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EFFECT OF IRRIGATION INTERVALS AND SOME NUTRIENTS APPLICATION ON BROAD BEAN PRODUCTION, NUTRIENTS UPTAKE AND SOME WATER RELATIONS IN DIFFERENT SOILS.

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ABSTRACT

This study was conducted during the two successive seasons of 2000/2001 and 2001/2002 at Gemmeiza Agric. Res. Station; in Lysimeters (2m in length, 1m in width and 2m in depth) cultivated by broad bean seeds variety Giza 2. The experiment was designed to study the effect of irrigation intervals, i.e. irrigation every fifteen days or irrigation every thirty days and nutrients application, N, P, Fe, Mn and control. Macro nutrients, N and P were added at the rates of 20 kg N/fed and 15.5 kg P_2O_5/fed of ammonium sulphate and superphosphate, respectively. Micro nutrients, Fe and Mn were added in the form of sulphate at the rate of 20 and 10 kg/fed, respectively on seed broad bean yield under four different soils. This investigation was carrying out to determine the effect of irrigation intervals and nutrients application and their interactions on broad bean production, concentration and uptake of macro and micronutrients and some water relations of the different soils under the study. Split plot design was used.

The obtained results could be summarized as follows:-

1- The greatest seed and straw yields kg/fed were obtained with irrigation every fifteen days was used with N and P addition individually for all the different soils under the study. Seed and straw yields per fed were enhanced with loamy soil than the other soils.
2- Total irrigation water applied (T.I.W.A.) increased by decreasing irrigation intervals for all soils, irrigation every fifteen days was recorded the highest values of (T.I.W.A.). Sandy soil was recorded the highest amount of total irrigation water applied, while the lowest one was obtained with clay soil.
3- The highest consumptive use (C.U.) for broad bean was obtained when irrigation every fifteen days was used coupled with N addition for all soils; but the greatest (C.U.) was noticed with calcareous soil, while the lowest one with the sandy soil.
4- On the contrary, water use efficiency (W.U.E.) for broad bean seed yield, the highest value was obtained with irrigation every thirty days coupled with P application for all soils under investigation. The greatest values of (W.U.E.) were recorded by clay and loamy soils compared with the two other soils.
5- The greatest values of any element concentration and uptake of broad bean seed and straw were noticed by irrigation every fifteen days when the same element was added than any other elements application. The greatest values of nutrients concentration and uptake for broad bean seeds and straw were obtained with loamy soil followed clay soil and the lowest one the sandy.

In general, it could be summarized that irrigation every fifteen days and adding N and fertilization individually for all different soils produced the greatest seed and straw yields per feddan and greatest values of any elements concentration and uptake.

INTRODUCTION

Broad bean (*Vicia faba*) is one of the important leguminous crops cultivated in Egypt. Its seeds are consumed in our country as a cheep source of protein for human and animal. Therefore, any improvement in the yield and the nutritional value of broad bean seeds is required. One of the most important factors affecting broad bean production are soil moisture and water irrigation. Water is the limiting factor of Agriculture production in arid and semiarid regions, where irrigation is required either contensively or extensively.

To obtain potential crop yields of broad bean, application of adequate amounts of water at the proper time is considered to be of high importance. Doorenbos and Pruitt (1975) concluded that seasonal evapotranspiration , and accordingly water use efficiency was affected by crop characteristics climate, length of growing season, time of planting, soil moisture levels, and agricultural practices. Khamis (1987) found that the seed and dry matter yields of broad bean and its water use efficiency increased significantly with increasing soil moisture content from 50 to 75% of the field capacity. Also, he pointed out that water use efficiency was highly significantly by increasing soil moisture content from 50% to 75% of field capacity of a sandy soil. Schneider (1991) pointed out that the estimates of total water use by *Vicia faba* for a growth cycle of 151 days ranged from 600-700 mm. Abd El-Mottale and Abbas (1992) found that the highest values of water consumption (1497 m^3/fed) was obtaine from treatment irrigated at 2 bars, while the lowest value (874m^3/fed) was obtained from treatment having irrigation at 10 bar. Ainer *et al.* (1993) found that optimum yield of faba bean was obtained by irrigation the crop at 2 bar. Water consumptive use by faba bean ranged from 170.2 – 370 mm. at Sakha and from 175.2 – 385.9 mm. at Gemmeiza. Water use efficiency increased by increasing soil moisture stress. Wahba *et al.* (1993) reported that the wet treatment produced the highest value of seed yield. They also found evapotranspiration by faba beans increased as soil moisture stress decreased, while the values of water use efficiency increased as soil moisture stress increased. El-Naggar *et al.* (1994) found that lowering the depletion from available soil moisture tended to increase the production of seed and straw of broad bean yields, the water requirements and consumptive use of water. But on the contrary, water use efficiency increased by increased available soil moisture depletion. In addition Hanna *et al.* (1996) came to the same conclusions at Gemmeiza region.

