plants received 0.30 g Zn + 0.15 g Mn /kg seeds, meaning that, it is recommend not to exceed the Mn dose in coating material more than 0.15 g/kg seeds, because of the negative effects of higher dose of Mn on plant yield was detected. These results are matchable with those obtained by (Azer *et al.*, 1992) .

Table (3):Effect of first irrigation timing and micro-nutrient application on seed yield/plant (g) and 100-seed weight (g).

Charaters	seed yield/plant (g)				100-seed weight (g).			
	Date of the first irrigation (El-Mohaya) from sowing							
Treatment	After 2 weeks	After 4 weeks	After 6 weeks	Mean	After 2 weeks	After 4 weeks	After 6 weeks	Mean
Zn 0 Mn 0	63.7	64.8	51.0	59.9	103.9	103.1	94.4	100.5
Zn 0 Mn 1	63.3	60.1	56 2	59.8	108.6	103.7	95.6	102.6
Zn 0 Mn 2	65.8	74.5	59.5	66.6	106.3	105.2	98.8	102.7
Zn 1 Mn 0	72.6	68.4	62.5	68.9	108.9	106.9	104.2	106.3
Zn 1 Mn 1	80.7	78.4	73.1	77.4	112.6	111.1	104.4	109.4
Zn 1 Mn 2	76.5	73.8	64.2	71.5	111.4	105.5	103.9	106.9
Zn 2 Mn 0	75 9	75.4	70.9	74.1	111.9	108.2	115.3	111.8
Zn 2 Mn 1	90.2	77.8	74.3	80.3	115.2	108.8	110.2	111.4
Zn 2 Mn 2	71.4	70.0	65.8	68.7	101 8	105.3	107.2	104.8
Mean	73.4	71.5	64.2	69.7	109.0	106.4	103.4	106.3
L.S.D.0.05								
Irrigation				3.31				2.38
Fertilization				1.91				4.12
Interaction				5.70				7.14

Weight of 100- seed:

As faba bean plants gradually suffered from water deficit, the weight of 100 seeds gradually decreased as shown in (Table 3). Not only flowering, pod shedding and biomass productions were affected by water stress but also, translocations of assimilate would be affected in turn. Also as soil drought decreased, the nutrient intake decreased and therefore affect the efficiency of the applied fertilizers (Xia 1997). These circumstances led to a reduction in seed filling capacity which contributed in the reduction occurred when faba bean suffered from water deficit by delaying the first irrigation .It is recommended that in calcareous soil not to delay irrigation even it was during the early vegetative period. Similar results were pointed out by (Xia 1990 and Grashoff 1990). Data presented in (Table 3), show that applying micro-nutrients to faba bean plants enhance seed filling since 100 seeds weight was increased by such treatments over control treatment, however the amount of fertilizers which produce the greatest seed weight 111.8 g application of 0.30 g Zn + 0.0 g Mn /kg seeds. It is concluded that applying micro-nutrient enhance seed filling capacity specially the amount of 0.30 g Zn which is a common factor in all increases occurred in plant growth and yield observed in this investigation. It is documented that such micro-nutrients play an important role in plant metabolism, it activates several enzymes systems, acts as a cofactors, has a primary role in oxidation and non-oxidation decarboxylation reactions and has a particular role in photosynthesis (Burnell 1988). For such role, it is suggested that there is a distinguished role of the micro-nutrient used in this investigation on plant metabolism specially photosynthesis and translocation from source to sink. Similar results were found by (Khade *et al.*, 1989).

Protein content:

Total protein percentages showed gradual reduction as water stress gradually increased by delaying first irrigation from two weeks to four and six weeks. Adequate amount of water supply stimulates the protein translocated in seed. Data presented in (Table 4), show the determined protein content of seed produced under different Zn + Mn combination . Dose of 0.15 g Zn + 0.00 g Mn /kg seeds gave the greatest values of protein percentage followed by dose of 0.15 g Zn + 0.15 g Mn /kg seeds, respectively. Applying micro-nutrients caused plants to translocate more protein, that was true up to amount of 0.15 g Zn only or 0.15 g Zn combined with 0.15 g Mn , while greater amount of 0.30 g Zn or Mn in coating material caused protein percentages to be lowered . Meaning that low amount of Zn or Zn + Mn as much as 0.15 g caused faba bean plants to synthesize more protein, while higher amount caused protein percentage to be reduced even more than control seed. Similar results documented by (Hebblethwaite 1981 and Azer *et al.*, 1992).

