4. RESULTS AND DISCUSSION

The first experiments: Effect of saline water management and broad bean cultivars on growth characters, yield and its components and seed chemical composition**. The results could be divided into three sections dealing with the following main topics:**

1- Growth characteristics.

2- Yield and its components.

3- Chemical composition.

Each head was further subdivided into the following subheadings: -

1- Effect of saline water irrigation on growth characters.

2- Effect of cultivars on growth characters.

3- Effect of the interaction on growth characters

1- Effect of saline water irrigation on yield and its components.

2- Effect of cultivars on yield and its components.

3- Effect of the interaction on yield and its components

1- Effect of saline water irrigation on seeds chemical composition.

2- Effect of cultivars on seeds chemical composition.

3- Effect of the interaction on seeds chemical composition.

4.1. Growth characters:

Plant growth expressed as plant height, number of branches, leaf area and fresh and dry matter percentage of shoots.

4.1.1. Effect of saline water irrigation on growth characters:

Data presented in Tables (1-5) and figures (1-3) indicate the effect of water salinity on growth characters of broad bean plants through different the period of growth. The results show that with increasing water salinity, growth of broad bean decreased, while control treatment and alternative irrigation system (1: 1) between saline and tap water showed significant better growth in the two growing seasons. The results agree with those obtained by **Al-Tahir and Al-Abdulsalam 1997; Cordovilla *et al.* 1999** and **Abd-Alla *et al.* 2001**. They revealed that vegetative growth significantly decreased by salinity stress. **Katerji *et al.* (2001)** salinity affected the development leaf area of broad bean and soybean.

The results obtained in Table (1) & Fig. (1) indicate that with increasing water salinity, plant height decreased while control treatment and alternative irrigation system (1:1) between saline and tap water improved growth and gave the tallest plant in the two growing seasons. These results in the same line with results obtained by **Shehata and Farrag (1983)** and **Shaheen (1984)** they found that average plant height of broad bean cv. El-Kobrosy decreased in the range 40-27 cm with increasing salinity from 0 to 4000 ppm respectively.

In this regard, **Shafshak (1989)** mentioned that irrigation once with drainage water followed by three irrigation with Nile water improved growth of broad bean, plant height. The least values of such characters were obtained in plants irrigated four times with drainage water. Also, **Sallam (1999)** who indicated that plant height was reduced with increasing salinity level of water up to 2.0 % KCl or 4000 ppm NaCl.

Data illustrated in Table (**2**) showed that number of branches significantly higher with control and alternative irrigation system (1:1) than other water treatments in the two growing seasons. These results in the same line with results obtained by **Shehata and Farrag 1983; Shaheen 1984** and **Shafshak 1989** they irrigation once with drainage water followed by three irrigation with Nile water improved growth of broad bean and number of branches. **Ruiz *et al.* 1998; Abd-Alla *et al.* 2001** and **Lopez et *al.* 2003** they found that number of branches of broad bean plants was decreased with increasing salinity from 0 to 4000 ppm.

The results obtained in Table (3) & Fig**.** (2) indicate that with increasing water salinity, average leaf area was decreased. The control treatment and alternative irrigation system (1:1) between saline and tap water improved growth and gave the highest average leaf area in the two growing seasons. These results in the same harmony with results obtained by **Shehata and Farrag 1983** and **Shaheen 1984** they found that leaf area of broad bean decreased with increasing salinity from 0 to 4000 ppm. Also, **Wignarajah (1990)** found that there was an initial delay in development of the leaves of *phaseolus vulgaris* with salinity stress**. Herz *et al.* (1992)** found that total leaf area of *Vicia faba* of stressed plants was reduced by accelerated leaf senescence and by decreased leaf numbers and size. **Pascale *et al.* 1997; Mola *et al.* 1998; Ruiz *et al.* 1998; Sibole *et al.* 1998; Abd-Alla *et al.* 2001**; **Lopez *et al.* 2003** and **Tammam 2003** found that salinity causes a decline in leaf area and leaf number of broad bean and *phaseolus vulgaris*.

Data revealed in Table (4) & Fig. (3) showed that fresh weight of shoots of control plants or those irrigated alternatively with (1:1) significantly surpassed other treatments. These results agree with results obtained by, **Shehata and Farrag 1983; Shaheen 1984; Abd-Alla *et al.* 2001 and Khadri *et al.* 2001.**

The beneficial effect of alternative irrigation may be due to reduce the harmful effect of salts by leaching and enables plant to absorb water from soil and return to the natural case of growth **(Abdel-Salam *et al.* 1970; Abed *et al*. 1988 and shafshak 1989).**

Data revealed in Table (5) total chlorophyll had no significant effect between saline irrigation water treatments in the two growing seasons, the results agree with, **Melesse and Caesar 1992 and Hamada and El-Enany (1994)** found that the concentrations of chlorophylls and carotenoids were increased in *Vicia faba* leaves while in *pea* plants they remained more or less unchanged by up to 80 mM NaCl; at higher concentrations a significant decrease in these contents was observed. **Sallam, 1999; Cucci *et al* 2000; Lovelli *et al.* (2000) and Mandal *et al.* 2002** they recorded that salinity decreased the contents of chlorophyll of broad bean. **Demir and Kocacaliskan (2003)** investigated that effect of NaCl (150 mM) on chlorophyll of bean (*Phaseolus vulgaris*). NaCl decreased chlorophyll contents.

4.1.2. Effect of cultivars on growth characters of broad bean:

Obtained data concerned with different growth parameters of broad bean as affected by cultivars are illustrated in Tables (1-5) and Figures (1-3). Results reveal that thier were a clear variation between the three investigated broad bean cultivars plant height, number of branches, average leaf area, fresh and dry weights of plant foliage during the two season of growth. These results agree with **Shafik 1985; and Abul-Naas *et al.* 1989** they mentioned some faba bean cultivars of widely differences in vegetative growth. In the same line, **El-Shouny *et al.* (1989)** confirmed highly significant differences between three faba bean cultivars, in all the growth characters studied. **Tyurin and Sidorova 1982** and **Sharaf *et al.* 1988** studies on the 136 varieties the duration of growth period was highly variable.

In this respect, cultivars Reina Mora and Luz De Otone significantly surpassed cv. El Kobrosy in growth characters. Results showed significant differences in plant height as recorded in Table (1) and Fig. (1) in the two growing seasons. The results obtained were in the same line with **Shafik 1985; Piech and Mikulski 1988; Shafik *et al.* 1988; Abul-Naas *et al.* 1989 and El-Shouny *et al.* 1989.** They recorded that some faba bean cultivars had widely differences in plant height. **Edris 1993; Hassanein 1995** and **Hossny 1997** they indicated that the cultivars significantly differed in plant height of faba bean. The variation in plant height between cultivars may be due to the different ecotypes of the cultivar **(Abou Hamela 1987; El-Hamied 1990 and Raghavaiah *et al.* 2002).**

Cultivars Reina Mora, Luz De Otone and El Kobrosy show had no significant differences in number of branches per plant as data revealed in Table (2) in the two growing seasons. On the contrary, **Shafik 1985; Abul-Naas *et al.* 1989**; **El-Shouny *et al.***

1989; Hassanein 1995 and **Hossny 1997** they recorded that some faba bean cultivars had widely differences in number of branches/plant.

Cultivars Reina Mora exhibited the highest value of leaf area compared with El Kobrosy and Luz De Otone**.** Moreover, cultivars Reina Mora and Luz De Otone significantly surpassed in leaf area than cv. El Kobrosy in the two growing seasons as data shown in Table (3) and Fig. (2). The results obtained agree with those of**, Younis *et al*. 1985; Wali *et al.* 1990** and **Edris 1993** they reported that there were significant differences among faba bean cultivars in leaf area. Also, **Hossny (1997)** indicated that the tested four cultivars of broad bean significantly differed in leaf area.

Results also revealed in Table (4) and Fig. (3) show that cultivars Reina Mora and Luz De Otone significantly surpassed cv. El Kobrosy in fresh weight of shoot per plant. These results agree with, **Shafik 1985; Piech and Mikulski 1988; Abul-Naas *et al.* 1989 and Edris 1993** they reported significant differences among faba bean cultivars in fresh weight of leaves per plant could be detected. However, **Hassanein (1995)** in Egypt, they found significant difference among faba bean cultivars with fresh weight of leaves/plant at different stages of growth. **Hossny (1997)** indicated that the four cultivars of broad bean significantly differed in fresh weight of leaves per plant and fresh weight of stems per plant.

Data revealed in Table (5) cvs. Reina Mora and Luz De Otone significant increased than El Kobrosy in total chlorophyll in the two growing seasons, the results agree, **Maksoud and EL-**

Oksh 1983; Jalal *et al.* 1984; Younis *et al*. 1985 and **Jaworska 1994** they mentioned that the differences between total chlorophyll could be due to a genetic factors of cultivars.

In Germany, **Barton *et al.* (1995)** measured photosynthesis of several *Vicia faba* cultivars. They showed that there was no significant difference in photosynthetic capacity between the cultivars and this was also true for light compensation point, light saturation, and quantum yield. Photosynthesis was strongly dependent on leaf age. **Broetto *et al.* 1999 and Fukuta *et al.* (2000)** found that varietal differences in chlorophyll contents of leaves in 16 varieties of Vicia faba. **Melesse and Caesar 1992** and **Mohammad *et al.* (1994)** evaluated seven faba bean cultivars for protein and P contents. cv. VH 82-1 gave the highest protein and a high total P content (0.27%).

4.1.3. Effect of interaction on growth characters of broad bean:

The interaction effect of cultivars and saline irrigation water treatments on growth of broad bean illustrated in Tables (1-5) figures (1-3). The interaction effect had no significant response in plant height, However, respective of number of branches/plant and fresh weight of shoots which was increased as a result of the interaction between cv. Reina Mora and irrigation with saline water at 1:1 or 4000 ppm, the interaction between the same cultivar (Reina Mora) and the irrigation with tap water effected the highest values in all studied growth parameters during both seasons of study. The results obtained agree with those obtained by, **El-Motaz Billah 1965; EL-Beheidi *et al.* 1985; El-Sawah 1990 and Lahiri *et al.* 1996** showed that there are relation between the genotypes and tolerance to salinity. The genotypes exhibited differential sensitivity to salinity in terms of root growth. Considering, the most salt-tolerant genotypes, exhibiting relatively better shoot growth and root growth of seedlings. **Yadav *et al.* 1998; Abu-Awwad 1999; Palaniappan *et al.* 1999; Abd-Alla *et al.* 2001 and Khadri *et al.* 2001; Raghavaiah *et al.* 2002 and Maiti *et al.*** 2003 they found that phaseolus and broad bean cultivars are affected by salinity. The physiological parameters used as parameters of sensitivity or resistance are indices of growth rate, and leaf area and dry weight. **Al-Mutawa 2003; Boughribil *et al.* 2003; Saadallah *et al.* 2003; Santana *et al*. 2003 and Tammam 2003** showed that the growth components, namely leaf area, fresh and dry matter, and water content of *broad bean* were significantly reduced with an increase in salinity.

In this respect, the interaction had no effect in total chlorophyll as recorded in Table (5), salinty had no effect, the cultivars Reina Mora and Luz De Otone and El Kobrosy significantly differed, also salinity declined growth characters in the two growing seasons. The results obtained agree with those obtained by, **Melesse and Caesar (1992) and Hamada and El-Enany (1994)** found that low levels of salinity (40 meq/litre NaCl) increased chlorophyll content of 6 *Vicia faba* cultivars but did not lead to simultaneous increase in photosynthesis. Increased salinity levels (80 meq/L NaCl) decreased chlorophyll content and stomatal conductance. The results suggested increased salinity affects photosynthesis not only due to its effect on stomatal closure but also due to other non-stomatal effects like ultra structural damage and decrease in chlorophyll content below a threshold level.

This study relates the changes in concentrations of leaf metabolites (chlorophyll) at a soil salinity of 10 dS m-1 in 10 *cluster bean.* (**Lahiri *et al.* 1996). Demir and Kocacaliskan (2003)** investigated that effect of NaCl (150 mM) on chlorophyll of bean (*Phaseolus vulgaris* cv. Kizilhac). NaCl decreased chlorophyll contents.

Table (1): Effect of saline water irrigation and cultivars on plant height (cm) of broad bean during the growth Seasons.

cultivar / Treatments	plant height (cm)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	68.3	81.7	74.7	74.9	63.0	77.9	73.7	71.5
Altr.Irrig. 2:1	61.3	67.0	72.0	66.8	59.3	69.0	71.0	66.4
2000 ppm	59.0	70.7	70.0	66.6	60.2	66.7	70.3	65.7
4000 ppm	55.5	67.0	65.5	62.7	62.5	65.0	63.3	63.6
Cont.	70.0	84.7	85.0	79.9	70.3	84.7	86.7	80.6
Mean	62.8	74.2	73.4		63.1	72.7	73.0	
L.S.D. at 0.05 for irrigation =5.3					= 8.2			
cultivar =3.2					= 4.8			
Irrig. x cv.=N.S.					= N.S.			

Table (2): Effect of saline water irrigation and cultivars on number of branches of broad bean during the growth Seasons.

cultivar / Treatments	number of branches							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	4.7	6.0	5.3	5.3	4.9	5.2	5.0	5.0
Altr.Irrig. 2:1	4.0	4.8	3.8	4.2	4.2	4.3	4.4	4.3
2000 ppm	4.5	4.6	4.2	4.4	3.9	4.8	4.3	4.3
4000 ppm	3.2	4.4	3.4	3.7	4.0	4.4	4.2	4.1
Cont.	4.7	5.4	4.9	5.0	4.0	4.5	4.7	4.4
Mean4	4.2	5.1	4.3		4.2	4.7	4.5	
L.S.D. at 0.05 for irrigation = 0.7					0.5			
cultivar = N.S.					N.S.			
Irrig. x cv.= N.S.					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Table (3): Effect of saline water irrigation and cultivars on average leaf area (cm^2) of broad bean during the growth Seasons.

cultivar / Treatments	Leaf area (cm^2)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig.1:1	98.1	138.7	137.5	124.8	102.5	142.5	139.3	128.1
Altr.Irrig.2:1	75.1	140.8	127.5	114.5	78.9	144.5	131.3	118.2
2000 ppm	57.2	143.3	143.1	114.5	60.6	146.8	146.4	117.9
4000 ppm	98.4	111.1	107.1	105.5	88.0	108.5	107.6	101.5
Cont.	114.3	152.2	118.9	128.5	122.7	155.7	151.6	143.3
Mean	88.6	137.2	126.8		90.5	139.6	135.2	
L.S.D. at 0.05 for irrigation = N.S.					15.4			
cultivar = 14.1					7.9			
Irrig. x cv.= N.S					N.S			

Table (4): Effect of saline water irrigation and cultivars on average fresh weight (g) of shoots of broad bean during the growth Seasons.

cultivar / Treatments	Fresh weight of shoots (g)							
	2001-2002				2002-2003			
	1	2	3	X¯	1	2	3	X¯
Altr.Irrig. 1:1	237	280	243	253	203	254	275	244
Altr.Irrig. 2:1	188	262	254	235	172	259	230	220
2000 ppm	159	274	278	237	174	238	244	219
4000 ppm	192	238	256	219	164	243	242	216
Cont.	227	254	245	242	179	329	262	257
Mean	195	262	255		178	265	251	
L.S.D. at 0.05 for irrigation=18.9					24.9			
cultivar = 25.3					14.5			
Irrig. x var.= N.S.					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Table (5): Effect of saline water irrigation and cultivars on chlorophyll content of leaves (SPAD unit) of broad bean during the growth Seasons.

cultivar / Treatments	Total chlorophyll (SPAD unit)							
	2001-2002				2002-2003			
	1	2	3	X¯	1	2	3	X¯
Altr.Irrig. 1:1	41.4	46.4	46.1	44.6	43.6	47.1	48.7	46.5
Altr.Irrig. 2:1	41.3	55.5	50.4	49.1	41.3	50.3	45.3	45.6
2000 ppm	42.6	48.3	44.5	45.1	43.4	48.8	45.7	46.0
4000 ppm	47.2	48.3	49.0	48.2	45.4	48.8	47.2	47.1
Cont.	46.7	51.3	46.3	48.1	42.6	48.0	46.3	45.6
Mean	43.8	50.0	47.3		43.3	48.6	46.6	
L.S.D. at 0.05 for irrigation = N.S.					N.S.			
cultivar = 3.84					2.87			
Irrig. x var.= N.S.					N.S.			