The effect of water regime and fertilizers application on plant constituents were studied by many investigators. Khamis (1987) showed that increasing soil moisture content caused a highly significant increase in concentration and uptake of NPK by broad bean seeds and shoots. Not only, the macro-nutrients NPK affected by water regime but also micro-nutrients are affected. El-Naggar *et al.* (1991) stated that concentration and uptake of micro elements in grain and straw of wheat increased as soil moisture stress decreased. They added also that NPK concentration in the grain and straw of wheat plants decreased by spraying Fe, Cu, Zn and Mn. Othman (1989) found that N concentration and uptake by straw of broad bean was insignificantly affected by the foliar application of Zn and Fe; whereas they increased with high significance in seeds, and found that a P-concentration and uptake by broad bean straw and seeds decreased by the same treatments compared to the control treatment. Thalooth *et al.* (1981) reported that high yield of broad bean seeds was obtained from foliar Fe.

Nitrogen is commonly the fourth most abundant element in plants, following carbon and the elements of water, it is a constituent of amino acids, nucleic acids and enzymes, so that it is important to both plant growth and yield. El-Naggar *et al.* (2001) found that the seasonal consumptive use increased by increasing nitrogen application rate, increasing nitrogen fertilizer rate from 60 to 90 kg N/fed decreased (W.U.E.) for clay and loamy soils and increased it for calcareous and sandy ones. El-Naggar *et al.* (1995) reported that addition of any sources of nitrogen tended to increase N concentration and uptake by stover and grains of maize. They also stated that any addition from nitrogen tended to increasing in grain and straw of broad bean yields.

Phosphorus is an important nutrients for crop production. Many soils in their native state do not contain sufficient available P to maximize crop yield, it plays an important role and release of energy during cellular metabolism and inter in many organic compound. Hanna *et al.* (1996) mentioned that seeds and straw yields of broad bean, the consumptive use of water, water use efficiency and NPK concentration and its uptake in seeds and straw were increased by phosphorus application either to soil or as foliar.

Manganese activates a number of enzymes, through its specific involvement in any enzyme is not thoroughly understood. It is know to induce a cycle of reaction within the plant. The role of Mn in photosynthesis is clearly identified through its absolute necessary for water splitting during photosynthesis. Iron plays a key role in several enzyme systems in which haem or haemin functions as the prosthetic group. These haem enzyme systems comprise the catalases. Peroxidases and several cytochromese. El-Naggar *et al.* (1994) observed that, with micronutrients application to soil (Fe, Zn and Mn), seeds and straw of broad bean, the consumptive use of water and water use efficiency were increased. They also mentioned micronutrients addition under the study, increase N and K content in seeds and straw; also, micronutrients application increased the uptake of N, P and K in seeds and straw. They also, stated that, the addition of any microelement tended to increase the same element and decreased the other elements. Finally, they mentioned that the micronutrients uptake in seeds and straw of broad bean plant increased with micronutrients application to soil as fertilization.

The current work was aimed to investigate the effect of irrigation intervals and addition of some macro and micronutrients on some water relations, yield production of broad bean and nutrients uptake by broad bean seeds and straw in different soils.

MATERIALS AND METHODS

Two lysimeters experiments were conducted at El-Gemmeiza Agricultural Research Station, El-Gharbia Governorate during 2000/2001 and 2001/2002 seasons. A lysimeters consists of forty basin 2m in length, 1m in width and 2m in depth were used in this study. Lysimeters divided into four groups, every group were filled with a soil type namely clay, loamy, calcareous and sandy soils. Each soil is considered as an independent experiment as split plot design with two replicates. The main plots are two water regimes (irrigation intervals), the first was irrigated every fifteen days and the second every thirty days. Nutrients application were considered as sub treatment including nitrogen, phosphorus, iron, manganese and control. Macro nutrients, nitrogen and phosphorus were added at the rates of 20 kg N/fed and 15.5 kg P_2O_5/fed of ammonium sulphate, and superphosphate, respectively. Micronutrients, Fe and Mn were added in the form of sulphate at the rate of 20 and 10 kg/fed, respectively. The plot area (2 x 1 m) was planted with broad bean Giza 2 variety. Broad bean seeds were hand sown in November 1st in 2000/2001 and 2001/2002 seasons. Planted were thinned to double plants per hill and the distance between hills was 20cm just 54 plants per basin area, apart (113400 plant/fed). Macro and micronutrients were added one once as a soil fertilization. Broad bean plants were hoed twice to control weeds before 2nd and 3rd watering, respectively. Normal agricultural practices for growing broad bean were conducted in the usual manner followed by farmers at the region. Each basin was harvested at the first week of May. The harvested plants were threshed, seeds and straw yield was estimated for each basin.

The chemical and physical analysis for the experimental soil were measured according to the standard methods reported by Hesse (1971) and Lovenday (1974), Tables (1a) and (1b).

Samples of seeds and straw were ground wet digested and Nitrogen was determined using micro Kjeldahl method as described by Hesse (1971).Phosphorus was determined colorimetrically using the chlorostannois reduced molybdophosphoric blue colour method as described by Jackson (1967). Fe and Mn were determined using Unicum SP 90 atomic absorption spectrophotometer.

Total irrigation water was added for each basin by water tap, and it was measured by water meter, total irrigation water applied (T.I.W.A.) was calculated and recorded. Water use efficiency (WUE) was calculated by dividing the marketable seed yield of broad bean (kg/fed.) by the water consumptive use (cubic metre/fed.).Consumptive use (C.U.) was determined by collecting soil samples from each basin before and after 48 hours of every irrigation and computed according to the equation, Israelsen and Hansen (1962).

$$U = \frac{\theta 2 - \theta 1}{100} \times Db \times \frac{60}{100} \times basin\,aera$$

Where :-

U = Amount of irrigation water applied (m^3/basin)
θ_2 = Soil moisture percentage by weight after 48 hours from irrigation.
θ_1 = Soil moisture percentage before irrigation.
Db = Bulk density (g/cm^3).
60 = Depth of soil (cm); i.e. root zone of broad bean.