Carbohydrates content:

Exposing faba bean to water stress by delaying the first irrigation up to six weeks stimulate the carbohydrates content to be increased in seeds. Hence , It could be concluded that drought enhance carbohydrates condition, meanwhile, reduction in carbohydrates percentage is not a obligatory circumstances if faba bean does not suffer from water stress since high carbohydrates percentage of 54.6 % was determined when first irrigation was applied after six weeks from sowing. Carbohydrates content was determined in faba bean seed after harvest, Application of 0.15 g Zn + 0.15 g Mn /kg seeds prior to sowing gave greatest of carbohydrates content. However, it is noticeable that applying micro-nutrients carbohydrates content if compared to control treatments, despite the level of micro-nutrients to be used . Therefore, micro-nutrients assumed to stimulate the carbohydrates biosynthesis during vegetative growth and seed filling stages, these assimilate translocated in seed

Vicine content:

Ripe seeds of faba bean are an important source of proteins for much of the world's population. Hence, it is an indispensable supply of protein for the third world. Some legume contain toxic substances (cyanogenic glycosides and non-protein amino acids) and anti nutritive factors. Vicine was found in faba bean seeds and to be considered as one of the anti-nutritive factors. The glucosides vicine, convicine are believed to be part of the " favism complex" which is responsible for hemolytic anemia which affects some people on a diet of faba bean seeds. It was reported that vicine and convicine content had a little difference among faba bean cultivars in testa and cotyledons parts. Agricultural treatments that may lowered the vicine content should be considered as well as the selection in genetic resourse for low vicine content. Therefore, vicine content was considered in this investigation since high yield, as a major target for agronomist should accompanied with obtaining high nutritional value seed. Faba bean seeds produced under water stress condition (giving first irrigation after six weeks from sowing) showed the lowest vicine content (Table 5). Vicine content varied in faba bean seeds as affected by micro-nutrients application. It is noticeable that, applying micro-nutrients caused vicine content to be reduced at all levels of applying if compared to control treatments. However, the greatest reductions were observed in seed produced from plants received 0.30 g Zn + 0.00 g Mn /kg seeds .

Table (4): Effect of first irrigation timing and micro-nutrient application on protein content % and carbohydrates content % .

Characters	Protein content %				Carbohydrates %			
	Date of the first irrigation (El-Mohaya) from sowing							
Treatment	After 2 weeks	After 4 weeks	After 6 weeks	Mean	After 2 weeks	After 4 weeks	After 6 weeks	Mean
Zn 0 Mn 0	22.8	22.5	20.1	21.8	53.8	49.5	48.6	50.8
Zn 0 Mn 1	24.9	22.9	20.6	22.8	49.6	49.3	54.5	51.1
Zn 0 Mn 2	23.6	22.7	18.8	21.7	48.9	53.6	55.9	52.1
Zn 1 Mn 0	25.6	25.6	20.1	23.9	50.5	51.1	56.0	52.5
Zn 1 Mn 1	25.1	25.2	20.7	23.7	56.9	55.8	55.9	56.2
Zn 1 Mn 2	24.2	19.9	20.5	21.5	55.9	54.9	58.0	56.2
Zn 2 Mn 0	25.1	20.3	21.7	22.4	50.5	53.2	50.8	51.5
Zn 2 Mn 1	26.2	23.0	20.9	23.4	57.7	49.9	54.8	54.2
Zn 2 Mn 2	23.2	20.0	19.2	20.8	53.9	47.1	56.6	52.6
Mean	24.5	22.4	20.3	22.4	52.9	51.6	54.6	53.0
L.S.D.0.05								
Irrigation				0.36				1.13
Fertilization				0.63				1.96
Interaction				1.09				3.39

Trypsin inhibitor:

Proteinase inhibitors are found in plant tissues, they are particularly widespread in legumes. They are proteins with molecular weights ranging from 6- 46 kdal. These .inhibitors combine with proteinases to yield an inactive complex which has a low dissociation constant , also covalent bonding occurs to a certain extent between the enzyme and its inhibitor. Trypsin inhibitor was found in faba bean seeds, however, proteinase inhibitors are mostly or completely inactivated by heat . Water stress showed a positive effects on trypsin inhibitor content, whereas, faba bean plants produced under water stress by delaying applying first irrigation produced low contained trypsin inhibitors seeds (Table 5). It is concluded that drought conditions caused faba bean plants to produce seeds with less trypsin inhibitors . Trypsin inhibitor varied due to the amount of Zn + Mn application whereas, the trypsin Inhibitor determined increased or decreased over the control value according to the treatment used. The lowest amount determined was found in seed produced from plants received 0.15 g Zn + 0.00 g Mn /kg seeds , therefore , micro-nutrient application showed unconstant response on trypsin inhibitor .

Table (5): Effect of first Irrigation timing and micro-nutrient application on seed vicine and trypsin Inhibitor contents.