Fig. (1): Effect of saline water irrigation and cultivars on plant height (cm) of broad bean during the growth seasons.

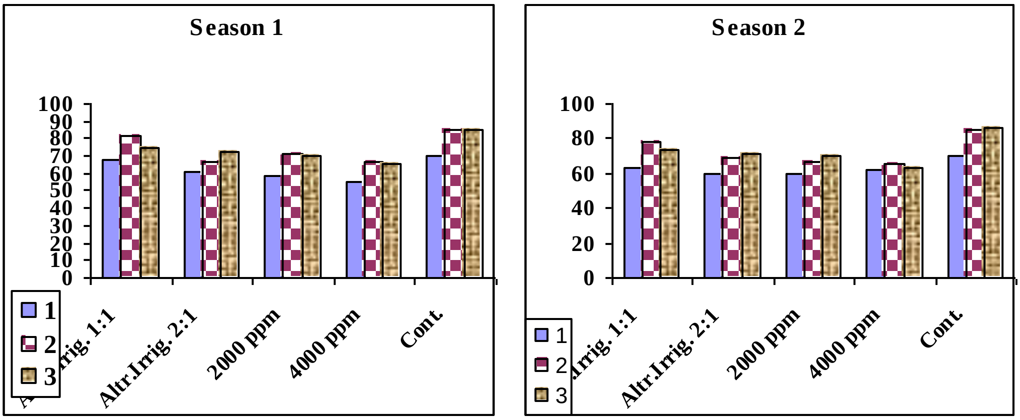


Fig. (2): Effect of saline water irrigation and cultivars on leaf area (cm^2) of broad bean during the growth seasons.

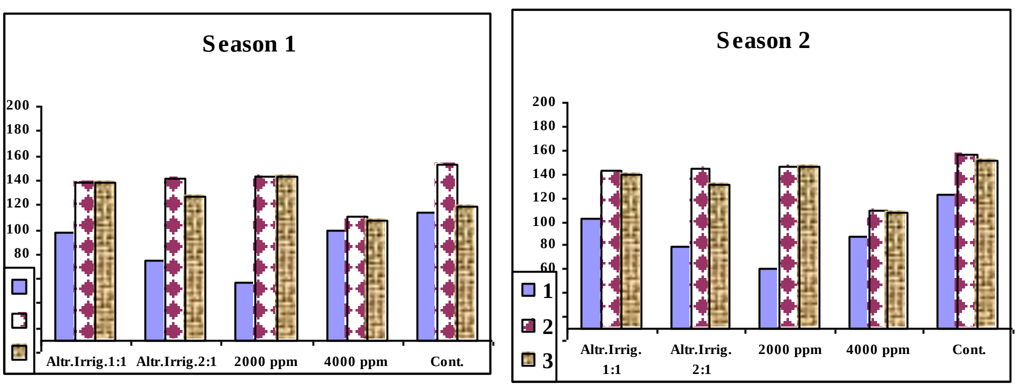
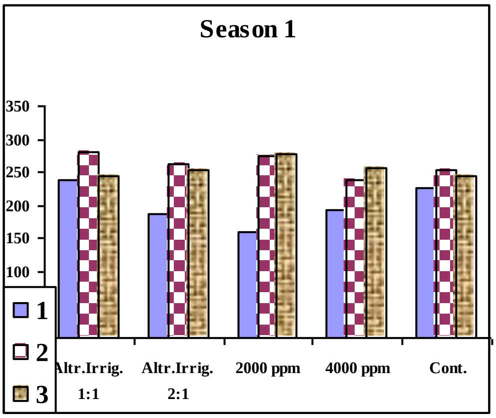
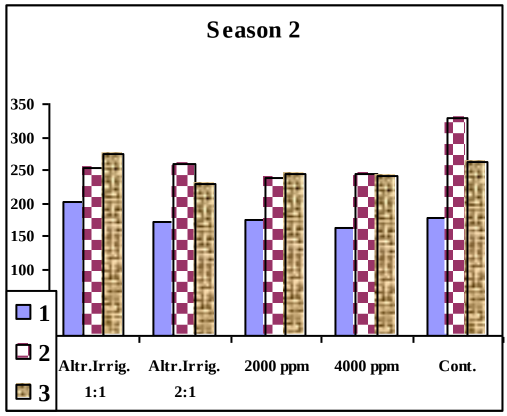


Fig. (3): Effect of saline water irrigation and cultivars on fresh weight of shoots (g) of broad bean during the growth seasons.





4.2. Yield and its components:

Yield and its components are expressed as pod length (cm), pod weight (g), Number of seeds/pod, weight of seeds/pod (g), netting percentage, weight of 100 seeds (g), total yield of green pods/plots, total yield of green pods/feddan, total yield of dry seeds/plots and total yield of dry seeds/feddan. Obtained results are recorded in Tables (6-15) and fig. (4-8).

4.2.1. Effect of water salinity on yield and its components:

Data presented in Tables (6-15) and fig. (4-8) show that the effect of irrigation with saline water on pod length, pod weight, number of seeds/pod, weight of seeds/pod, netting percentage, weight of 100 seeds, total yield of green pods/plot, total yield of green pods/feddan, total yield of dry seeds/plot and total yield of dry seeds/feddan.

Such results in Table (6) & Fig. (4) reveal that average pod length significantly increased with irrigation from saline well 2000 ppm and alternative irrigation treatment (1:1) and control about 600 ppm are similar in the first seasons than other water treatments, while pod length was decrease with increasing water salinity up to about 4000 ppm. The same trend was also observed in data presented in Tables (9) & Fig. (6) Weight of seeds/pod. Data in Tables (7) & Fig. (5) Pod weight was significantly increased with control than other treatments which didn't significantly in the first growing season, while the second season differed. Tables (11) & Fig. (7) Average weight of 100 seeds which were increased significantly with irrigation by water from well contain about 2000 ppm of total salts and control than other water treatments in the two growing seasons. Number of seeds/pod was significantly increased with alternative irrigation treatment (1:1) and control than other treatments in the second growing season Table (8).

On the contrary netting percentage as tabulated in Table (10) showed significant increase with increasing salinity in water of irrigation to about 4000 ppm and control in the first growing season, while not significant in the second season.

Results recorded in Tables (12&13) & Fig. (8) show that total yield of produced green pods/plots and total yield of green pods/feddan gave the highest values with irrigation from well its salinity about 2000 ppm, alternative irrigation treatment (1:1) in addition to the control treatment and alternative irrigation treatment (2:1) in the two growing seasons. While irrigation from well its salinity about 4000 ppm tended to decrease the yield of produced green pods significantly in the two seasons.

The total yield of dry seeds//plots shown in Tables (14) & Fig. (9) showed significant increase with control in addition to irrigation from well its salinity about 2000 ppm in the first season, while not significant in the second season. Total yield of dry seeds/feddan as shown in Tables (15) showed not significantly with all treatments in the two growing season. The results obtained agree with those recorded b**y Shehata and Farrag 1983; Dua et *al.* 1989; Abed *et al*. 1987 and Shafshak 1989** reported that irrigation once with drainage water followed by three irrigation with Nile water improved yield components of broad bean, increased green pod yield per feddan. While increasing drainage water frequencies more than once decreased green pod yield per feddan.

The reduction in broad bean yield with increasing salinity may be due to increasing irrigation water salinity decreased water use efficiency **(Dahdoh and Hassan 1997; Mola *et al.* 1998; Abu Awwad, 1999). Katerji *et al.* 2001 and Kamlesh *et al*. 2003** they concluded that yield of broad bean decreased with increasing salinity levels. **Ruiz *et al.* 1998; Younis *et al.* 1999** found that total dry seed yield of bean decreased as the salinity level in the nutrient solution increased**. Cucci *et al*. (2000)** found that the maximum irrigation water salinity that still allowed a good bean production ranged from 2 to 4 dS/m.

The good effect of alternative irrigation system on growth and yield of plant may be due to use of tap water in irrigation after saline water helps the plant to regain its normal growth pattern by elimination of salinity factor **(Strogonv, 1960).**

4.2.2. Effect of cultivars on yield and its components of broad bean:

Results in Table (6-9) & Fig. (4-6) indicate that cvs. Reina Mora and Luz De Otone significant surpassed cv. El Kobrosy in pod length, pod weight, Number of seeds/pod and weight of seeds/pod. Such results are similar in the two growing seasons. These results agree with those obtained by, **El-Shouny *et al.* 1989; Abul-Naas *et al.* 1989; Mohamed and El-Shazly 1989; Mangal *et al*. 1990; Jaworska 1994; Schafferman *et al.* 1994**; **Caruso and D'Anna 1995 and Hossny 1997** investigated some faba bean cultivars, the data confirmed highly significant differences between cultivars in length of pod, weight of pod, number of seeds/pod and seeds weight/pod, number of pods/plant, number of seeds/plant.

Data recorded in Tables (10-11) & Fig. (7) show that cv. Reina Mora significantly increased in netting percentage and weight of 100 seeds (g) in the second season than cvs. Luz De Otone and El Kobrosy. Also, cvs. Reina Mora and Luz De Otone significantly surpassed cv. El Kobrosy in weight of 100 seeds (g) in the two growing seasons. These results agree with**, Mahmoud and Al-Ayobi, 1987; Miccolis and Bianco 1988; Shafik *et al*. 1988 and Sharaf *et al.* 1988** they recorded that the cultivars differed, significantly in weight of hundred seeds and shattering of seeds were significantly differed among the tested cultivars. **Wali *et al.* (1990)** who found that Aquadulce had the highest shelling percentage. **Caruso and D'Anna (1995) and Hossny (1997)** investigated some faba bean cultivars; the data confirmed highly significant differences between cultivars in seed index (100-seed weight g).

The same trend observed in results illustrated in Tables (12&13) & Fig. (8**)** where cvs. Reina Mora and Luz De Otone significantly higher in total yield of produced green pods for plot and feddan than cv. El-Kobrosy. The results agree with, **Ortiz-Cereceres *et al.* 1984; Khalaf *et al.* 1981; Shehata and Farrag 1983; Dua *et al.* 1989.** They found that differed in the total yield for broad bean cultivars**. Piech** and **Mikulski 1988; Shafik *et al.* 1988; Hossny 1997 and Ragab *et al.* 2000** studied the variation in yield/plant and its components in 16 varieties. The highest-yielding varieties had a large number of pods/node and moderate values for number of nodes with pods.

Data presented in Tables (14-15) Fig. (9) indicated that cvs. Reina Mora and Luz De Otone surpassed cv. El Kobrosy significantly in total yield of dry seeds/plots and total yield of dry seeds/feddan. These results agree with, **Mohamed *et al.* (1981) and Piech and Mikulski (1988)** found that total yield was highly differed between some bean and soybean cultivars. **Abul-Naas *et al.* 1989; El-Hosry 1989; El-Shouny *et al.* 1989 and Mohamed and El-Shazly 1989** recorded that there are highly significant differences between faba bean cultivars in seed yield (ardab /feddan). **Jaworska 1994; Caruso and D'Anna 1995 and Hossny 1997** who found that some cultivars of broad bean differs in seed yield and seed quality, there were significantly differences among the some faba bean cultivars. The varietal differences between cultivars may be due to the specific genetic constitution of each cultivar **(Treutner *et al.* 1980 and Dushmukh and Derore 1990).**

4.2.3. Effect of interaction on yield and its components of broad bean:

The interaction effect of cultivars and saline irrigation water treatments on broad bean yield and its component showed that the highest yield of broad bean obtained from cv. Reina Mora irrigated with tap water (control) or alternative irrigation treatments (1:1) or 2000 ppm followed by the same treatments with cv. Luz De Otone in the second season. In this respect, average length of pod, weight of pod, No. of seeds/pod, weight of seeds/pod, net weight and weight of 100 seeds did not significantly increases due to interaction treatments. These results agree with, **Shehata and Farrag (1983)** and **Abed *et al.* (1988)** recorded differences in the total yield and its component for broad bean cultivars under salinity levels of 2000 or 4000 ppm. **Dua *et al.* (1989)** found that broad bean cultivars differed in the total yield and its component under Salinity (EC of 3, 6, 9, 12 dS/m). **Ismail (1996)** found that increasing NaCl concentration in the rooting medium (up to 200 mM) significantly reduced the yield in *Phaseolus vulgaris L*. varieties. **Pascale *et al.* (1997) and Lahiri *et al.* (1996)** recorded that *faba bean* and *Phaseolus vulgaris* cv. Bronco plants were treated with water with 0, 0.25 or 0.5 % NaCl. Salinity reduced total yield. They also found that soil salinity reduced mean pod weight of broad bean by 15% and the number of pods per plant (48%). Higher salinity stress decreased the seed yield by 67 % due to a reduction in seed weight and number, and also affected product quality. **Scholberg and Locascio (1999) Kamlesh *et al*. (2003)** recorded differences in the total yield and its component for cultivars under salinity. The high-yielding varieties of faba bean (VH-82-1) and rice bean (RB-32).

Table (6): Effect of saline water irrigation and cultivars on pod length (cm) of broad bean during the growth Seasons.

cultivar / Treatments	Pod length (cm)							
	2001-2002				2002-2003			
	1	2	3	X⁻	1	2	3	X⁻
Altr.Irrig. 1:1	12.5	22.3	21.8	18.9	13.5	21.0	18.6	17.7
Altr.Irrig. 2:1	12.7	20.2	19.3	17.4	12.7	20.2	19.7	17.5
2000 ppm	13.9	21.7	22.2	19.3	13.9	21.0	22.2	19.0
4000 ppm	13.0	19.0	18.0	16.7	12.2	21.3	18.2	17.2
Cont.	13.6	22.6	21.0	18.9	13.0	22.2	21.3	18.8
Mean	13.1	21.2	20.5		13.1	21.1	20.0	
L.S.D. at 0.05 for irrigation = 1.2					1.1			
cultivar = 1.1					0.8			
Irrig. x cv.= N.S.					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Table (7): Effect of saline water irrigation and cultivars on average pod weight (g) of broad bean during the growth Seasons.

cultivar / Treatments	Pod weight (g)							
	2001-2002				2002-2003			
	1	2	3	X⁻	1	2	3	X⁻
Altr.Irrig. 1:1	23.1	33.1	26.8	27.7	22.7	38.2	32.1	31.0
Altr.Irrig. 2:1	20.2	36.5	28.3	28.3	26.8	39.8	31.7	32.8
2000 ppm	18.9	30.5	29.3	26.3	22.2	33.8	32.7	29.6
4000 ppm	17.7	26.9	30.6	25.0	20.9	30.2	33.9	28.4
Cont.	24.4	39.3	29.7	31.1	27.7	42.6	33.0	34.4
Mean	20.9	33.3	28.9		24.1	36.9	32.7	
L.S.D. at 0.05 for irrigation = 2.7					2.5			
cultivar = 1.9					2.2			
Irrig. x cv.= N.S.					N.S.			