Table (1-a) : Some physical properties of different soils under the study .

Soil type	Particle size distribution (%)				O.M. (%)	$CaCO_3$ (%)	Soil texture class	Bulk density (g/cm^3)	Moisture constants (%)		
	Clay	Silt	Coarse sand	Fine sand					F.C.	W.P.	A.W.
Clay	45.90	33.11	7.02	13.30	2.90	3.40	Clay	1.13	42.30	19.40	22.90
Loamy	29.95	36.85	11.23	22.18	2.80	3.30	Loamy	1.22	37.60	17.20	20.40
Calcareous	10.10	15.70	12.82	59.74	1.00	25.90	Sandy Loamy	1.52	20.80	9.50	11.30
Sandy	6.93	5.15	12.26	74.63	0.60	4.20	Sandy	1.95	14.10	6.20	7.90

Table (1-b) : Some chemical properties of different soils under the study .

Soil type	Soluble Cations* (meq/l)				Soluble Anions* (meq/l)				EC* mmhos/cm at 25C°	pH in 1:2.5 Soil water suspension	Available (NPK)		
	Ca^{++}	Mg^{++}	Na^+	K^+	CO_3^{--}	HCO_3^-	CL^-	SO_4^{--}			N	P	K
Clay	19.10	11.30	6.80	1.90	0.29	0.99	19.80	18.02	3.90	7.90	35.90	6.10	345.00
Loamy	13.80	10.05	5.70	0.74	0.25	0.68	19.71	9.65	3.00	7.80	32.70	7.90	285.00
Calcareous	8.51	1.90	5.10	0.90	0.49	0.84	5.91	8.27	1.50	8.50	13.50	2.80	80.00
Sandy	3.46	1.72	5.30	0.82	0.81	0.39	3.60	6.50	1.10	7.20	9.20	1.70	45.00

*** EC , Soluble cations and anions were determined in soil paste extract.**

Data were statistically analyses according to the procedure described by Snedecor and Cochran (1967). Least significant differences was used to compare between treatments. Combined analysis between the two seasons was done according to Waller and Dunchan (1969).

RESULTS AND DISCUSSION

Seed and straw yields:

The data in Table 2 showed that the greatest mean values of seed and straw yields kg/fed at different study soils are obtained when irrigation was every fifteen days. Increasing irrigation intervals tended to a sharp highly significant decrease in seed and straw yields/fed. The decrease of seed and straw yields at high irrigation intervals for the soil under study may be due to the decreases in available water which plants needed it all over the growing season. The greatest seed and straw yields of broad bean were recorded in loamy soil followed by clay and lasty sandy soil. These results are in agreement with those obtained by Khamis (1987), El-Naggar *et al.* (1994) and Eisa and Hanna (1997).

Table(2):Seed and straw yields/fed as affected by irrigation intervals and nutrients application and their interaction at different studied soils (Combined of the two seasons).

Irrigation intervals	Nutrients application	Soil types							
		Clay		Loamy		Calcareous		Sandy	
		Seed kg/fed	Straw kg/fed	Seed kg/fed	Straw kg/fed	Seed kg/fed	Straw kg/fed	Seed kg/fed	Straw kg/fed
Every 15 days	Cont.	1521.8	1821.3	1640.2	1940.8	750.8	1069.3	405.8	710.5
	N	1911.9	2211.2	2014.1	2320.7	963.7	1273.3	594.6	899.3
	P	2110.3	2410.3	2354.3	2652.5	870.4	1180.5	683.2	999.7
	Fe	1800.5	2100.7	1987.5	2273.9	865.1	1173.1	673.4	982.5
	Mn	1784.1	2084.1	1835.7	2131.6	801.9	1109.4	591.7	888.8
	Means	1825.7	2125.5	1966.4	2263.9	850.4	1161.1	589.7	896.2
Every 30 days	Cont.	1480.3	1721.3	1560.3	1840.2	622.3	969.3	360.8	710.5
	N	1822.6	2106.5	1934.6	2225.1	850.1	1175.7	522.7	782.4
	P	2005.4	2310.8	2223.2	2552.8	768.7	1091.5	631.3	910.3
	Fe	1708.9	2002.5	1879.3	2153.7	758.6	1073.1	600.5	891.4
	Mn	1622.2	1986.3	1741.8	2031.6	693.2	1017.1	520.3	785.3
	Means	1727.9	1667.9	1367.8	2160.7	738.6	1065.3	527.1	816.0
L.S.D for irrigation 5%		25.9	29.9	1.7	6.1	26.1	0.9	18.8	57.4
Means of fertilization	Cont.	1501.1	1771.3	1600.3	1890.5	686.6	1019.3	383.3	710.5
	N	1867.3	2158.9	1974.4	2272.9	906.9	1224.5	558.7	840.9
	P	2057.9	2360.6	2288.8	2602.7	819.6	1136.0	657.3	955.0
	Fe	1754.7	2051.6	1933.4	2213.8	811.9	1123.1	646.0	937.0
	Mn	1703.2	2035.2	1788.8	2081.6	747.6	1063.3	556.0	837.1
L.S.D for fertili. 5%		196.8	250.4	231.0	242.6	98.5	138.8	73.3	104.0
L.S.D for intera. 5%		NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.