Characters	Vicine content (mg/g)				Trypsin Inhibitor(TIU/mg)			
	Date of the first Irrigation (El-Mohaya) from sowing							
Treatment	After 2 weeks	After 4 weeks	After 6 weeks	Mean	After 2 weeks	After 4 weeks	After 6 weeks	Mean
Zn 0 Mn 0	18.41	17.07	15.02	16.83	5866.7	9283.3	3666.7	6272.3
Zn 0 Mn 1	12.82	14.79	14.11	13.91	8750.0	6950.0	3000.0	6233.4
Zn 0 Mn 2	14.02	19.20	11.23	14.81	8083.4	7850.0	6483.3	7472.2
Zn 1 Mn 0	12.27	13.16	11.40	12.28	5700.0	4833.4	4216.6	4916.8
Zn 1 Mn 1	15.00	14.84	12.56	14.14	8966.6	7783.4	8083.3	8277.8
Zn 1 Mn 2	14.28	13.48	11.71	13.16	6150.0	4900.0	5066.7	5372.2
Zn 2 Mn 0	12.08	12.30	11.61	11.85	7516.7	4883.3	4100.0	5500.0
Zn 2 Mn 1	14.44	14.86	11.89	13.73	8183.3	2983.4	5300.0	5488.9
Zn 2 Mn 2	15.08	16.96	12.46	14.84	5666.7	4583.3	6516.7	5588.9
Mean	14.27	15.19	12.39	13.95	7209.3	6005.6	5159.3	6124.7
L.S.D.0.05								
Irrigation				0.38				175.7
Fertilization				0.67				304.3
Interaction				1.15				526.9

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تأثير ميعاد ريه المحاياه و إضافة الزنك و المنجنيز على التزهير و عقد القرون و جودة البذور في الفول البلدي صنف جيزة بلانكا

أشرف ماهر عبد الغني [١] – رحاب أحمد محمد عبد الرحمن [٢]
١-قسم المحاصيل – كلية الزراعة – جامعة عين شمس – ص ب ٦٨ حدائق شبرا – القاهرة ١١٢٤١ – مصر .
٢-قسم المحاصيل البقولية – معهد المحاصيل الحقلية – مركز البحوث الزراعية – جيزة – مصر .

أقيمت ست تجارب حقلية في كل من موسمي للزراعة ١٩٩٩/٢٠٠٠، ٢٠٠٠/٢٠٠١ بمحطة مركز البحوث الزراعية بالنوبارية لدراسة تأثير ميعاد ريه المحاياه والتسميد بالعناصر الصغرى (الزنك و المنجنيز) بطريقة تغليف البذرة على التزهير و عقد القرون وجودة البذور لمحصول للفول البلدي صنف جيزة بلانكا . تم إضافة رية المحاياة (الرية الأولى) على ثلاث فترات بعد أسبوعين و أربع أسابيع و ستة أسابيع من ريه الزراعة. وتحت كل تجربة ري تمت دراسة معاملات التسميد وهي توافيق ثلاث مستويات لكلا من الزنك و المنجنيز (٠،٠٠ ، ٠،١٥، ٠،٣٠ جم /كجم بذور في صورة مخلبية) . وأوضحت النتائج أن صفات عدد الأيام لتزهير ٥٠% من النباتات وعدد الأيام لإكتمال فترة التزهير وطول فترة و النسبة المئوية للقرون المتساقطة و ومحصول بذور النبات بالجم ووزن ١٠٠ بذرة بالجم والنسبة المئوية للبروتين والنسبة المئوية للكربوهيدرات والمحتوى الكلي للفايسين ونشاط مثبط انزيم التربسين قد تأثر معنويا بميعاد إضافة رية المحاياة وإضافة المغذيات الصغرى وأيضا التفاعل بينهما . تأثرت هذه الصفات تأثرا ملحوظا بتعريض النباتات للإجهاد المائي بتأخير رية المحاياة من أسبوعين إلى اربعة أو ستة أسابيع من الزراعة والذي عرض النباتات للإجهاد المائي في فترة النمو الخضري المبكرة إلى إتجاة النباتات لمرحلة التزهير مبكرا (٥٠% من النباتات المزهرة) ، وإلى تقصير فترة التزهير وزيادة نسبة تساقط القرون . كما لم يلاحظ إتجاة واضح لتأثير استخدام المغذيات الصغرى وتفاعلها مع معاملات الري على صفات التزهير تحت الدراسة . أظهرت معاملة إضافة رية المحاياه بعد أسبوعين من الزراعة تفوقا ملحوظا في محصول البذور/ نبات ووزن ١٠٠ بذرة . كما أن زيادة الإجهاد المائي التدريجية بتأخير رية المحاياة من أسبوعين إلى أربعة أو ستة أسابيع أدى إلى نقص تدريجي في نسبة البروتين في البذور . بينما أدى إضافة (٠،١٥ جم زنك) للحصول على أعلى نسبة بروتين في البذور . أدى تأخير رية المحاياة إلى ستة أسابيع إلى زيادة محتوى للبذور من الكربوهيدرات وأقل محتوى من الفايسين ، بينما أدت إضافة المغذيات الصغرى إلى خفض محتوى البذرة من الفايسين عن معاملة المقارنة . أظهر الإجهاد المائي تأثير إيجابي على محتوى البذرة من مثبط التربسين حيث احتوت البذور المنتجة تحت إجهاد مائي على أقل محتوى من مثبط التربسين تحت ظروف.