Table (8): Effect of saline water irrigation and cultivars on average number of seeds/pod of broad bean during the growth Seasons.

cultivar / Treatments	No. of seeds/pod							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	4.3	5.3	5.4	5.2	4.2	5.6	5.7	5.2
Altr.Irrig. 2:1	4.2	5.2	4.9	4.8	4.2	5.2	5.4	4.9
2000 ppm	4.4	5.4	5.1	5.0	4.7	5.5	5.2	5.1
4000 ppm	4.8	5.5	5.2	5.0	4.5	5.5	5.0	5.0
Cont.	4.5	5.5	5.3	5.1	4.4	5.7	5.2	5.1
Mean	4.4	5.4	5.2		4.4	5.5	5.3	
L.S.D. at 0.05 for irrigation = N.S.					0.1			
cultivar = 0.4					0.5			
Irrig. X cv. = N.S.					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Table (9): Effect of saline water irrigation and cultivars on average weight of seeds/pod (g) of broad bean during the growth Seasons.

cultivar / Treatments	Weight of seeds/pod (g)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	9.8	16.5	14.3	13.5	10.5	17.2	14.9	14.2
Altr.Irrig. 2:1	9.5	17.3	14.1	13.6	9.9	18.0	14.7	14.2
2000 ppm	11.4	19.3	14.4	15.0	12.1	20.0	15.1	15.7
4000 ppm	9.3	15.9	15.0	13.4	9.7	16.6	15.7	14.0
Cont.	9.5	15.9	15.4	13.6	10.2	16.6	16.1	14.3
Mean	9.9	17.0	14.6		10.5	17.7	15.3	
L.S.D. at 0.05 for irrigation = N.S.					1.2			
cultivar = 1.1					1.3			
Irrig. x cv.= N.S.					N.S.			

Table (10): Effect of saline water irrigation and cultivars on netting percentage of seeds broad bean during the growth Seasons.

cultivar / Treatments	Netting (%)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	50.5	49.9	49.5	50.0	46.1	47.1	46.4	46.5
Altr.Irrig. 2:1	47.3	47.6	49.1	48.0	37.4	45.3	46.0	42.9
2000 ppm	46.9	49.3	49.0	48.4	43.6	47.0	45.9	45.5
4000 ppm	52.6	59.2	48.6	53.5	45.9	54.9	46.1	49.0
Cont.	50.4	52.2	52.5	51.7	45.8	49.3	49.2	48.1
Mean	49.5	51.6	49.7		43.7	48.7	46.7	
L.S.D. at 0.05 for irrigation = 3.17					N.S.			
cultivar = N.S.					2.54			
Irrig. x cv.= N.S.					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 p

Table (11): Effect of saline water irrigation and cultivars on average weight of 100 seeds (g) of broad bean during the growth Seasons.

cultivar / Treatments	Weight of 100 seeds (g)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig.1:1	235.0	343.3	288.7	289.0	255.0	363.3	308.7	309.0
Altr.Irrig.2:1	226.7	335.7	294.3	285.6	246.7	355.7	314.3	305.6
2000 ppm	258.3	351.7	299.7	303.2	278.3	371.7	319.7	323.2
4000 ppm	236.3	309.7	319.3	288.4	256.3	329.7	332.7	306.2
Cont.	254.0	331.3	319.7	301.7	269.7	351.3	339.7	320.2
Mean	242.1	334.3	340.3		261.2	354.3	323.0	
L.S.D. at 0.05 for irrigation = 11.6					14.6			
cultivar = 21.2					20.9			
Irrig. xcv.=N.S.					N.S.			

Table (12): Effect of saline water irrigation and cultivars on total yield of green pods (kg/plot) of broad bean during the growth Seasons.

cultivar / Treatments	Total yield of green pods (kg)							
	2001-2002				2002-2003			
	1	2	3	X⁻	1	2	3	X⁻
Altr.Irrig.1:1	10.094	16.616	15.328	14.013	10.801	17.316	16.331	14.816
Altr.Irrig.2:1	8.554	14.725	14.745	12.676	9.604	15.380	15.799	13.594
2000 ppm	11.723	17.738	17.099	15.520	12.278	18.788	15.722	15.522
4000 ppm	6.316	7.754	11.590	8.553	7.133	8.108	12.639	9.293
Cont.	11.702	15.505	16.226	14.519	14.266	13.555	18.347	16.389
Mean	9.702	14.468	14.998		10.816	15.229	15.768	
L.S.D. at 0.05 for irrigation = 0.69					2.17			
cultivar = 1.45					1.43			
Irrig. x cv.= N.S					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Table (13): Effect of saline water irrigation and cultivars on total yield of green pods (ton/feddan) of broad bean during the growth Seasons.

cultivar / Treatments	Total yield of green pods (ton)							
	2001-2002				2002-2003			
	1	2	3	X⁻	1	2	3	X⁻
Altr.Irrig.1:1	4.038	6.646	6.131	5.605	4.320	6.926	6.532	5.926
Altr.Irrig.2:1	3.422	5.890	5.910	5.074	3.842	6.152	6.320	5.438
2000 ppm	4.689	7.095	6.839	6.208	4.911	7.515	6.289	6.238
4000 ppm	2.526	3.101	4.636	3.421	2.853	3.243	5.055	3.717
Cont.	4.730	6.202	6.491	5.808	5.706	6.622	7.339	6.556
Mean	3.881	5.787	6.001		4.326	6.092	6.307	
L.S.D. at 0.05 for irrigation = 0.29					0.81			
cultivar = 0.58					0.58			
Irrig. x cv.= N.S.					0.54			

Table (14): Effect of saline water irrigation and cultivars on total yield of dry seeds (kg/plot) of broad bean during the growth Seasons.

cultivar / Treatments	Total yield of dry seeds (kg)							
	2001-2002				2002-2003			
	1	2	3	X⁻	1	2	3	X⁻
Altr.Irrig.1:1	2.623	3.263	3.183	3.023	2.634	3.248	3.194	3.025
Altr.Irrig.2:1	1.771	3.381	3.449	2.867	1.783	3.393	3.460	2.879
2000 ppm	2.966	3.250	3.078	3.098	3.136	3.262	3.089	3.162
4000 ppm	2.165	3.390	2.707	2.754	2.177	3.402	2.718	2.766
Cont.	2.067	3.997	3.318	3.127	2.079	4.009	3.330	3.139
Mean	2.318	3.456	3.147		2.362	3.463	3.158	
L.S.D. at 0.05 for irrigation = 0.28					N.S.			
cultivar = 0.43					0.45			
Irrig. x cv.= N.S.					N.S.			

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

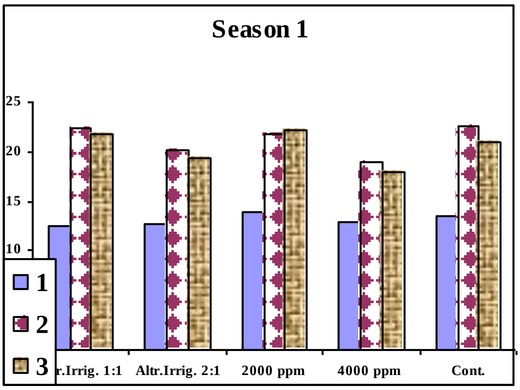
Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Table (15): Effect of saline water irrigation and cultivars on total yield of dry seeds (ton/feddan) of broad bean during the growth Seasons.

cultivar / Treatments	Total yield of dry seeds (ton)							
	2001-2002				2002-2003			
	1	2	3	X⁻	1	2	3	X⁻
Altr.Irrig.1:1	1.049	1.295	1.273	1.206	1.054	1.299	1.278	1.210
Altr.Irrig.2:1	0.708	1.352	1.380	1.147	0.713	1.357	1.384	1.151
2000 ppm	1.186	1.300	1.231	1.239	1.254	1.304	1.236	1.265
4000 ppm	0.866	1.356	1.083	1.102	0.871	1.361	1.087	1.106
Cont.	0.827	1.599	1.327	1.251	0.832	1.604	1.332	1.256
Mean	0.927	1.380	1.259		0.945	1.385	1.263	
L.S.D. at 0.05 for irrigation = N.S.					N.S.			
cultivar = 0.170					0.178			
Irrig. x cv.= N.S.					N.S.			

Fig. (4): Effect of saline water irrigation and cultivars on pod length (cm) of broad bean during the growth seasons.



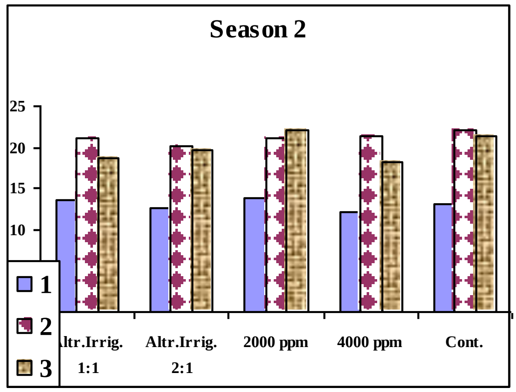
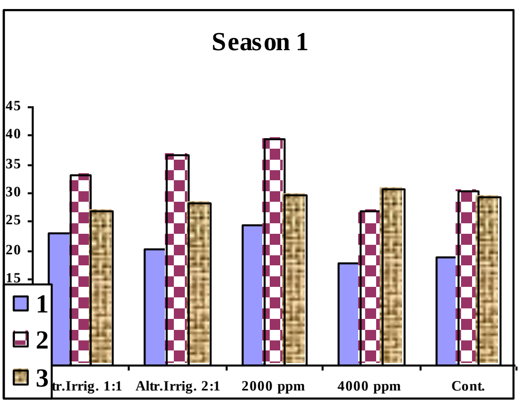


Fig. (5): Effect of saline water irrigation and cultivars on pod weight (g) of broad bean during the growth seasons



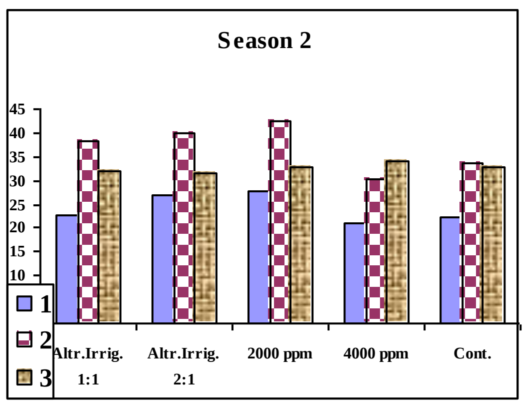


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Fig. (6): Effect of saline water irrigation and cultivars on weight of seeds/pod (g) of broad bean during the growth seasons.

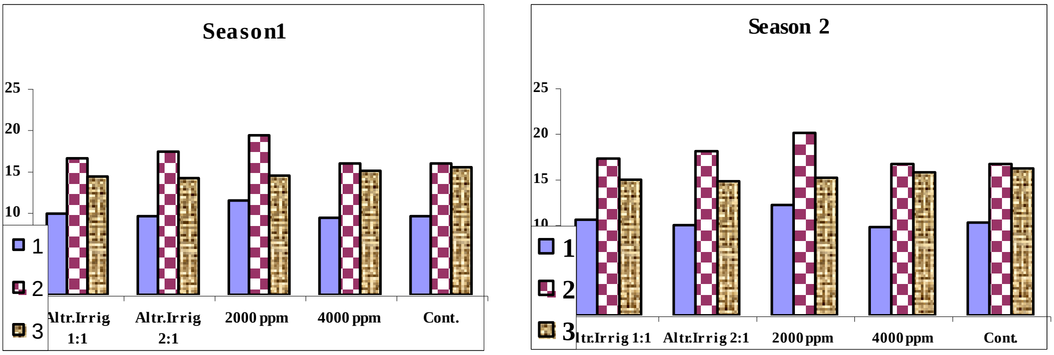


Fig. (7): Effect of saline water irrigation and cultivars on weight of 100 seeds (g) of broad bean during the growth seasons.

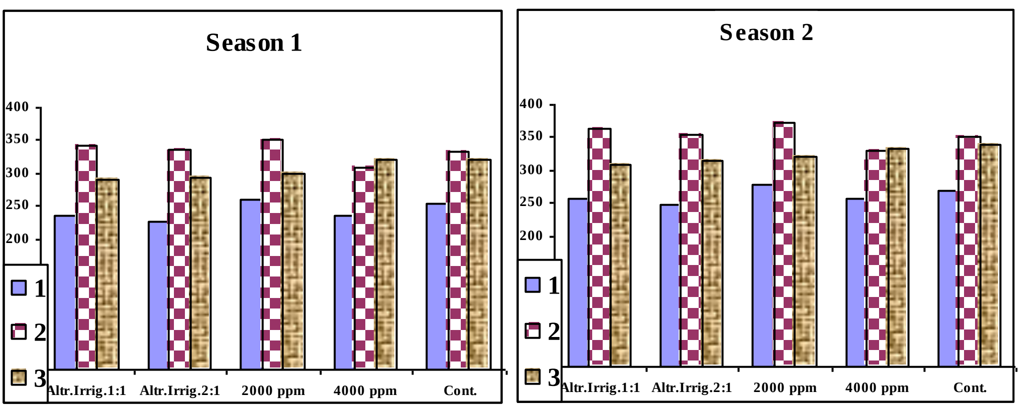


Fig. (8): Effect of saline water irrigation and cultivars on total yield of green pods/feddan (ton) of broad bean during the growth seasons.

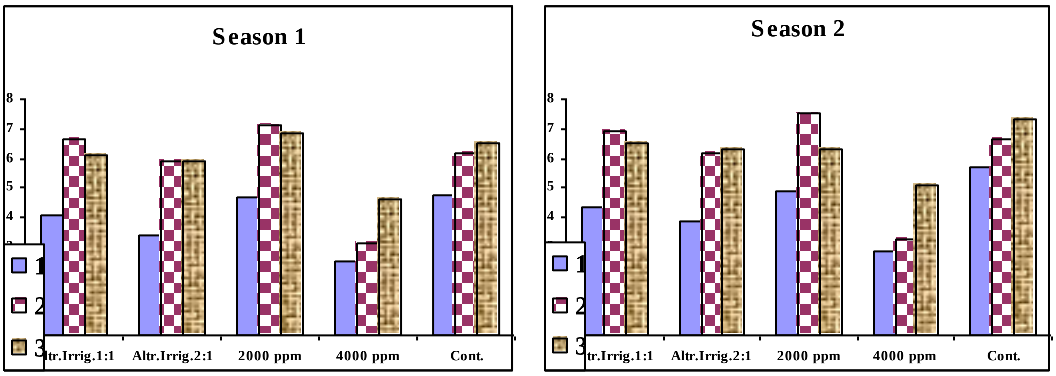
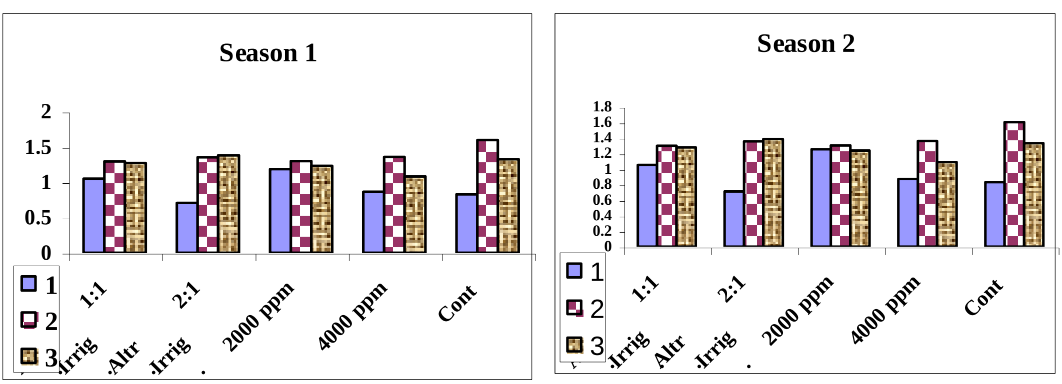


Fig. (9): Effect of saline water irrigation and cultivars on total yield of dry seeds/feddan (ton) of broad bean during the growth seasons.



4.3. Chemical composition:

4.3.1. Effect of saline water irrigation on chemical composition.

4.3.1.a. Dry matter percentage of plant tissues:

1-Dry matter percentage of shoots:

Dry matter percentage of shoots increased significantly with (4000 ppm) water salinity treatment than other treatments as shown in Table (16). These results agree with those obtained by**, Raafat *et al.* 1984; Schmidhater 1985; Ferreyra *et al.* 1997 and Abd-EL Motey 2004** who found that with increasing salinity the moisture content decreased in plant and dry matter percentage increase **Pascale *et al.* 1997; Ruiz *et al.* 1998**; **Adiku *et al.* 2001 and Katerji *et al.* 2001** found that total dry matter of *Phaseolus vulgaris* decreased as the salinity level in the nutrient solution increased (2.1, 7.2, 12.6 and 16.8 dS m^{-1}). **Santana *et al***. **(2003) and Tammam (2003)** showed that water content of broad bean was significantly reduced with the increase in the salinity of water irrigation.