Concerning the effect of nutrients application on seed and straw yields of broad bean, data in Table 2 show that seed and straw yields kg/fed significantly increased by the nutrients addition under the study in the case of sandy and clay soils except the Mn application for the clay soil; while in the loamy soil seed and straw yield significantly increased by the nutrients addition except also Mn addition, but the calcareous soil seed yield significantly increased with nutrients application except Mn element, while in the same soil significant increase for straw with N but non significant observed by others nutrients.

Generally, the application of any nutrient from elements under investigation for the studied soils caused increases in seed and straw yields of than control, also the data revealed that, the greatest seed and straw yields were obtained with P application followed by nitrogen in all soils. Also, the loamy is best soil produced the greatest seed and straw yield of broad bean while the sandy is the last one. The increment of seed and straw yields by nutrients addition may be due to the role of these nutrients and that it was important to both plant growth and yield. These results are in harmony with the findings of El-Awag *et al.* (1993), El-Naggar *et al.* (1994) and Hanna *et al.* (1996).

Regarding the interaction effect between irrigation intervals and nutrients application, it was found that seed and straw yields/fed insignificantly affected as showed in Table 2. It was noticed that the best soil for produced the greatest seed and straw yield was the loamy soil which were recorded 2354.3 and 2652.5kg/fed respectively; and the lowest soil was sandy soil which were 683.2 and 999.7 kg/fed respectively.

Total irrigation water applied (T.I.W.A.)

The total amount of irrigation water applied for the two treatments of irrigation intervals are presented in Table 3. The average water applied for the two growing seasons were decreased by increasing irrigation intervals, where the highest values were obtained with irrigation intervals every fifteen days treatment of the four soil groups.

Generally, total irrigation water applied for sandy soil were recorded the highest values among the four soils, while the clay soil were reflected the lowest one. The suitable irrigation water applied which gave the greatest yield reached 451.3,466.8,482.2 and 489.5 mm water depth for irrigation interval every fifteen days treatment for clay, loamy, calcareous and sandy soils respectively. The present results are in agreement with those obtained by Sammis (1981), Hanna *et al.* (1996) and El-Naggar *et al.*(2001).

Water consumptive use (C.U.)

Table 3 illustrated that the general means of consumptive use are generally influenced by irrigation intervals. Increasing the irrigation intervals caused a progressively highly significant decrease in consumptive use of the four soil groups. The highest value of consumptive use was recorded for loamy soil and the contrary was for the sandy one, it was reached 348.6 and 260.4 mm water depth for loamy and sandy soils respectively. The increment of consumptive with decreasing irrigation intervals may be due to the increment of evaporation from soil and plant surface as well as transpiration as a result of increasing the moisture content. Similar results were found by Ainer *et al.* (1993), El-Naggar *et al.* (2001).

Concerning the effect of nutrients application on consumptive use, Table 3 show that, there was significant increment for consumptive use by any nutrient element addition in sandy soil only than control treatment; while in the clay and calcareous soils, significant increment for (C.U.) with nitrogen element addition compared with control, but for these soils non significant increment between another addition nutrients and control treatment; in the loamy soil non significant differences between addition any nutrients and control on (C.U.). Generally, addition any element of soils

Table 3 : Seed yield in kg/fed and some water relations as affected by irrigation intervals and nutrients application and their interaction at different studied soils (Combined of the two seasons).

Soil types: Clay and Loamy

Irrigation intervals	Nutrients application	Clay Seed kg/fed	Clay T.I.W.A.* m³/fed	Clay T.I.W.A.* mm	Clay C.U.** mm	Clay W.U.E.*** kg/mm	Loamy Seed kg/fed	Loamy T.I.W.A.* m³/fed	Loamy T.I.W.A.* mm	Loamy C.U.** mm	Loamy W.U.E.*** kg/mm
Every 15 days	Cont.	1521.80	1895.60	451.30	321.20	4.70	1640.20	1960.40	466.80	346.40	4.70
	N	1911.90			360.10	5.30	2014.10			360.10	5.60
	P	2110.30			335.90	6.30	2354.30			358.20	6.60
	Fe	1800.50			331.70	5.40	1987.50			340.10	5.80
	Mn	1784.10			330.20	5.40	1835.70			338.20	5.40
	Means	1825.70			335.80	5.40	1966.40			348.60	5.60
Every 30 days	Cont.	1480.30	1285.80	306.10	230.10	6.40	1560.30	1315.20	313.10	240.10	6.50
	N	1822.60			245.50	7.40	1934.60			251.30	7.70
	P	2005.40			243.60	8.20	2223.20			260.40	8.50
	Fe	1708.90			239.10	7.10	1879.30			231.70	8.10
	Mn	1622.20			236.20	6.90	1741.80			239.30	7.30
	Means	1727.90			238.90	7.20	1867.80			244.60	7.60
L.S.D for irrigation 5%		25.85	---	---	6.31	---	---	---	---	3.13	---
Means of fertilization	Cont.	1501.10			273.30	5.50	1600.30			301.50	5.30
	N	1867.30			291.90	6.40	1974.40			340.10	5.80
	P	2057.90			280.10	7.40	2288.80			350.20	6.50
	Fe	1754.70			273.20	6.40	1993.40			310.70	6.40
	Mn	1703.20			275.30	6.20	1778.80			309.20	5.80
L.S.D for fertili. 5%		196.80	---	---	16.40	---	---	---	---	NS.	---
L.S.D for intera. 5%		NS.	---	---	NS.	---	---	---	---	NS.	---