The effect of salinity on plant growth may be, due to the absence of adequate osmotic pressure which enables the absorption of water from soil **(Abd El- Salam *et al.* 1970).**

2- Dry matter percentage of seeds:

Results recorded in Tables (17) show dry matter % in green seed gave the highest values with irrigation from well its salinity about 4000 ppm, in addition to the control treatment in the first season. The results obtained agree with those recorded by, **Katerji *et al.* (1992)** found that with increasing salinity (2.1 and 4 dS/m) DM production of *Vicia faba* increased. **Cucci *et al*. (2000)** found that the maximum irrigation water salinity that still allowed a good bean production ranged from 2 to 4 dS/m. Increasing dry matter (%) with increasing salinity agree with results obtained by **(Gough and Hobson 1990 and Abd-El-Motey 2004).** On the contrary, **Ruiz *et al.* 1998; Younis *et al.* 1999** found that total dry matter of bean decreased as the salinity level in the nutrient solution increased

4.3.1. b.<u>Organic constituents:</u>

1- <u>Crude Protein:</u>

Results presented in Tables (18) and Fig. (10) reveal that, the plants which were irrigated from tap water and well with salinity of about 2000 ppm showed the highest content of protein, **T**he increasing of protein agree with the results obtained by **Gadallah 1999; Sallam 1999; Ismail and Azooz 2002; Mandal *et al.* 2002 and Demir and Kocacaliskan 2003** recorded that irrigation with saline water increased the conc. of protein. Salinity decreased the contents of soluble proteins in seeds of broad bean. Moreover, the same trend of results was reported by**, Kamlesh *et al*. (2003**) who mentioned that faba bean contained higher concentrations of crude protein (25.5 g/100 g) under soil salinity condition.

2- <u>Amino acids:</u>

Data in Tables (25) and Fig. (11, 12, 13 & 14) reveal that, the amino acids increased in broad bean seeds. The plants which were irrigated from alternative irrigation system (2:1) between saline and tap water in the two growing seasons, showed the highest content of amino acids as glutamic, argenine, phenyl alanine, alanine, leucine, isoleucine and ammonia surpassed tnan the other amino acids. The increasing of amino acids by salinity agree with the results obtained by **Hussein *et al.* 1984 and Gadallah 1999** recorded that irrigation with saline water increased the conc. of amino acids in seeds broad bean. **Tammam (2003)** reported that the proline content significantly increased with NaCl treatment. Salinity also induced an increase in total amino acids and ammonia of broad bean retarded proline. The total amino acid content was approximately 1.6-fold of the control and there was a drastic increase in threonine and serine content**.** The great accumulation of the amino acids under drought stress may be considered as cytoplasmic osmotic for which there is evidence in particular species include glutamine, glutamic acid, asparagines, asparatic acid and a number of other amino acids **(Ramanjulu and Sudhakar 1997; Wang *et al.* 20004)**

4.3.1. c. Mineral chemical constituents:

Results presented in Tables (19) reveal that, with increasing water salinity, the chemical composition increased in broad bean seeds. The plants which were irrigated from tap water and well with salinity of about 2000 ppm showed the highest content of nitrogen. The increasing of nitrogen by salinity agree with the results obtained by, **Shehata and Farrag, 1983; Hussein *et al.* 1984; Eid**

and Shereif 1996; Gadallah, 1999; Sallam 1999; Ismail and Azooz 2002; Mandal *et al.* 2002 and Demir and Kocacaliskan 2003 they recorded that irrigation with saline water increased the conc. of N in seeds of broad bean.

On the contrary, **Abed *et al.* (1987**) investigated that pea plant grown under various salinity conditions (6000 ppm and 9000 ppm in irrigation water) salinity decreased N. While, **Shafshak (1989)** indicated that nitrogen concentration of both plant foliage and green seeds nearly constant values in broad bean plants irrigated with various frequencies of drainage water.

The results presented in Tables (20, 21 & 22) showed that there was a significant increment in phosphorus with control and alternative irrigation system (1:1) between saline and tap water in the two growing seasons, while phosphorus decreased with 4000 ppm. The plants which were irrigated from tap water and well with salinity of about 2000 ppm showed the highest content of potassium**.** there was a significant increment in calcium with alternative irrigation system (2:1) between saline and tap water and well with salinity of about 2000 and 4000 ppm in the two growing seasons, This result agree with, **Abed *et al.* (1988)** and **Shafshak (1989)** indicated that increasing drainage water frequencies decreased the concentration of P and K in both foliage and green seeds broad bean plants, while Ca concentration increased in plant foliage but did not reflect any significant increase in green seeds. **Eid and Shereif (1996)** found that the content of P increased significantly with mixed waste water compared to freshwater, in mixed waste water treatment (1:2), compared to freshwater. Contents of P and K are significantly greater in grain or seed than in straw of broad beans. **Dahdoh and Hassan (1997)** found that saline water irrigation increased plant P of beans grown in loamy sand, while in beans grown in calcareous loam soil decreased**.** **Belkhodja (1998)** indicated that faba bean exposed to salinity stress. With increasing salinity, K^+ ion accumulation was highest in the leaves at all salinity levels. Also, **Mola-Doila *et al.* (1998)** found that salinity decline in Ca in leaf tissues of broad bean

Gadallah 1999 and Lovelli *et al.* (2000) indicated that plants exposed to salinity stress had higher concentrations of Ca^{2+}, and lower concentrations of K^+, in new leaf tissue than unstressed plants. **Abd-Alla *et al.* (2001)** under high levels of NaCl indicated that Ca and K were lower in faba bean nodules than control ones. Also, **Nandini *et al.* (2003)** found that potassium and calcium contents decreased under NaCl stress in various plant parts in mung bean.

The results obtained in Table (23) show that with increasing salinity sodium content was increased in seeds of broad bean with well 4000, 2000 & Alternative 2:1).While alternative irrigation system (control & 1:1) between saline and tap water gave the lowest values of sodium than the other treatments in the two growing seasons. These results agree with**, Dahdoh and Hassan 1997; Abd-Alla *et al.* 2001; Boughribil *et al.* 2003 and Belkhodja 1998** indicated that with increasing salinity Na^+ ions accumulated more in stems than leaves of faba bean. **Mola-Doila *et al.* (1998)** found that salinity declined K/Na ratio and increased leaf permeability and osmotic potential which probably led to more accumulation of toxic ions like Na in leaf tissues of broad bean. ***Vicia*** *faba* responded to increasing soil salinity by decreased leaf relative water content and osmotic potential. Salinity enhanced, Na^+, the ratio of K^+/Na^+ was decreased on Salinization **(Gadallah, 1999). Tammam (2003)** reported that sodium content in both roots and shoots of broad bean increased with increasing salinity.

As regard, chloride content, it increased with increasing the concentration of salinity as shown in Table (24) with well 4000, 2000 & Alternative 2:1).While alternative irrigation system (1:1 & control) between saline and tap water gave the lowest values of chloride than the other treatments in the two growing seasons. These results agree with those obtained by, **Belkhodja 1998**; **Mola-Doila *et al.* 1998; Abd-Alla *et al.* 2001 and Raptan *et al*. 2001** who indicated that with increasing salinity Cl^- ions mainly accumulated in the roots of faba bean and mung bean plants. Also, **Banuelos *et al*. 2002; Boughribil *et al.* 2003 and Nandini *et al.* 2003** they found that Cl^- content in bean and mung bean increased with increasing salinity up to (4 dS/m).

4.3.2. Effect of cultivars on chemical composition:

4.3.2. a. Dry matter percentage of plant tissues:

1- Dry matter percentage of shoots

Results illustrated in Table (16) clearly show that dry matter percentage significantly increased in cvs. Reina Mora and Luz De Otone than cv. El Kobrosy. The results agree with those recorded by **Abou-Hamela 1987; Piech and Mikulski 1988; Abul-Naas *et al.* 1989; Wali *et al.* 1990; Edris 1993 and Hassanein 1995** they found significant differences among faba bean cultivars in dry weight of leaves/plant at different stages of growth. **Hossny (1997)** indicated that the faba bean cultivars significantly differed in dry weight of leaves per plant. The varietal differences between cultivars could be due to specific genetic make up differences (**Maksoud and El-Oksh 1983 and Lahiri *et al.* 1996).**

2- Dry matter percentage of green seeds:

Obtained results recorded in Table (17) show that cvs. Reina Mora and Luz De Otone significantly surpassed cv. El Kobrosy in dry matter percentage of seeds. Results agree with, **Scigalska 1992; Jaworska 1994; Ashmawy *et al.* 1998 and Saini and Negi 1998** found that differences in dry matter of broad bean cultivars were recorded.

4.3.2.b.<u>Organic constituents:</u>

1- <u>Crude Protein:</u>

Results presents in Table (18) show a comparison between broad bean cultivars (Reina Mora, Luz De Otone and El Kobrosy) on the content of total protein in broad bean seeds. Data in Table (18) declared that cv. Reina Mora showed significant increment a compared with cvs. Luz De Otone and El Kobrosy in total protein content of seeds in the second season. The obtained results agree with those of, **Hegazi *et al.* 1981**; **Khalaf *et al.* 1981; Jalal *et al.* 1984; Younis *et al*. 1985** and **Scheybal 1988** they indicated that protein composition in seeds of six genotypes of *Vicia faba* differed. **Jaworska 1994; Khalifa *et al.* 1997 and Hossny 1997** and **Kamlesh *et al*. 2003** they found that there are differences in the protein content.

2- <u>Amino acids:</u>

Results presents in Table (25) and Fig. (11, 12, 13 & 14) declared that cv. Luz De Otone showed significant increment in amino acids as glutamic, argenine phenyl alanine, alanine, leucine, isoleucine and ammonia than cvs. Reina Mora and El Kobrosy in the content of amino acids in seeds. The obtained results agree with those of, **Hegazi *et al.* 1981**; **Khalaf *et al.* 1981; Mnembuka and Eggum 1993; El-Khalifa *et al.* 1997 and Heikal *et al.* 2000** who indicated that amino acids composition in seeds of genotypes of *Vicia faba* differed. Five protein fractions were detected, however, the relative amount of each fraction varied, to some extent in the different genotypes. Separated protein amino acids indicated that regardless of the tested genotypes, the amounts of aspartic acid, glutamic acid and arginine were higher and variable than other amino acids. The proportion of essential amino acids varied in narrow range but tended to raise in lines with lower protein content.

4.3.2. c. Mineral chemical constituents:

Data in Table (19) declared that cvs. Reina Mora and Luz De Otone showed significant increment a compared with cv. El Kobrosy in total nitrogen content of seeds in the second season. The same trend observed in phosphorous content as shown in Tables (20). The obtained results agree with those, **Maksoud and**

EL-Oksh (1983) mentioned that the differences between mineral content could be due to a genetic factors of cultivars. **Jalal *et al.* (1984)** and **Younis *et al*. (1985)** recorded that the variety was most heavily infested was found to have a higher nitrogen. Also, **Fukuta *et al.* (2000)** found that varietal differences in the mineral contents of leaves in 16 varieties of Vicia faba.

Results in Tables (21-24) indicated that cvs. El Kobrosy and Luz De Otone significantly increased than cv. Reina Mora in potassium, calcium**,** sodium and chloride in the two growing seasons. While cv. Reina Mora gave the lowest values of potassium, calcium**,** sodium and chloride than the other two cultivars in the two growing seasons. But cv. El Kobrosy significantly increased than cvs. Reina Mora and Luz De Otone in potassium, calcium**,** sodium and chloride content in the two growing seasons. The obtained results agree with those of, **El-Tinay *et al.* (1989)** investigated that the proximate compositions of several cultivars of broad bean and soybean were estimated. The variability in calcium, phosphorus, potassium and sodium contents within legume cultivars.

The content of K, Na, and Cl differs according to cultivars as shown by the results obtained by **Perez *et al.* 1993; Francois 1994; Siddiqui *et al.* 1996 and Nurzynska and Wierdak 1997.**

4.3.3. Effect of interaction on chemical composition:-

4.3.3. a. Dry matter percentage of plant tissues:

1- Dry matter percentage of shoots.

Obtained results recorded in Table (16) show that the interaction between saline water and cultivars had no effect in two growing seasons in dry matter percentage of shoots. The results agree with, **Shehata and Farrag (1983) and Shaheen (1984)** found that dry matter of broad bean cv. El- Kobrosy was decreased with increasing salinity from 0 to 4000 ppm. **Dua *et al.* (1989) and Lahiri *et al.* (1996)** recorded that their were changes in performance, dry matter at a soil salinity of 10 dS m^{-1} in 10 cluster bean. The tolerant and sensitive genotypes differed in their responses to salinity in all the parameters measured. The responses of the moderately tolerant genotypes to salinity were variable and inconsistent. **Pascale *et al.* 1997; Mola-Doila *et al.* 1998 and Ruiz *et al.* 1998** recorded that *Vicia faba* cv. VH-82-1 and *Phaseolus vulgaris* cv. Bronco plants were treated with water with 0-10 dS/m or 0, 0.25 or 0.5% NaCl. Salinity reduced dry weightof shoots.

In another study, **Cordovilla *et al.* (1999)**, recorded that faba bean cv. Alborea salinity significantly decreased shoot dry weight. **Khadri *et al.* (2001)** reported that high salinity reduced plant dry weight common bean cvs. **Tammam, (2003)** showed that dry matter of *broad bean* were significantly reduced with an increase in salinity.

2-Dry matter percentage of seeds.

Results recorded in Table (17) show that the interaction between saline water and cultivars dry matter percentage of produced seeds was higher in case of cv. Reina Mora irrigated with tap water (600 ppm) followed by using saline water at about (2000 ppm) and 4000 ppm all over the growing season and the alternative irrigation system at the ratio (1:1) of normal and saline water compared with the other tested treatments.

This study relates to the changes in performance (dry matter of seed yield) at a soil salinity of 10 dS m^{-1} in 10 cluster beans**. (Lahiri *et al.* 1996). Scholberg and Locascio (1999) and Kamlesh *et al*. (2003)** recorded differences in the dry matter of beans cultivars under salinity**.**

4.3.2.b.<u>Organic constituents:</u>

1- <u>Crude Protein:</u>

Results presents in Table (18) show the interaction between broad bean cultivars (Reina Mora, Luz De Otone and El Kobrosy) and saline water on the content of total protein in broad bean seeds. Data in Table (18) declared that the interaction dad no effect in the two growing second seasons. The obtained results agree with those of, **Fierotti *et al.* 1988; Sibole et al. 1998; Raptan *et al*. 2001**; **Broetto *et al.* 1999** and **Demir and Kocacaliskan 2003** investigated that effect of NaCl (150 mM) on protein of broad bean and (*Phaseolus vulgaris* cv. Kizilhac). NaCl decreased protein contents.

1- <u>Amino acids:</u>

Results presents in Table (25) and Fig. (11, 12, 13 & 14) declared that cv. Luz De Otone and alternative irrigation system (2:1) between saline and tap water in the two growing seasons, showed the highest content of amino acids as glutamic, argenine, phenyl alanine, alanine, leucine, isoleucine and ammonia surpassed tnan the other amino acids. The increasing of amino acids agree with the results obtained by **Broetto *et al*. 1999 and Sallam 1999** found that free amino acids increased with increasing salinity levels in beans.

On the contrary, Gadallah 1999 and Heikal *et al*. (2000) showed that faba beans irrigated with 0 to 300 mM NaCl) faba beans was decreased the accumulation of free amino acids in the shoots and roots, proline accumulation increased with increasing salinity level. **Raptan *et al*. (2001**) found that black gram *(*Vigna mungo cultivars Barimash-1 and Barimash-2) and mung bean (cultivars Barimung-3 and Barimung-4) grown in 0 to 100 mM NaCl solutions. Salinity decreased the total N concentration in black gram and mung bean. The Cl^- and Na^+ contents increased with increasing salinity. K^+ decreased with salinity in all parts of black gram and mung bean, except seeds. Salinity increased the Ca^{2+} uptake in all parts of both crops, except the roots.

4.3.2. c. Mineral chemical constituents:

The interaction effect between broad bean cultivars and saline irrigation water treatments on chemical composition of broad bean seeds in Tables (19-24) show that cv. Reina Mora combined with irrigation from well its salinity 4000 ppm exhipted the highest values of potassium, phosphorus, sodium and chloride content, calcium content significantly increased only in the second season. While nitrogen content did not appear significantly differences between interaction treatments.

Obtained results agree with those obtained by **Melesse and Caesar 1992; Lahiri *et al.* 1996 and Gadallah 1999** mentioned that, the changes in mineral composition (N, P, K, Na and Cl), concentrations of leaf metabolites at a soil salinity of 10 dS m^{-1} in 10 cluster bean. The sensitive genotypes had higher concentrations of Na and Cl in shoot tissues under stress as compared to tolerant genotypes**.**

Banuelos et al. (2002) found that Leaf tissue accumulated the greatest concentrations of Cl- (up to 8%) from the saline treatments of faba bean. **Kamlesh *et al.* (2003) and Tammam (2003)** reported that sodium content in both roots and shoots of broad bean was increased with increasing salinity, whereas potassium and calcium decreased.

Table (16): Effect of saline water irrigation and cultivars on dry matter percentage of shoot of broad bean during the growth Seasons.

cultivar / Treatments	Dry matter percentage of shoot (%)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	20.3	21.9	20.4	20.9	15.9	21.1	23.7	20.2
Altr.Irrig. 2:1	15.9	20.1	21.9	19.3	14.3	19.7	19.7	17.9
2000 ppm	14.4	23.2	22.3	20.0	15.0	19.2	20.6	18.3
4000 ppm	19.1	22.3	22.2	21.2	14.9	27.8	22.0	21.6
Cont.	15.2	21.8	20.0	19.0	14.0	20.7	18.6	17.8
Mean	17.0	21.9	21.4		14.8	21.7	20.9	
L.S.D. at 0.05 for irrigation = N.S.					1.8			
cultivar = 2.6					1.9			
Irrig. x cv.=N.S.					N.S.			

cv.1 = El Kobrosy   cv. 2 = Reina Mora   cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Table (17): Effect of saline water irrigation and cultivars on dry matter percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	Dry matter (%) of green seeds							
	2001-2002				2002-2003			
	1	2	3	X¯	1	2	3	X¯
Altr.Irrig. 1:1	34.6	37.4	36.1	36.0	32.6	36.3	37.8	35.6
Altr.Irrig. 2:1	27.6	36.6	35.9	33.4	32.4	40.5	37.2	36.7
2000 ppm	30.5	41.7	33.1	35.1	31.8	42.8	35.3	36.6
4000 ppm	31.4	38.5	36.0	35.3	34.7	38.8	39.8	37.8
Cont.	27.6	44.4	38.5	36.8	33.0	46.2	40.0	39.7
Mean	30.3	39.7	35.9		32.9	40.9	38.0	
L.S.D. at 0.05 for irrigation = 2.14					2.23			
cultivar = 1.64					1.65			
Irrig. x cv.= 4.41					4.72			

Table (18): Effect of saline water irrigation and cultivars on protein percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	protein (%) of seeds							
	2001-2002				2002-2003			
	1	2	3	X¯	1	2	3	X¯
Altr.Irrig.1:1	22.56	23.31	22.19	22.69	20.13	23.23	20.31	21.22
Altr.Irrig.2:1	21.81	22.69	21.88	22.13	20.13	22.75	22.56	21.81
2000 ppm	22.75	23.75	23.56	23.38	22.32	24.96	23.23	23.50
4000 ppm	22.25	22.81	22.50	22.50	22.69	23.31	23.19	23.06
Cont.	23.06	24.13	23.81	23.65	24.63	25.94	24.19	24.94
Mean	22.49	23.34	22.79		21.98	24.04	22.70	
L.S.D. at 0.05 for irrigation = 0.62					2.16			
cultivar = N.S.					1.48			
Irrig. x cv.= N.S.					N.S.			

cv.1 = El Kobrosy   cv. 2 = Reina Mora   cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Table (19): Effect of saline water irrigation and cultivars on nitrogen percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	nitrogen (%) of seeds							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	3.61	3.73	3.55	3.63	3.22	3.72	3.25	3.40
Altr.Irrig. 2:1	3.49	3.63	3.50	3.50	3.22	3.64	3.61	3.49
2000 ppm	3.64	3.80	3.77	3.74	3.57	3.99	3.72	3.76
4000 ppm	3.56	3.65	3.60	3.60	3.63	3.73	3.71	3.69
Cont.	3.69	3.86	3.81	3.78	3.94	4.15	3.87	3.99
Mean	3.60	3.73	3.65		3.52	3.85	3.63	
L.S.D. at 0.05 for irrigation = 0.09					0.35			
cultivar = N.S.					0.24			
Irrig. xcv.=N.S.					N.S.			

Table (20): Effect of saline water irrigation and cultivars on phosphorus percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	phosphorus (%) of seeds							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	0.25	0.35	0.38	0.33	0.35	0.45	0.41	0.40
Altr.Irrig. 2:1	0.23	0.25	0.30	0.26	0.25	0.31	0.32	0.29
2000 ppm	0.19	0.24	0.26	0.23	0.21	0.26	0.28	0.25
4000 ppm	0.15	0.18	0.21	0.18	0.17	0.23	0.21	0.20
Cont.	0.39	0.41	0.45	0.43	0.45	0.43	0.47	0.45
Mean	0.24	0.29	0.32		0.29	0.34	0.34	
L.S.D. at 0.05 for irrigation = 0.11					0.09			
cultivar = 0.02					0.01			

Irrig. x cv.= N.S	N.S

cv.1 = El Kobrosy   cv. 2 = Reina Mora   cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Table (21): Effect of saline water irrigation and cultivars on potassium percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	potassium (%) of seeds							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	1.52	1.58	1.35	1.48	1.43	1.51	1.45	1.46
Altr.Irrig. 2:1	1.63	1.45	1.56	1.54	1.60	1.45	1.46	1.50
2000 ppm	1.63	1.48	1.54	1.55	1.60	1.47	1.49	1.52
4000 ppm	1.56	1.48	1.52	1.52	1.60	1.49	1.52	1.53
Cont.	1.60	1.44	1.55	1.53	1.57	1.46	1.80	1.61
Mean	1.59	1.49	1.50		1.56	1.48	1.54	
L.S.D. at 0.05 for irrigation = 0.03					0.06			
cultivar = 0.02					0.04			
Irrig. x cv.= 2.13					2.76			

Table (22): Effect of saline water irrigation and cultivars on calcium percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	Calcium (%) of seeds							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig.1:1	0.727	0.545	0.636	0.636	1.000	0.727	0.627	0.785
Altr.Irrig.2:1	1.000	0.818	1.091	0.970	1.091	0.818	1.182	1.030
2000 ppm	1.000	0.818	1.000	0.939	1.091	0.909	0.818	0.939
4000 ppm	1.182	0.636	0.909	0.909	1.000	1.066	0.818	0.961
Cont.	0.818	0.554	0.618	0.663	1.091	0.727	0.818	0.879
Mean	0.945	0.674	0.851		1.055	0.849	0.853	
L.S.D. at 0.05 for irrigation = 0.21					= 0.11			
cultivar = 0.09					= 0.06			

Irrig. x cv.= N.S.	= 0.28

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Table (23): Effect of saline water irrigation and cultivars on sodium percentage in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	Sodium (%) of seeds							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	1.28	1.15	1.10	1.18	1.20	1.14	1.20	1.18
Altr.Irrig. 2:1	1.28	1.14	1.31	1.24	1.31	1.17	1.22	1.23
2000 ppm	1.31	1.13	1.24	1.23	1.33	1.13	1.19	1.22
4000 ppm	1.35	1.16	1.57	1.36	1.34	1.30	1.22	1.29
Cont.	1.23	1.13	1.20	1.19	1.19	1.10	1.18	1.15
Mean	1.29	1.14	1.28		1.27	1.17	1.20	
L.S.D. at 0.05 for irrigation = 0.03					= 0.05			
cultivar = 0.03					= 0.03			
Irrig. X cv.= 1.11					= 1.27			

Table (24): Effect of saline water irrigation and cultivars on Chloride meq./L in green seeds of broad bean during the growth Seasons.

cultivar / Treatments	Chloride (meq./L)							
	2001-2002				2002-2003			
	1	2	3	$\bar{X}$	1	2	3	$\bar{X}$
Altr.Irrig. 1:1	4.5	5.0	6.0	5.2	4.0	4.5	5.0	4.5
Altr.Irrig. 2:1	5.0	6.0	5.0	5.3	7.0	4.0	5.0	5.3
2000 ppm	6.0	4.5	5.0	5.2	8.0	6.0	4.0	6.0
4000 ppm	6.5	7.0	6.0	6.5	5.0	7.0	6.5	6.2
Cont.	4.0	5.0	7.0	5.3	6.0	4.0	6.0	5.3
Mean	5.2	5.5	5.8		6.0	5.1	5.3	
L.S.D. at 0.05 for irrigation =0.74					=0.62			
cultivar = N.S.					= 0.5			

Irrig. x cv.= 0.7	= 0.5

cv.1 = El Kobrosy cv. 2 = Reina Mora cv. 3 = Luz De Otone

Altr.Irrig. 1:1= Alternative irrigation system (1:1) one irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm.

Altr.Irrig. 2:1= Alternative irrigation system (2:1) twice irrigation from saline water well 4000 ppm salinity , followed by one tap water 600 ppm

T 25

Fig. (10): Effect of saline water irrigation and cultivars on protein of seeds broad bean during the growth seasons.

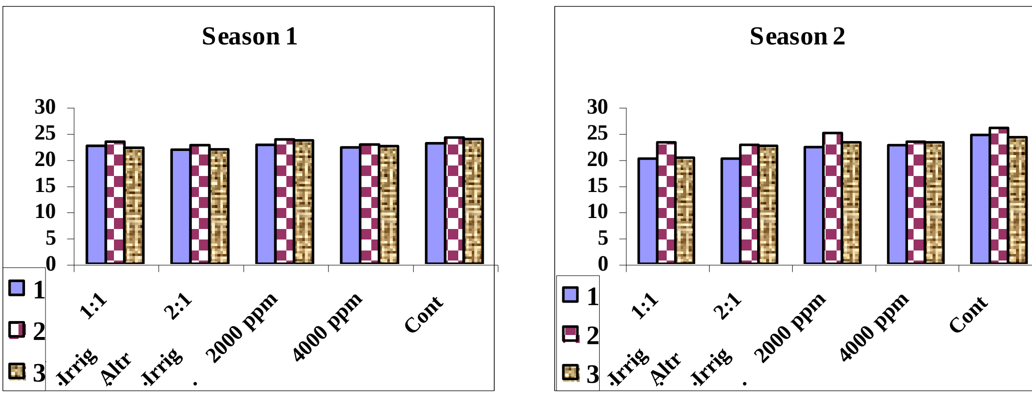
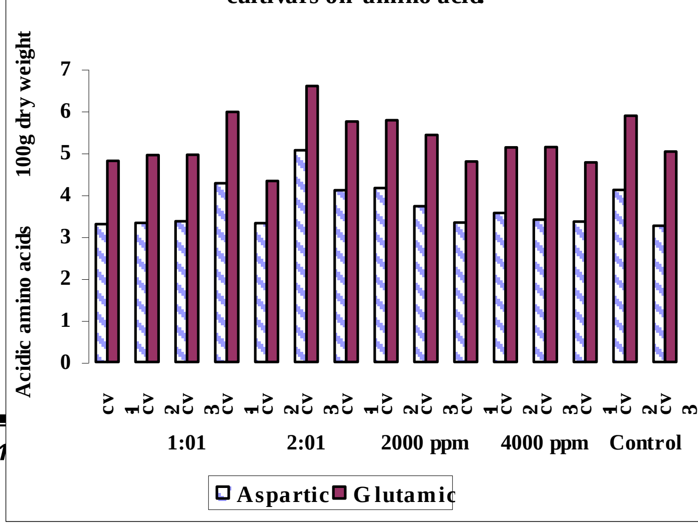


Fig.(11): Effect of saline water irrigation and cultivars on amino acid



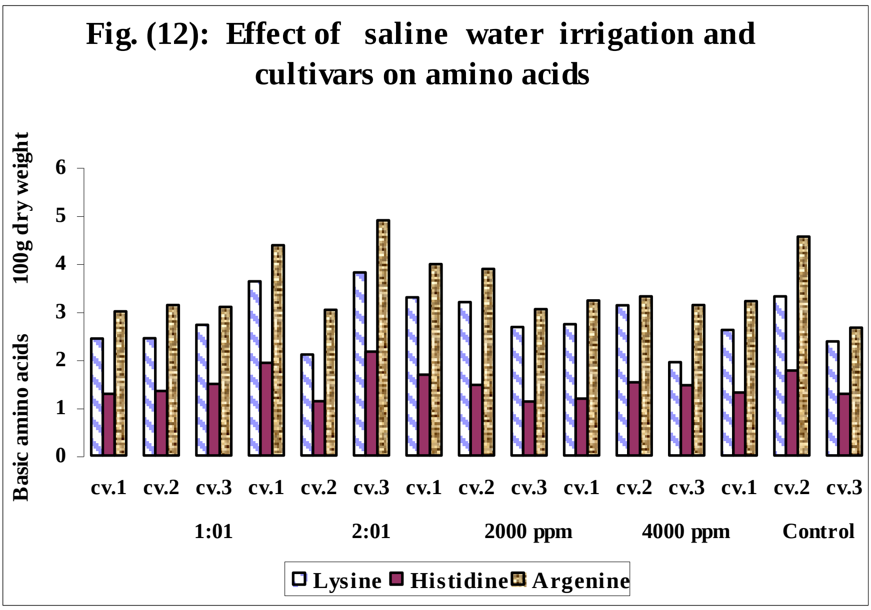


Fig. (12): Effect of saline water irrigation and cultivars on amino acids
Basic amino acids 100g dry weight
0
1
2
3
4
5
6
cv.1 cv.2 cv.3 cv.1 cv.2 cv.3 cv.1 cv.2 cv.3 cv.1 cv.2 cv.3 cv.1 cv.2 cv.3
1:01
2:01
2000 ppm
4000 ppm
Control
Lysine
Histidine
Argenine

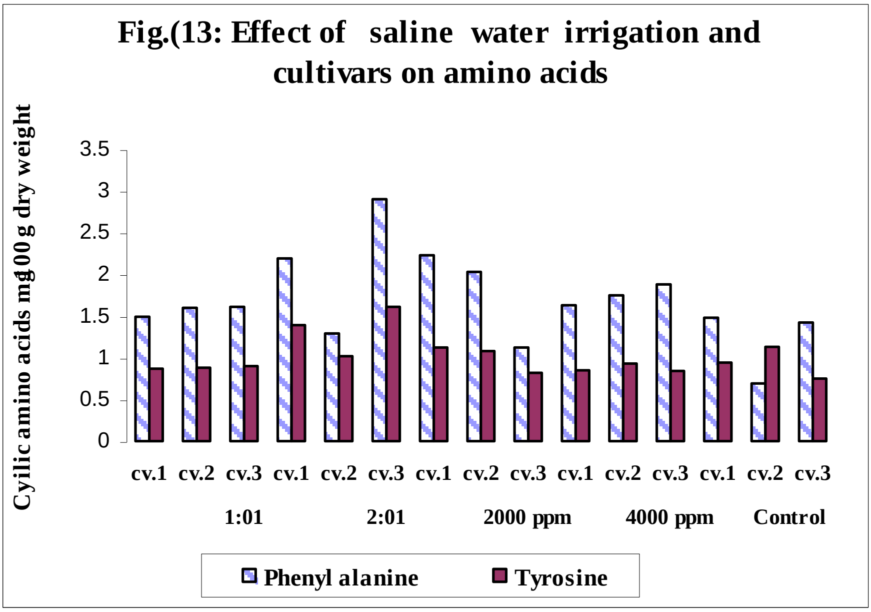
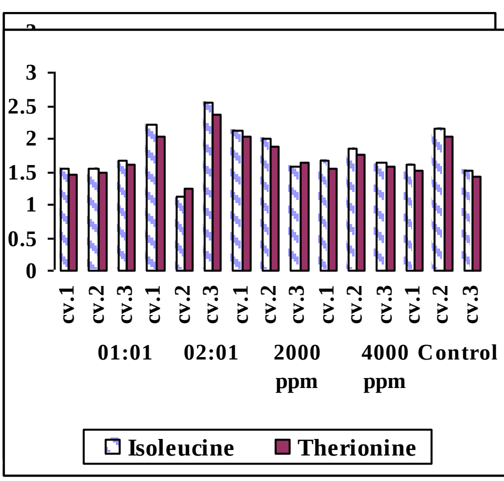
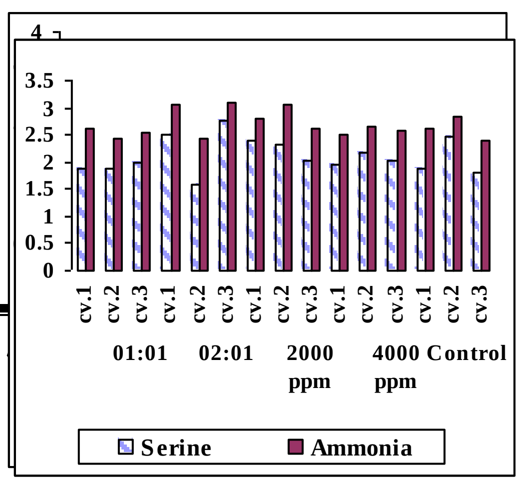


Fig.(13: Effect of saline water irrigation and cultivars on amino acids

Fig. (14): Effect of cultivars and saline water irrigation on amino acids of seeds broad bean.