Soil types: Calcareous and Sandy

Irrigation intervals	Nutrients application	Calcareous Seed kg/fed	Calcareous T.I.W.A.* m³/fed	Calcareous T.I.W.A.* mm	Calcareous C.U.** mm	Calcareous W.U.E.*** kg/mm	Sandy Seed kg/fed	Sandy T.I.W.A.* m³/fed	Sandy T.I.W.A.* mm	Sandy C.U.** mm	Sandy W.U.E.*** kg/mm
Every 15 days	Cont.	750.80	2025.10	482.20	299.10	2.50	405.80	2055.90	489.50	250.10	1.60
	N	963.70			389.70	2.50	594.60			275.90	2.20
	P	870.40			340.20	2.60	683.20			268.30	2.60
	Fe	865.10			331.20	2.60	673.40			251.70	2.70
	Mn	801.90			326.30	2.50	591.70			255.90	2.30
	Means	850.40			337.30	2.50	589.70			260.40	2.30
Every 30 days	Cont.	622.30	1501.70	357.50	201.40	3.10	360.80	1531.20	364.60	175.20	2.10
	N	850.10			380.10	2.30	522.70			201.90	2.30
	P	768.70			252.50	3.10	631.30			193.80	3.30
	Fe	758.60			245.30	3.10	600.50			190.10	3.20
	Mn	693.20			231.60	3.00	520.30			185.70	2.80
	Means	738.60			262.20	2.80	527.70			155.30	3.40
L.S.D for irrigation 5%		---	---	---	2.08	---	---	---	---	4.63	---
Means of fertilization	Cont.	686.60			271.20	2.50	383.30			220.50	1.70
	N	906.90			291.50	3.10	558.70			240.70	2.30
	P	819.60			281.40	2.90	657.30			260.10	2.50
	Fe	811.90			281.30	2.90	646.00			251.60	2.60
	Mn	747.60			280.20	2.70	556.00			255.90	2.20
L.S.D for fertili. 5%		---	---	---	17.33	---	---	---	---	11.60	---
L.S.D for intera. 5%		---	---	---	17.33	---	---	---	---	NS.	---

* Total irrigation water applied. ** Consumptive use. *** Water use efficiency.

under the investigation tended to increasing in (C.U.), but the increment was highly with N and P addition. the highly consumptive use was found in loamy soil with phosphorus which was recorded 350.2mm water, on the other hand the lowest of consumptive use with nutrients addition was 240.7mm water for sandy soil with nitrogen element addition. This increase may be due to the increase of vegetative growth, plant healthy and response of all soils under the study to nutrient elements addition. El-Naggar *et al.*(1995), El-Naggar *et al.* (1996), Wahdan *et al.* (1996) and El-Naggar *et al.* (2001).

As for interaction between irrigation intervals and nutrients addition on (C.U.), Table 3 revealed that, non significant differences was found in all soils except the calcareous soil. The highest values for consumptive use affecting by interaction were recorded for the irrigation interval every fifteen days coupled with nitrogen element for all soils under the study except the sandy soil. These results are similar to those obtained by Mohamed *et al.* (1995), El-Naggar *et al.* (1996) and Hanna and El-Awag (2000).

Water use efficiency (W.U.E.).

Water use efficiency (kg of seed broad bean yield per mm of water consumptive use) for the two studied irrigation intervals and application of macro and micronutrients are presented in table 3. Data revealed that (W.U.E.) increased with increasing irrigation intervals for all soils. The highest value of (W.U.E.) was obtained with irrigation intervals every fifteen days for the loamy soil which was recorded 7.6 kg/mm and followed the clay soil at the same treatment of irrigation which was recorded 7.2 kg/mm, in the last the calcareous soil come, which was recorded 2.8 kg/mm, the highest values of (W.U.E.) for the loamy and clay soils than others soils, may be attributed to the high production of seed broad bean in these soils with optimum using of water . Similar results were obtained by El-Awag *et al.*(1993) and El-Naggar *et al.* (1994).

Regarding the effect of nutrients application on (W.U.E.), it could be seen that from Table 3 any addition for any nutrient caused increasing for (W.U.E.) of all different studied soils. The highest values of (W.U.E.) among nutrients addition were obtained from phosphorus application in clay and loamy soils, which were recorded 7.4 and 6.5 kg./mm. respectively; for the calcareous soil the highest value for (W.U.E.) was 3.1 kg/mm was obtained with nitrogen application; while the highest value of (W.U.E.) of sandy soil was with iron. This is due to the important of phosphorus fertilization in alluvial soils, also the role of phosphorus in plants, these tended to obtained of higher production especially with broad bean. But the sandy and calcareous soils all the nutrient elements were very important. These results are in agreement with those obtained by Hanna *et al.* (1996).