Aliphatic amino acids





4.2. Second Experiments

Effect of micronutrients on growth characters, yield and its components and some chemical compositions on of broad bean (El-Kobrosy cultivar) grown under saline water condition. This results are divided into three sections dealing with the following main topics:

1- Growth characteristics.

2- Yield and its components.

3- Chemical composition.

Each head was further subdivided into the following subheadings: -

1- Effect of micronutrients on growth characters

2- Effect of micronutrients on yield and its components.

3- Effect of micronutrients on chemical composition.

4.2.1. Growth characteristics

Effect of micro-nutrients on growth characters: -

Obtained data concerned with different growth parameters of broad bean as affected by micronutrients are illustrated in Tables (1).

Results recorded in Table (1) & Fig. (1) show that spraying broad bean plants of El Kobrosy cultivar with a solution containing a mixture of (Mo, Zn, Fe and Cu each at 50 and 100 ppm) gave the highest plant height than the other treatments in the two growing seasons. While the control irrigated with saline water gave the lowest value in plant height. These results agree with those obtained by **Saad *et al.* 1980; Abed *et al.* 1987; El-Nagar and Awad 1987; Acuna and Cordero 1989; Harb 1992; Agwah and Mahmoud 1993 and Srivastava and Ahlawat 1995** working on legumes demonstrated that the maximum plants height was recorded by plants sprayed with Cu or Zn-EDTA. **Srivastava and Ahlawat (1995)** found that plant height of peas increased with increasing Mo rate. **Rashad and Ahmed (1997) and El-Hafeny and Mahmoud (1999)** revealed that Fe (75 ppm) increased significantly plant height tended to reduce slightly the bad effect of salinity and significantly increased plant height. **El-Hafeny (2002)** found that plant height of broad bean significantly increased with Zinc foliar spray application method than soil addition under Maryout conditions. The highest values of growth characters obtained with application of Zinc Sulphate at 2 g/L as foliar spray or 10 kg/fed as soil addition.

Results in Table (1) reveal that no significant effect between micronutrients treatments on No. of branches in the two growing seasons. On the contrary, **Agwah and Mahmoud (1993**) found that using sodium molybdate as a foliar spray, molybdenum concns at 250 and 500 ppm increased tillers number per plant compared with control. **Rashad and Ahmed 1997 and El-Hafeny 2002** found that Fe and Zn increased significantly number of branches per plant.

Results in Table (1) indicated that Mo concns at 50 ppm as foliar spray significantly increased than the other treatments in leaf area in the two growing seasons. The same trend observed in mixed concns at 100 ppm (Mo, Zn, Fe and Cu) and Cu 50 ppm**.** The highest values obtained with Mo concns at 50 ppm foliar spray treatment. These results agree with those obtained by, **Saad *et al.* 1980 and Mahmoud *et al.* 1981.**They found that leaf area of broad bean, soybean and ground nut significant increase when plants were sprayed with Mo. **Dahdoh (1997)** found a significant increase in plant growth by adding 20 kg of Zn/fed in sulphate form to faba bean in sandy soil as soil addition. **Andrade *et al.* (1998) and Srivastava *et al.* (1998)** showed that Mo increased growth of *Vicia faba* and pea plant. **El-Hafeny and Mahmoud (1999)** indicated that spraying pea plants with molybdenum (75 or 150 ppm) significantly increased leaf area.

On sandy loam soil, studied the effect of Zinc and molybdenum on the growth of *Phaseolus vulgaris* (as 25 kg ZnSO4 and 1 kg sodium molybdate/ha that applied in all combinations) generally increased the growth (**Kushwaha, 1999) El-Hafeny (2002**) found that leaf area of broad bean increased significantly with application of Zinc Sulphate at 2 g. /L as foliar spray or 10 kg./fed as soil addition.

The favourable character of fresh weight of shoots (g) as shown in Table (1) & Fig. (1) obtained with treatment of mixed nutrient elements (Mo, Zn, Fe and Cu) at 100 ppm or mixed at 50 ppm, also, Zn at 50 ppm significantly increased than other treatments. These results agree with **Abed *et al*. (1987)** found that micro-nutrients as Cu + Zn (each at 100 ppm foliar application on pea plant, grown under various salinity conditions tended to reduce slightly the bad effect of salinity, and significantly increased fresh weight per plant. **Abd El-Reheem *et al.* 1992; Harb Eglal 1992** and **El-Hafeny 2002** found that plant weight of broad bean significantly increased with foliar spray application of Zinc Sulphate at 2 g/L as foliar spray or 10 kg/fed as soil addition

On the contrary, **Badawy and Tagoury (1977)** found that broad bean was grown on a sandy-loam soil. Fe, when applied with Co or Zn to the soil significantly reduced fresh weight of broad bean but increased fresh weight in pea. **T**he favourable effect of zinc on plant growth may be due to increase IAA content, (**Devlin and Witham 1979).** **A**s regard Cu or Zn has a role in the promotion of enzymes activity and the internal growth regulators, which may be connected with plant growth **(Hassan, 1985 and Abed *et al.* 1987).**

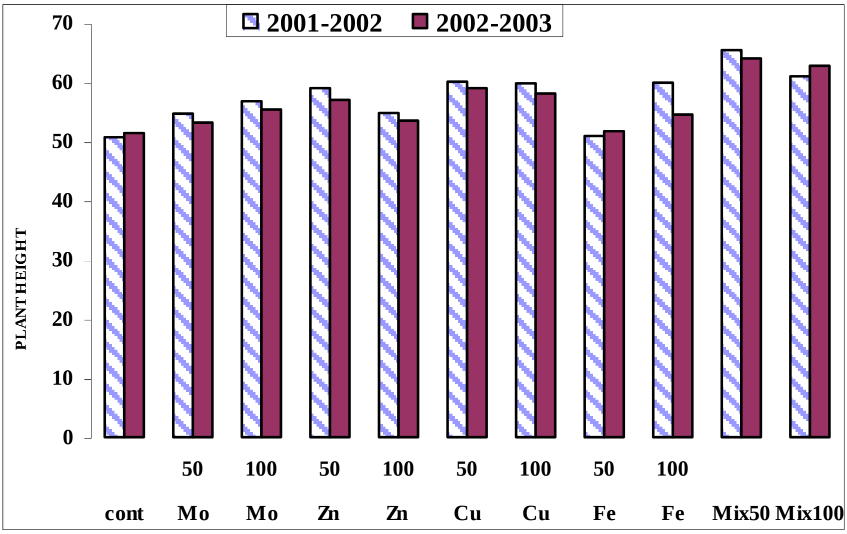
Molybdenum is essential constituent of nitrogenase in legume nodules and hence increases growth and has function in N fixation which enhances plant height and growth **(Firgany and Traulsen 1983 and Xia and Xiong 1991). Atia (1995)** suggest that the influence of Zn on growth of broad bean plant is rather relevant to the enzymatic systems responsible for the biosynthesis of amino acids, protein, chlorophyll and photosynthesis. These results may be attributed to the role of Cu and Zn in plant metabolic aspects which affect plant growth and productivity. These results are in accordance with those found by **Farrag (1978)** on broad bean.

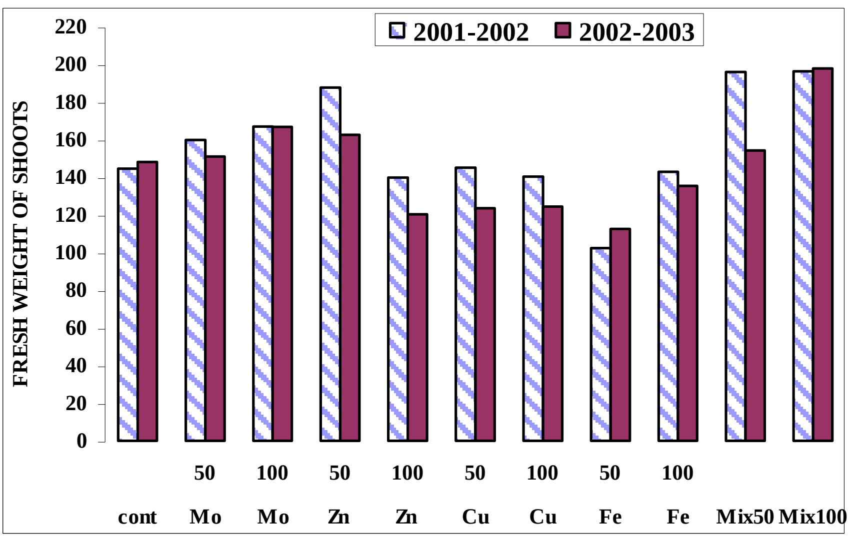
Agwah and Mahmoud 1993 found that sodium molybdate as a foliar spray at 500 ppm surpassed the other treatment in Dry weight % of leaves of broad bean. **Faiyad 1995; Srivastava and Ahlawat 1995** and **Rashad and Ahmed 1997** found that application of Fe 50 and Zn 25 ppm, Cu or 0.5 kg Mo/ha significantly increased dry matter of shoots of broad bean. **Andrade *et al.* 998; Salam 1998** and **Amara 2001** showed that Mo or 200 ppm Zn increased dry weight of shoots of *Vicia faba.*

Results in Table (1) indicated that micro-nutrients (Mo, Zn, Fe and Cu) at 50 or 100 ppm individual or mixed had no significantly effects**.** On the contarary, **Dekock *et al.* (1960)** mentioned that there is often a good correlation between the level of Fe supply and the chlorophyll content. **Mahmoud *et al.* (1981)** showed that Mo produced the highest carotenoid and stable chlorophyll contents of broad bean. Also, **Abed *et al.* (1987)** investigated that micro-nutrients as Cu + Zn (each at 100 ppm foliar application on *pea* plant, grown under various salinity conditions tended to reduce slightly the bad effect of salinity, using Cu or Zn or a mixture of the two elements had a remarable stimulative effect on the chlorophyll content of pea leaves. This effect was more pronounced under salinity conditions. **Xia and Xiong (1991)** found that treatment with ammonium molybdate gave the highest total chlorophyll contents in seeds of faba bean and peanut. **Atia (1995)** suggested that the influence of Zn on growth of broad bean plant is rather relevant to the enzymatic systems responsible for the biosynthesis of chlorophyll and photosynthesis. **Rashad and Ahmed (1997)** found that there are increases of total chlorophyll in response to Fe (50 and 75 ppm) and Zn 50 ppm as foliar application. Spraying bean plants with Cu, Mn or Zn led to a significant increment in chlorophyll a, b and total chlorophyll content of leave.

T1

Fig. (1): Effect of some micronutrients on plant height (cm) and fresh weight of pod (g) of broad bean plants grown under saline water irrigation condition.





<u>4.2.2. Yield and its components:</u>

Effect of micronutrients on yield and its components: -

Data in Table (2) & Fig. (2) indicate that using copper at 50 ppm, the mixed micro-nutreints at 100 ppm and Fe 50 ppm gave the highest value of pod length in the two seasons. These results agree with those obtained by, **Abed *et al.* (1987)** they found that micro-nutrients as Cu + Zn (each at 100 ppm foliar application on pea plant, grown under various salinity conditions (6000 ppm and 9000 ppm in irrigation water) tended to reduce slightly the bad effect of salinity, and significantly increased each of average of pod length of pea plant.

Data presented in Table (2) & Fig. (2) reveal that mixed micro-nutreints at 100 ppm (Mo, Zn, Fe and Cu), Fe at 50 ppm, Zn 50 and Mixed 100 ppm as foliar spray significantly surpassed in weight of pod in the two growing seasons than the other treatments. These results agree with those obtained by, **Saad *et al.* (1989)** and **El-Hafeny and Mahmoud (1999)** they found that spraying peanut or pea plants with molybdenum increased average pod weight. Also, **Abed *et al.* (1987)** found that micro-nutrients as Cu + Zn (each at 100 ppm foliar application on pea plant, grown under salinity conditions, significantly increased average of pod weight of pea plant. On the contrary, **Fawzi *et al.* (1986**) mentioned that trace element treatment sprayed in form EDTA chelated at (4.5% Mn, 3.0 % Zn and 1.5 % Fe) had no significant effects on individual pod weight of *Vicia faba*.

Data revealed in Table (2) indicate that the mixed micro-nutreints had no significantly in number of seeds/pod in the two growing seasons. Data recorded in Table (2) show that mixed micro-nutreints at 100 ppm, mixed at 50 ppm (Mo, Zn, Fe and Cu) and Fe 100 ppm as foliar spray increased significantly weight of seeds/pod (g) than the other treatments in the two seasons. The results agree with those, **Fawzi *et al.* 1986; Abed *et al.* 1987 and rivastava and Ahlawat 1995** mentioned that trace element sprayed in form EDTA chelated at (4.5% Mn, 3.0 % Zn and 1.5 % Fe) or Cu + Zn (each at 100 ppm foliar application on pea plant, grown under various salinity conditions increased weight of seeds/pods of *Vicia faba* and significantly increased each of average number of seeds per pod of pea plant. On The other hand, seeds number/pod was decreased by the plants treated with Fe 25, Fe 75 and Zn 25 ppm compared with control plants **(Rashad and Ahmed 1 997). El-Hafeny and Mahmoud 1999** working on broad bean and pea plants given 0 or 0.5 kg Mo/ha. They found that number and weight of seed/pod increased with increasing Mo rate.

Data in Table (3) & Fig. (3) illustrate that mixed at 100 ppm and mixed at 50 ppm (Mo, Zn, Fe and Cu). Also Mo at 50 ppm as foliar spray gave the highest value in average weight of 100 seeds (g). These results in the same line with those obtained by **Abed *et al.* (1987)** found that micro-nutrients as Cu+Zn (each at 100 ppm) foliar application on pea plant, grown under salinity conditions tended to reduce slightly the bad effect of salinity and significantly increased average weight of 100 green seed of pea plant. **Mahmoud and Agwah 1993; Agwah and Mahmoud 1993 and El-Hafeny and Mahmoud 1999** they found that spraying broad bean or pea plants with micro-nutreints increased the average weight of 100 seeds. **El-Hafeny (2002)** found that weight of 100 seeds of broad bean significantly increased with application of Zinc Sulphate at 2g/L as foliar spray or 10 kg/fed as soil addition under Maryout conditions.

Data presented in Table (3) indicate that mixed at 100 ppm, Mo at 100, mixed at 50 ppm, Zn at 50 and at Fe 100 as foliar spray increased significantly than the other treatments in the netting percentage (Seed weight/pod weight x 100) in the two seasons. These results in the same line with, **Abed *et al.* 1987; El-Hafeny and Mahmoud 1999** and **El-Hafeny 2002** using iron, zinc and molybdenum to broad bean and peas significantly increased netting percentage.

These results may be due to the effect of molybdenum, zinc, iron and copper assimilates and the role of these elements in increasing the photosynthetic rate and nitrogen assimilation and increasing protein synthesis which in turn caused increments in length of pod, pod weight, average weight of 100 seeds, seeds weight/pod, number of seeds/ pod,_and net weight **(Xia and Xiong 1985 and Brhada 1988).**

Data revealed in Table (3) & Fig. (3) indicate that mixed micro-nutreints at 50 ppm, Fe at 100, Mo at 50 and mixed micro-nutreints at 100 ppm significantly increased total yield of green pods/plots and/feddan in the two growing seasons. These results in the same line with, **Abd-El-Hadi *et al.* 1986; Abed *et al.* 1987 and Podma *et al.* 1989** found that molybdenum, copper and zinc as foliar spray in form sodium molybdate significantly increased yield of green pods of broad bean, pea and French bean. Also, **Gomaa 1991; Abdrabou 1992**; **Dahdoh *et al.* 1992; Agwah and Mahmoud 1993**; **Agwah 1993 and Mahmoud and Agwah 1993** investigated that using a mixture of iron and zinc and molybdenum to broad bean significantly increased pods fresh weight and the yield increment reached to about 25 % over control.

Spraying pea plants with partially chelated trace containing mixture for Zn, Mn, Fe, B, Mg or K_2o, Mo, and S produced higher pod yield than the untreated plants (**Jana and Arkel, 1996). El-Hafeny and Mahmoud (1999) and El-Hafeny (2002)** found that spraying broad bean and pea plants with molybdenum or zinc significantly increased the total yield of green pods.

Data presented in Tables (3) & Fig. (4) indicate that mixed 50 ppm, mixed 100 ppm and Mo at 100 ppm gave the highest value in total yield of dry seeds/feddan and total yield of dry seeds/plots in the two seasons. These results agree with those obtained by, **Gabal *et al*. 1985**; **Abd-El-Hadi *et al.* 1986 and Fawzi *et al.* 1986** found that micronutrients chelate gave the best results from yield of faba bean. **Abdrabou and Hamada 1991**; **Abdrabou 1992** and **Abdel-Reheem *et al.* 1992** found that seed yield of faba beans was highest with spray 0.6 % Zn or spray 0.8 % Zn or application of 300 g Zn/fed. **Harb 1992; Kucharski and Niklewska 1992; Agwah and Mahmoud 1993; Hegazy *et al*. 1993 and Majumdar *et al.* 1994** mentioned that trace element treatment sprayed in form EDTA chelated at (4.5% Mn, 3.0 % Zn and 1.5 % Fe) or (Mn+ Zn +B at 100 ppm) or (0.1 % Fe, Zn, Mn, or Mo) increased seed yields of *Vicia faba*.

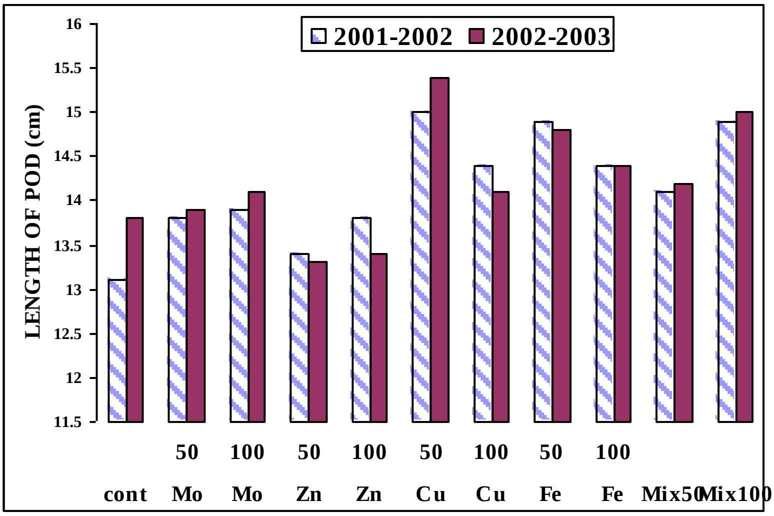
Dahdoh 1997; Srivastava and Ahlawat 1995; Srivastava *et al.* 1998 and Kushwaha 1999. found that Mo, Fe and Zn as foliar spray significantly increased yield of dry seeds of broad bean and *Phaseolus vulgaris*. The favorable effect of Zn on yield of broad bean may be due to zinc activate in the enzyme tryptophan synthetase, therefore, zinc participates in the metabolism of plants as an activator of several enzymes. It is of interest to point out that foliar application with micro-nutrients (Mo, Zn, Fe and Cu) resulted in significant increases length of pod, weight of pod, number of seeds/pod, weight of seeds/pod, net weight,. They also mentioned that foliar application is the best and fast way to increase micro-nutrients uptake when compared with the other methods of application. These results may be attributed to the role of Cu and Zn in plant metabolic aspects which affect plant growth and productivity. These results are in accordance with those found by, **Farrag (1978)** on broad bean

From the above mentioned results, it could be concluded that foliar application with (molybdenum, zinc, iron and copper) had a good effect in enhancing growth and increasing the productivity of broad bean plant particularly at the low concentration (50 ppm) Therefore, Mixed micronutrients application seemed to be more favourable with regard to broad bean plant.

T2

T3

Fig. (2): Effect of some micronutrients on pod length (cm) and pod weight (g) of broad bean plants grown under saline water irrigation condition.



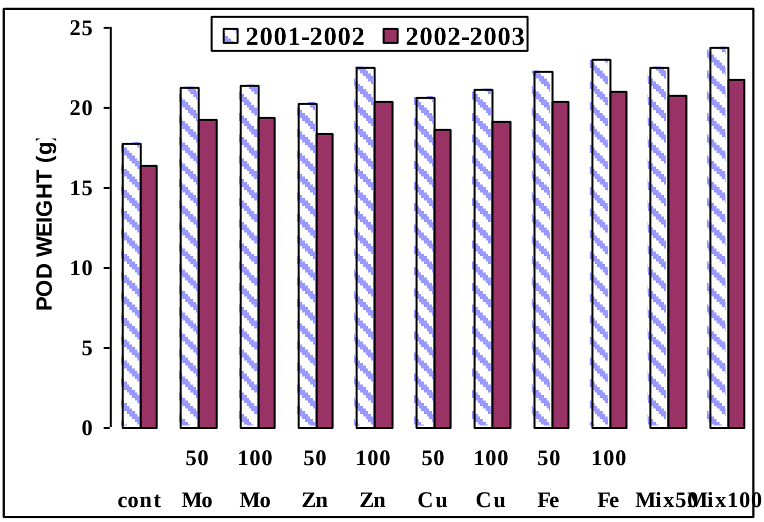
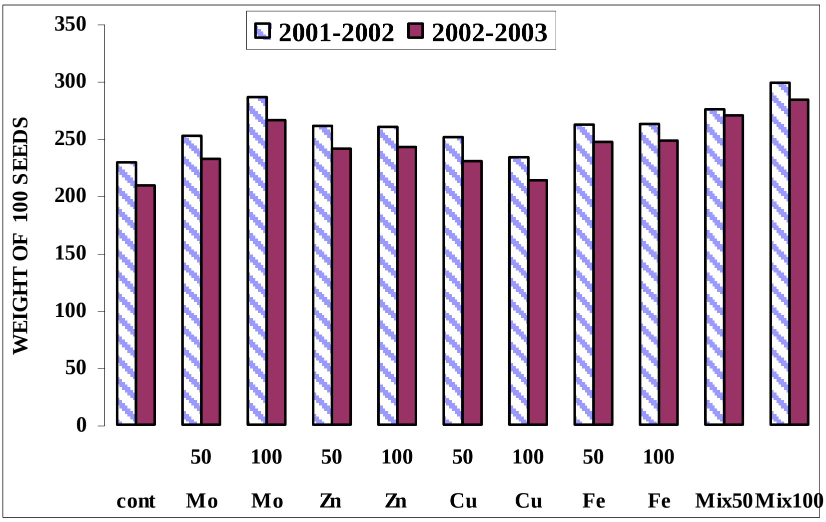


Fig. (3): Effect of some micronutrients on weight of 100 seeds and total yield of green pods /fed. (ton) of broad bean plants grown under saline water irrigation condition.



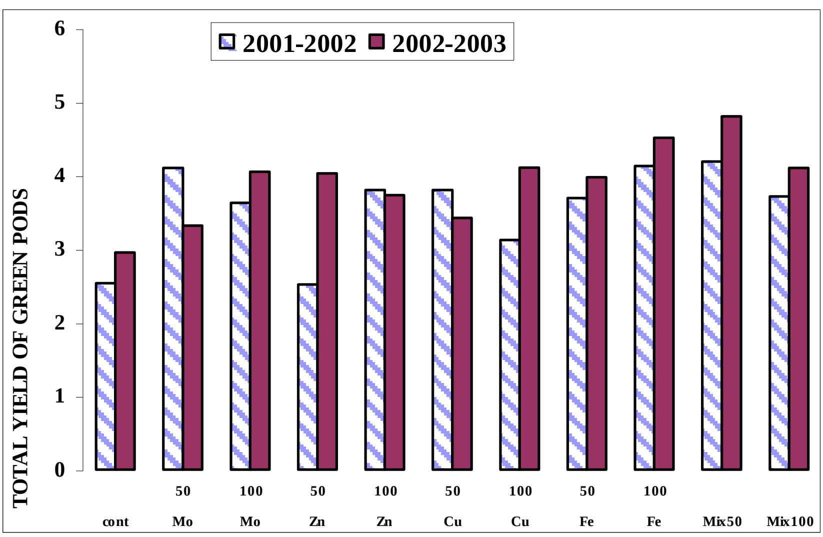
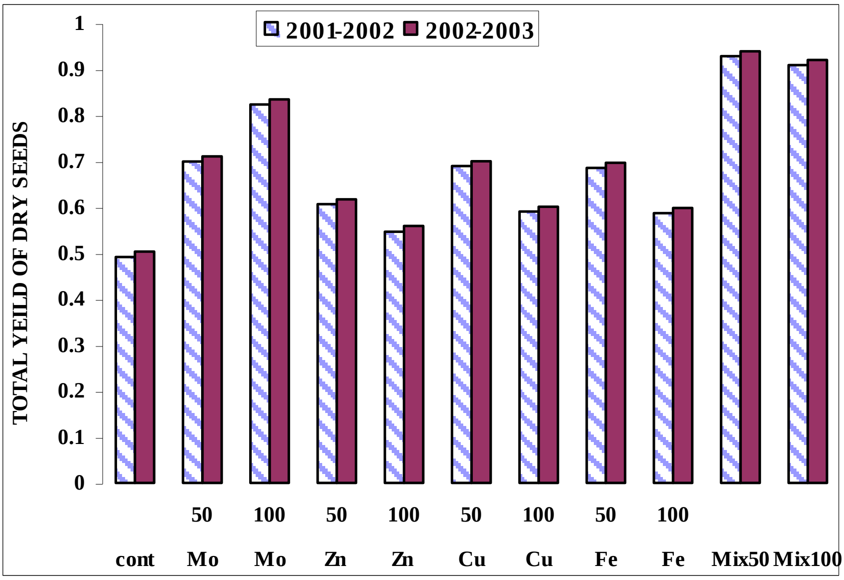


Fig. (4): Effect of some micronutrients on total yield of dry seeds / fed. (ton) of broad bean plants grown under saline water irrigation condition.



4.2.3. Chemical composition:

Effect of micronutrients on chemical composition:

4.2.3. a Dry matter (%) of tissue plant:

1- Dry matter (%) of shoots

Data present Table (4) reveal that mixed of micro-elements i.e., (Mo, Zn, Fe and Cu) at 50 ppm or 100 ppm as foliar spray surpassed the other treatments in dry matter % of shoots in the first season. Mixed 100 ppm, Zn 100 and 50 ppm gave the highest value in the second season. These results agree with**, El-Shakaweer *et al.* (1982) and Abed *et al.* (1987**) they used micro-nutrients as Cu + Zn (each at 100 ppm) foliar application on pea plant, grown under various salinity conditions (6000 ppm and 9000 ppm) in irrigation water tended reduce slightly the bad effect of salinity, and significantly increased dry weight and dry matter. **Saad *et al.* 1980 and Abdel-Aziz *et al.* 1987** found that when leaves of plants were sprayed with 25 ml of one the following trace elements: B, Fe, and Mo the complete mixture or 0.03 % Zn-EDTA increased leaves and stem dry weight of broad bean.

Abd El-Aal and Ebaid (1989) found that application of Bayfolan to faba bean plant led to an increase in, leaves and stem dry weight. **Agwah (1993**) **and Rashad and Ahmed (1997)** found that Fe, Cu, Mn and Zn increased significantly dry weight of leaves, stems *Vicia faba*. However, the increases in the dry weights of stem which recorded by Fe 50 and Zn 25 treatments. In Egypt, **Nassar *et al.* (2002)** investigated the effect of seed coatings using Fe at 0.3 g on faba bean growth. The minerals were applied as

EDTA compounds. Micronutrient treatments increased dry matter of plant organs.

2- Dry matter (%) of seeds:

Data in Table (3) illustrate that mixed at 100 ppm and Mo at 100 and Cu 50 ppm gave the highest value in dry matter % of seeds in the two growing season. These results agree with those indicated by, **Abed *et al.* 1987 and Agwah 1993** using a mixture of zinc, iron and copper sulphate or iron and zinc or Cu+ Zn application significantly enhanced dry matter percentage in green seeds as compared with the control. **Majumdar *et al*. 1994; Faiyad (1995) and Jana and Arkel (1996)** found that Zn and Cu significantly increased dry matter of faba bean and pea. **El-Hafeny and Mahmoud (1999)** found that spraying *pea* plants with molybdenum (75 or 150 ppm) increased dry matter percentage. **El-Hafeny (2002**) found that dry matter of seeds % of broad bean increased significantly with application of zinc sulphate at 2g/L as foliar spray or 10 kg/fed. as soil addition under Maryout conditions.

4.23.1. Organic constituents:

1- Protein:

Results presented in Tables (4) & Fig. (5) clearly indicate that the plants which were irrigated from well with salinity of about 4000 ppm and sprayed with tested micro-nutrients Mo, Zn, Fe and Cu at 50 or 100 ppm as a foliar application such micro-nutrients tended to reduce slightly the bad effect of salinity. Data also showed that (Mo+ Zn+ Fe and Cu) at 100, 50 & Mo 50 ppm achieved significantly the highest protein content in seeds under sandy soil condition when compared with the control in the two growing seasons. These results agree with**, Abdel-Aziz *et al.* (1987) and Abed *et al.* (1987)** investigated that micro-nutrients as Cu + Zn (each at 100 ppm foliar application on pea plant, grown under various salinity conditions tended to reduce slightly the bad effect of salinity and significantly increased protein.