As for the interaction effect between irrigation intervals and nutrients application on (W.U.E.) data presented in Table 3 show non significant differences on W.U.E. values but it could be noticed that irrigation intervals every fifteen days with phosphorus application in all studied soils recorded the highest values of (W.U.E.), which were 8.5, 8.2, 3.3 and 3.1 kg/mm for loamy, clay, sandy and calcareous soils respectively. These results are in harmony with the findings of El-Naggar *et al.* (1994), and Hanna *et al.* (1996).

Nutrients concentrations for seed :

The data in Table 4 show significant differences in all nutrients concentrations of seeds except P element as affected by irrigation intervals for different studied soils. Generally, from Total 4 it could be seen obvious that, irrigation every fifteen days caused increases in all nutrients concentration of seeds compared with irrigation every thirty days except iron nutrient which was recorded 173.2 and 151.1 µg/g. dry weight for irrigation every thirty and fifteen days respectively. These increment of all nutrients by irrigation every fifteen days may be attributed to, the effect of available soil moisture content on the solubility of these nutrients compounds in all different soil under the investigation. These findings generally agreed with the results of Khamis (1987), El-Naggar *et al.* (1991) and El-Naggar *et al.*(1994).

Concerning the effect of nutrients application on elements concentration of broad bean seeds, data in Table 4 indicated that, significant increases was founded for any concentration element when it was added, but with added another elements were noticed increased for element concentration without significant for different studied soils. The results in Table 4 could be seen clear that, concentration of all nutrients for seeds were highest in loamy soil followed by clay soil and the last with sandy soil. This was due to the high fertility of clay and loamy soils than the other soils under the investigation. This concept is supported by the results of Ghaly *et al.* (1984) and El-Awag *et al.* (1993).

Regarding the interaction effect between irrigation intervals and nutrients application on broad bean seeds nutrients concentration, it could be stated that there is non significant in these characters as showed in Table 4.
Generally, irrigation every fifteen days with any element added, tended to a higher increasing of the same element concentration, also caused a little increment for element concentration when were added by another elements compared with control in all soils. The highest values for nutrients concentration were recorded with loamy soil in case of irrigation every fifteen days than the other soils. These results are in good line with those reported by Thirumurugan *et al.* (1984), Halevy *et al.* (1987) and Hanna (1990).

Nutrients concentrations for straw:

The data in Table 5 show significant increase in P, Fe and Mn of broad bean straw concentration at irrigation every fifteen days in clay soil, except N concentration was increased without significant; but significant increase of all nutrients concentration in straw by also irrigation every fifteen days, except the iron element it was increased by irrigation intervals in loamy soil. The results indicated that, N and Mn concentration in straw recorded significant increase with irrigation interval every fifteen days, while the two others nutrients increased without significantly at also the irrigation interval in the calcareous soil, increase in P and Mn concentrations of straw

Table 4: Macro and micro nutrients concentrations of broad bean seeds as affected by irrigation intervals and nutrients application and their interaction in different soils (Combined of the two seasons).

Irrigation Intervals	Nutrients application	Soil types															
		Clay				Loamy				Calcareous				Sandy			
		Macro nutrients (mg/g)		Micro nutrients (µg/g)		Macro nutrients (mg/g)		Micro nutrients (µg/g)		Macro nutrients (mg/g)		Micro nutrients (µg/g)		Macro nutrients (mg/g)		Micro nutrients (µg/g)	
		N	P	Fe	Mn	N	P	Fe	Mn	N	P	Fe	Mn	N	P	Fe	Mn
Every 15 days	Cont.	40.80	4.90	172.30	21.80	51.30	5.80	181.30	24.20	21.60	3.90	130.80	19.40	17.90	3.10	119.90	16.00
	N	49.50	8.30	181.20	30.10	59.40	6.20	196.60	36.70	35.20	4.10	135.90	24.20	27.30	3.70	124.40	19.90
	P	43.70	8.80	185.10	31.20	58.70	10.10	196.20	37.20	30.40	5.80	136.40	23.80	23.80	4.80	122.80	18.30
	Fe	41.60	5.30	199.30	29.40	53.90	5.90	215.70	35.40	29.90	4.00	154.70	22.70	22.10	3.40	139.20	17.20
	Mn	41.30	5.70	178.50	49.50	51.70	5.80	185.10	53.80	28.20	4.10	132.30	35.10	22.70	3.50	130.60	27.90
	Means	35.10	6.20	151.10	32.40	55.00	6.60	195.00	37.50	29.10	4.40	138.00	25.00	22.60	3.70	127.40	19.90
Every 30 days	Cont.	32.00	4.20	162.00	18.40	42.90	4.90	170.20	20.90	19.00	3.10	121.00	15.50	13.30	2.80	110.10	13.20
	N	40.90	4.90	175.30	26.00	51.00	5.30	181.00	31.20	30.40	3.60	129.20	22.10	23.00	3.00	120.20	15.10
	P	35.70	6.90	176.70	25.20	48.20	8.20	180.20	32.10	26.20	4.90	127.10	21.90	20.70	4.20	119.00	15.20
	Fe	34.00	4.40	180.50	24.60	46.10	5.10	195.30	30.00	25.10	3.30	145.90	20.30	20.10	2.90	132.90	14.70
	Mn	34.20	4.30	171.30	31.00	44.80	5.00	175.40	41.20	25.00	3.20	122.30	30.20	20.20	2.80	118.00	20.30
	Means	35.40	4.90	173.20	25.00	46.60	5.70	180.40	31.10	25.00	3.00	129.10	22.00	15.40	3.10	120.00	15.70
L.S.D for irrigation 5%		2.38	7.42	1.84	0.35	0.41	1.29	1.84	1.22	1.23	N.S	1.63'	0.34	0.27	0.07	0.05	0.14
Means of fertilization																	
	Cont.	36.40	4.60	167.20	20.10	47.10	5.40	175.80	22.60	20.30	3.50	129.90	17.50	15.60	3.00	115.00	14.60
	N	45.20	5.60	178.30	28.30	55.20	5.80	188.80	34.00	32.80	3.90	132.60	23.20	25.20	3.40	122.30	17.50
	P	39.70	7.90	180.90	28.20	53.50	9.20	188.20	34.70	28.30	5.40	131.80	22.90	22.30	4.50	120.90	16.80
	Fe	37.80	4.90	189.90	27.00	50.00	5.50	205.50	32.70	27.50	3.70	150.30	21.50	21.40	3.20	136.10	16.00
	Mn	37.80	5.00	174.90	40.30	48.30	5.40	180.30	47.50	26.60	3.60	127.30	32.70	21.50	3.20	124.30	24.10
L.S.D for fertili. 5%		5.78	6.91	19.30	3.31	4.29	2.59	N.S	N.S	3.91	N.S	17.95	N.S	4.16	1.14	17.06	3.02
L.S.D for intera. 5%		NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.