Spraying pea plants with molybdenum or iron had a favourable effect on total protein contents of seeds **(Hatem *et al.* 1990; Koteecki, 1990 and Gowily and Abdel Kader 1991).** Also, **Abdel-Reheem *et al.* 1992; Dahdoh *et al.* 1992; Agwah 1993; Dahdoh and Hassan, 1997 and Salam, 1998** showed that seed protein of broad bean was highest with both fertilizers (Zn or Mo.). **Dahdoh and Moussa 2000** indicated that application of Fe (at a concentration of 0.6%) especially as foliar spray lead to higher percentage of both proteins contents in broad bean plants. **El-Hefny (2002)** indicated that Zinc Sulphate application at rate 3 g/L as foliar spray or 15 kg/fed as soil addition under Maryout conditions increased protein in seeds of broad bean significantly.

Peterburgskii *et al*. (1975) revealed also that Mo stimulate plant respiration, nitrate reduction and catalase activities. The importance of zinc application to plants in increasing protein content may be due to its role in protein synthesis **(Devlin and Witham 1979).**

2- <u>Amino acids:</u>

Data illustrated in Table (6) & Fig. (6-9) show those amino acids content was increased with using iron at 100 ppm, copper at 50 ppm and molybdenum at 100 ppm. Data also showed that Fe at 100 achieved the highest amino acids as glutamic, aspartic, arginine and therionin content in seeds under sandy soil condition when compared with the control in the two growing seasons. While phenyl alanin achieved the highest with (Mo+ Zn+ Fe and Cu) at 50& Fe 100 ppm**.** These results agree with the results obtained by**, Saad *et al.* (1989) and Xia and Xiong (1991)** found that treatment with ammonium molybdate gave the highest tprotein content in seeds of faba bean and peanut.

Agwah and Mahmoud (1993) indicated that seeds soaking in molybdenum at 250 and 500 ppm significantly increased total nitrogen content in leaves and protein % in green and dry seeds of broad bean. **Abd El-Hamied (1990)** found that significant increment protein fractions content in vegetative parts of soybean. Iron application was superior to other treatments especially when applied with P. The effect of Fe alone on amino acids content did not have a consistent trend.

In calcareous soil, Spraying pea plants with Fe, Zn, Mn, Mo, and the combination of these elements led to significant increase in seed content of amino acid (**Negm *et al*. 1997**). The same trend of results observed in results of, **Rashad and Ahmed (1997)** who found that there are increases of total amino acids in response to Fe at (50 and 75 ppm) and Zn 50 ppm as foliar application for faba bean plants**.**

4.23.2. <u>Mineral chemical constituents:</u>

Results presented in Tables (4) showed that (Mo+ Zn+ Fe and Cu) at 100 achieved significantly the highest **nitrogen** content in seeds under sandy soil condition when compared with the control in the two growing seasons. These results agree with**, Badawy and Tagoury, 1977; Fawzi *et al*. 1986 and Saad *et al.* 1989** mentioned that trace element treatment sprayed in form EDTA chelated at (4.5% Mn, 3.0 % Zn and 1.5 % Fe) increased N of faba bean. **Abdel-Aziz *et al.* (1987) and Abed *et al.* (1987)** investigated that micro-nutrient as Cu + Zn (each at 100 ppm foliar application on pea plant, grown under various salinity conditions tended to reduce slightly the bad effect of salinity and significantly increased nitrogen**. Agwah and Mahmoud 1993; Negm *et al*. 1997; Andrade *et al.* 1998; Srivastava *et al.* 1998 and El- Hefny and Mahmoud 1999** it may be due to that Mo application increased nodulation and in sequence N content.

Saline water irrigation increased N concentration in broad bean shoots of beans grown in loamy soil. **(Akkhavan *et al.* 1991).** Also, **Abdel-Reheem *et al.* 1992; Agwah, 1993; Dahdoh *et al.* 1992; Dahdoh and Hassan, 1997 and Salam, 1998** showed that seed N concentration of broad bean was highest with both fertilizers (Zn or Mo.). The application of micronutrients increased chemical composition of plants may be due to its function in N fixation because Mo is essential constituent of nitrogenase in legume nodules as results of weakening of the bond between the two N atoms which render them susceptible to reduction by the reducing agent (**Chatj *et al.* 1969** and **Agwah and Mahmoud, 1993)**.

Spraying pea or soybean plants with Fe, Zn, Mn, Mo, the combination of these elements led to significant increase in seed content of total nitrogen (**Amara and Nasr, 1995; Negm *et al*. 1997 and Rizk and Abdo, 2001).** Mo increases growth of root nodules and has also a role in N metabolism and increase nitrogenous compounds of the plant (**Devlin, 1979 and Xia and Xioong, 1985**)

The results obtained in Tables (4) show that there was a significant increase in phosphorus content in broad bean seeds with the application of Mo at 50 and 100 ppm, Cu at 100 ppm and Fe at 100 ppm foliar application. While potassium significantly increased with Mix micro-nutreints at 50 ppm, Mo at 50 ppm, Fe at 50 ppm and Cu at 50 ppm also, calcium significantly increased with control, Zn at 100 ppm and Fe at 50 ppm in the two growing seasons. These results agree with**, Saad *et al.* 1980; Fawzi *et al*. 1986 and Abdel-Aziz *et al.* 1987)** mentioned that sprayed trace elements in form of EDTA chelated at (4.5% Mn, 3.0 % Zn and 1.5 % Fe) increased leaf P concn. of faba bean**.** Also, **Abed *et al* (1987)** investigated that micro-nutrients as Cu + Zn (each at 100 ppm) foliar application on pea plant, grown under various salinity conditions tended to reduce slightly the bad effect of salinity and significantly increased P and K except Ca that decreased as a result of such treatments. **Abd El-Hamied (1990)** found that significantly increased in plant P in vegetative parts of soybean with iron application. **Abdel-Reheem *et al.* (1992) and Dahdoh *et al.* (1992)**

found that the increase of K content with the higher rate of applied Fe and Zn. **Srivastava and Ahlawat (1995)** found that P uptake increased with increasing Mo rate.

Saline water irrigation increased K concentration in broad bean shoots. While decreased P and Ca (**Dahdoh and Hassan, 1997).** On the other hand, **Dahdoh and Moussa (2000)** addition of Zn increased K concentration, while decreased P concentration in broad bean plant. **Abd-Alla *et al.* (2001)** found that under high levels of NaCl indicate that Ca and K were lower in faba bean,

Results present in Table (4) indicated that the treatments of micronutrients application which showed decrement in the sodium percentage was Fe at 50 ppm and Mixed at 100 ppm although such reduction was not significant in the first season and Cu at 100 ppm and Mixed at 100 ppm in the second one. The only treatment that significantly increased the Na percentage was Mo at 100 ppm especially in the second season only. Also, in the same Table micronutrients application which showed decrement in the chloride was Mo at 50 ppm in the second season and Fe at 50 and 100 ppm. The general trend herein is the role of micronutrients in minimizing or lacking the physiological bad effect of salinity. These results are in agreement with those obtained **Abed *et al* (1987**) who investigated that pea plants grown under various salinity conditions, salinity increased Na and Cl concentrations of green seeds.

Saline water irrigation increased Na concentration in broad bean shoots grown in calcareous soil, **(Dahdoh and Hassan, 1997). Abd-Alla *et al.* (2001)** found that the highest level of salinity (120 mM) significantly decreased the concentrations of macro and micro nutrients in faba bean leaves. Under high levels of NaCl the Na and Cl content were higher in faba bean nodules than control ones. **Mola-Doila *et al.* (1998)** found that salinity cuses increased leaf permeability and osmotic potential which probably led to more accumulation of toxic ions like Na, Cl, S and B in leaf tissues of broad bean.

Molybdenum, Zinc, Iron and cupper content in broad bean plants:

Data illustrated in Tables (5) indicate that Molybdenum increase significantly with increasing the rates of Molybdenum with Mo 100 ppm gave the highest value. Also with Mo at 50 ppm, Zn at 50 ppm and Mixed at 100 ppm, Mixed at 50 ppm Iron as foliar application significantly increased the iron content of seeds. Mixed micronutrients at 100ppm and 50 ppm gave the highest value of Fe. However, Fe at 100 and Fe 50 ppm and Zinc at 50 ppm increased Fe in seeds. **Z**n application increased Zn uptake was at max. with foliar application of Zn at 100 ppm and 50 ppm.

Copper as foliar application significantly increased the copper content of seeds. The copper increased with Cu 100 ppm and 50 ppm. These results agree with those indicated by, **Hassan 1985; Fawzi *et al*. 1986; Singh *et al.* 1986; Abdel-Aziz *et al.* 1987 Abed *et al.* 1987; Krauze *et al.* 1989 and Ibrahim 1989** mentioned that trace element treatment sprayed in the form of EDTA chelated at (4.5% Mn, 3.0 % Zn and 1.5 % Fe) increased leaf Fe, Mn, Zn, and Cu concn. of faba bean.

Spraying pea and broad bean plants with Fe, Zn, Mn, Mo and Cu led to significant increase of Fe, Zn, Mn, Mo and Cu content in seed of pea and broad bean **(Hatem *et al.* 1990; Gowily and Abdel Kader 1991; Stepanok and Golenetskii 1991; Dahdoh *et al.* 1992; Singh *et al.* 1992; Singh and Singh 1993; Majumdar *et al.* 1994 ; Faiyad 1995; Petkov *et al.*1996 and Negm *et al*. 1997).**

Increasing rate of Zn as foliar added in sulfate form increased their concentration and significantly their uptake while decreased Cu concentration. Also increasing additions of Zn decreased Fe concentration in broad bean plant (**Dahdoh and Moussa, 2000). Abd-Alla *et al.* (2001)** found that the highest level of salinity level (120 mM) significantly decreased the concentrations of micro nutrients in faba bean leaves. **Amara (2001)** found that the highest Fe and Zn concentration in seeds corresponds to the combined effect between Mo and Azotobacter, Molybdenum at 4 ppm reduced Fe concentration in soybean seed. **El-Hefny (2002)** obtained that Zinc at 3 g./L as foliar spray or 15 kg./fed as soil addition significantly increased Zinc content in seeds of broad bean.

Finally, it may be concluded that saline water containing 4000 ppm can be safety used in irrigation of broad bean plants. This must be accompanied by spraying plants with micro-nutrients in order to produce normal growth, yield with best quality resembling to that produced from using normal water irrigation.

T4

T5

T6

Fig. (5): Effect of some micronutrients on protein % of seeds of broad bean plants grown under saline water irrigation condition.

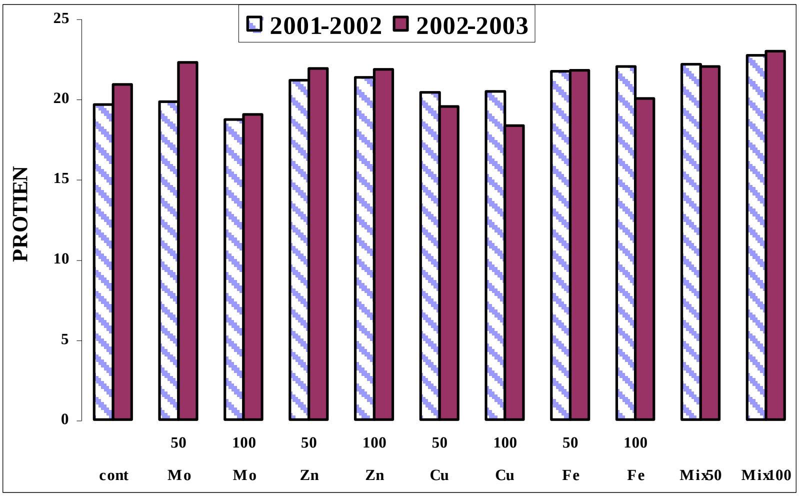


Fig. (6): Effect of some micronutrients on amino acid of seeds broad bean.

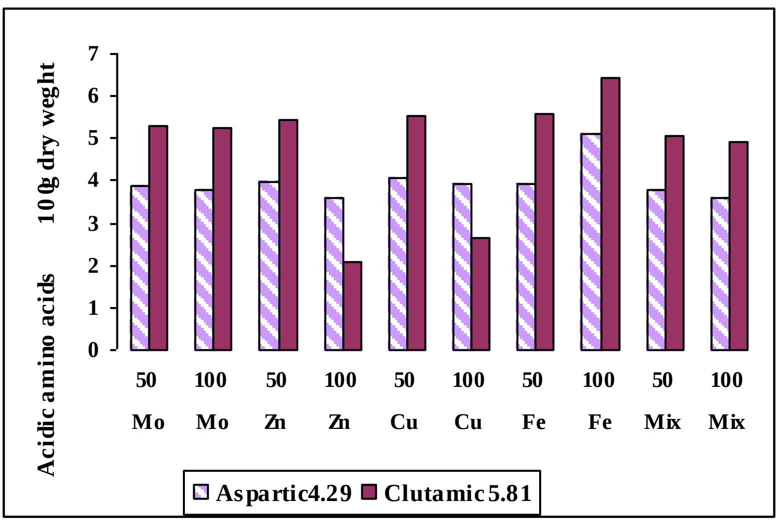


Fig. (7): Effect of some micro-nutrients on amino acid of seeds broad bean.

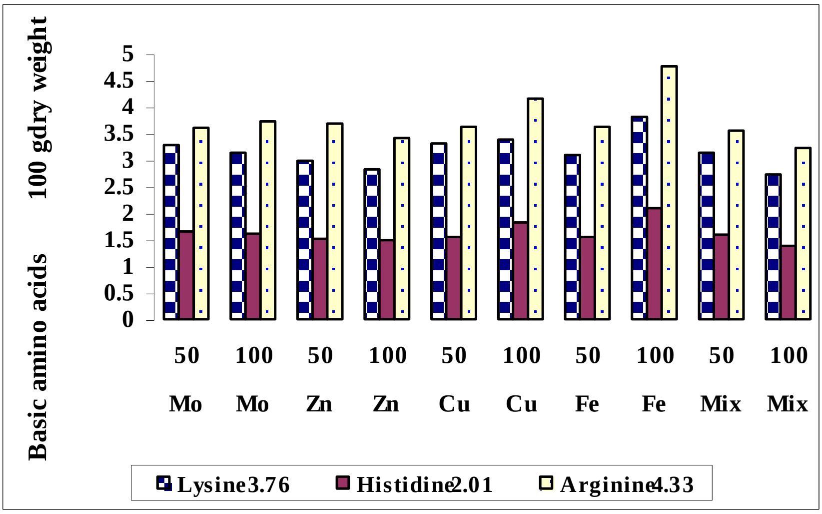


Fig. (8): Effect of some nicro-nutrients on amino acids of seeds broad bean.

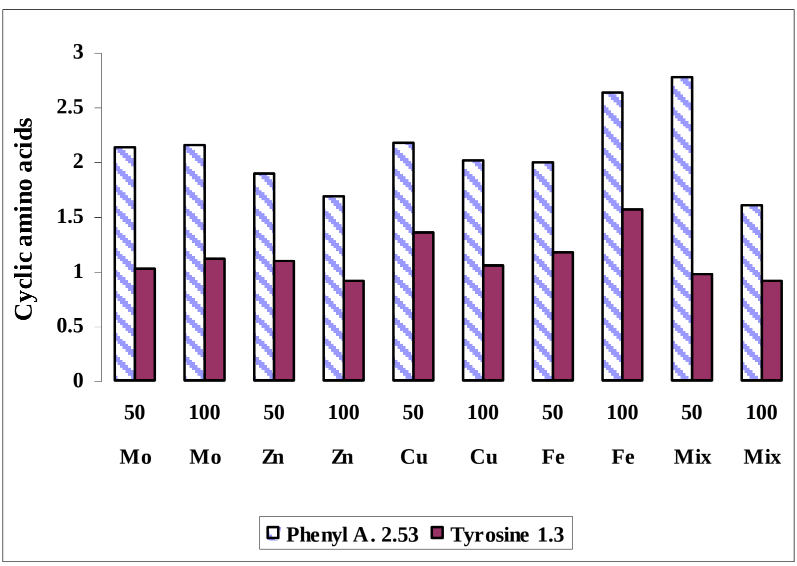


Fig. (9): Effect of some micronutrients on amino acids of seeds broad bean.

Aliphatic amino acids