Table 5: Macro and micro nutrients concentrations of broad bean straw as affected by irrigation intervals and nutrients application and their interaction in different soils (Combined of the two seasons).

Irrigation intervals	Nutrients application	Soil types															
		Clay				Loamy				Calcareous				Sandy			
		Macro nutrients (mg/g)		Macro nutrients (mg/g)		Macro nutrients (mg/g)		Macro nutrients (mg/g)		Macro nutrients (mg/g)		Macro nutrients (mg/g)		Macro nutrients (mg/g)		Macro nutrients (mg/g)	
		N	P	Fe	Mn	N	P	Fe	Mn	N	P	Fe	Mn	N	P	Fe	Mn
Every 15 days	Cont.	4.60	3.10	38.10	10.10	5.50	4.20	40.80	12.10	4.10	2.90	31.60	9.50	3.20	2.50	25.90	8.10
	N	8.30	3.80	44.30	18.20	9.20	4.90	44.70	16.20	5.60	3.20	38.20	9.90	4.90	3.00	32.70	8.90
	P	5.10	6.90	45.50	17.50	6.10	7.80	43.30	15.40	4.70	5.80	37.90	9.80	4.10	4.90	32.30	8.70
	Fe	4.20	3.70	69.10	16.30	5.70	3.90	73.90	13.90	4.30	3.10	61.30	9.40	3.60	2.80	58.40	8.00
	Mn	4.10	3.80	43.00	22.70	5.30	3.90	41.30	26.80	4.20	3.10	36.10	21.40	3.50	2.70	30.60	19.30
	Means	5.30	4.30	48.00	17.00	6.40	4.90	40.60	16.90	4.60	3.00	34.00	12.00	3.30	3.20	36.00	10.60
Every 30 days	Cont.	4.00	3.00	31.90	8.80	5.00	4.00	35.10	10.40	3.80	2.50	27.30	8.50	3.00	2.30	21.70	7.80
	N	6.50	3.20	40.80	15.40	8.80	4.10	40.20	13.20	5.00	3.00	31.90	9.00	4.20	2.80	28.20	8.50
	P	4.70	5.10	41.30	14.60	5.60	6.90	41.80	14.10	4.20	4.90	30.80	8.80	3.60	4.30	28.00	8.70
	Fe	4.30	3.30	60.00	12.20	6.50	3.20	68.70	11.90	4.20	3.00	54.20	8.70	3.50	2.70	50.30	7.30
	Mn	4.20	3.20	39.10	21.30	5.40	3.10	38.20	21.20	4.00	2.90	28.90	20.00	3.40	2.60	27.00	15.60
	Means	4.70	3.60	42.60	14.50	6.30	4.30	44.80	14.16	4.20	2.70	34.60	11.00	3.50	2.90	31.00	9.60
L.S.D for irrigation 5%		N.S	0.07	1.22	1.63	0.07	0.14	1.09	1.22	0.14	N.S	3.33	0.34	0.41	0.20	N.S	0.48
Means of fertilization																	
	Cont.	4.30	3.10	35.00	9.50	5.30	4.10	38.00	11.30	4.00	2.70	29.50	9.00	3.10	2.40	23.80	8.00
	N	7.40	3.50	42.60	16.80	9.00	1.50	42.50	14.70	5.30	3.10	35.10	9.50	4.60	2.90	30.50	8.70
	P	4.90	6.00	43.40	16.10	5.90	7.40	42.50	14.80	4.50	5.40	34.40	9.30	3.90	4.60	30.20	8.70
	Fe	4.30	3.50	64.60	14.30	6.10	3.60	71.30	12.90	4.30	3.10	57.80	9.10	3.60	2.80	54.40	7.70
	Mn	4.20	3.50	41.10	22.90	5.40	3.50	39.80	23.60	4.10	3.00	32.50	20.70	3.50	2.70	28.80	17.50
L.S.D for fertili. 5%		1.02	0.82	4.92	N.S	1.22	1.07	5.38	5.89	1.17	0.75	4.42	2.69	0.87	1.04	6.51	1.92
L.S.D for intera. 5%		NS.	NS.	NS.	2.04	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.

by irrigation at the near irrigation intervals, while were N and Fe at the near irrigation intervals were increased but without significant in the sandy soil.

In generally, the loamy soil recorded that, the highest values of nutrients concentrations in straw compared the other soils. This finding agrees with that of El-Awag *et al.* (1993) and El-Naggar *et al.* (1994).

Concerning the effect of nutrients application on nutrients concentrations for straw, the results showed that non significant increase for N concentration in straw with P, Fe and Mn application compared control, while there is a significant increase for N concentration with N application was found and non significant increase for P concentrations in straw. However, a significant increase for iron concentration compared with control when were added all elements under the study; but in case of clay soil, non significant increases for Mn concentrations in straw of broad bean compared with control.

In respect of loamy soil, data in Table 5 showed that, concentration of nutrients in straw as affected by nutrients application. The results indicated that, significant increase for N concentration with N nutrient application but non significant increment of N by other nutrients addition than control; and significant increase in P concentration than control, N application caused increment in P concentration but without significantly, inversely addition of other elements tended to decreasing in P concentration compared with control; regarding Fe concentration. Addition of Fe element caused significant increase of Fe concentration, while application of other nutrients tended to non significant increment of Fe concentration than control; significant positive effect for Mn concentration with addition it, but non significant increase for Mn concentration when the other nutrients applied compared with control.

Regarding the calcareous soil, significant increase for N concentrations with it addition, and non significant increases of N concentrations with other nutrients application compared control. In addition, a significant increases of P concentrations by addition of all elements than control. The results indicated that all elements addition recorded positive significant increase for Fe concentration except addition of Mn than control; Mn concentration significantly affected with it addition, but the other nutrients don't recorded significantly compared control.

Concerning the sandy soil, data in Table 5 illustrated clear that significant increases of N concentration with N application, but non significant increment on N concentration by application the other elements under investigation than control; was found P concentration was affected significantly by addition of it, but non significant increment for P concentration with addition of the other elements than control. In respect of Fe concentration, data revealed that all elements were recorded significant increases for Fe concentrations except Mn addition was recorded non significant increment than control; Mn concentration in straw non significant increase for Mn concentrations with application of all elements under study. This finding consider with the results of Halimark and Barber (1984), Khamis *et al.* (1987), El-Naggar *et al.* (1993) and Hanna *et al.* (1996) they reported that addition of any elements nutrient to soil significant increase concentrations of this elements in seed and straw of broad bean.

The interaction between irrigation intervals and nutrients application on nutrients concentrations of broad bean straw, data in Table 5 showed non significant interaction of these characters.

Nutrients uptake for seed:

The data in Table 6 show significant increases in N, P, Fe and Mn uptake at the near irrigation intervals for all different soils under investigation. The loamy soil were recorded the highest values of these nutrients uptake for broad bean seeds than the other soils followed by the clay soil and the last sandy one. The increasing of nutrients uptake in seed might be due to the two factor, the first is the effect of available soil moisture content for all types of soils on the solubility of these nutrients compounds in soil, the second factor due to increasing the broad bean seed yield with irrigation every fifteen days. Similar results were obtained by El-Naggar *et al.* (2001).

Concerning the effect of nutrients application on nutrients uptake, the results indicated that, significant increases in seeds nutrients uptake compared with control with application of any elements from these elements in the four soils under the study. it could stated that, the highest values for any nutrient uptake for seeds than control were obtained with addition of the same element. The increasing of N, P, Fe and Mn uptake in broad bean seeds might be due to the role of these nutrients specially micronutrients for organization in rapid alteration of nutritional compounds within plants through its effect on the enzyme and other metabolism activity. Similarly results were founded by Halevy *et al.* (1987), El-Naggar *et al.* (1994) and El-Naggar *et al.* (2001).

As for the interaction between irrigation intervals and nutrients application on nutrients uptake of broad bean seeds, the results in Table 6 indicated insignificant differences due to the interaction on nutrients uptake of seeds.

Nutrients uptake of straw:

The results in Table 7 indicated that nutrients uptake of broad bean straw as affected by irrigation intervals, high significant increases were found for all nutrients uptake by irrigation every fifteen days of different studied soils. The loamy soil proved that the values of nutrients uptake for straw were higher than the other soils and the last one was sandy soil. The increments for nutrients uptake of straw at a near of irrigation intervals may be attributed to a role of high available soil moisture content in different soils on the solubility of these nutrients compounds in soil and increasing of straw yield with irrigation every fifteen days. Similar results were obtained by El-Naggar *et al.* (1991) and Hanna *et al.* (1996).

Concerning nutrients elements application on nutrients uptake in broad bean straw. The results showed that significant increases for nutrients uptake than control in all soils by addition any element under the study.

Table 6 : Macro and micro nutrients uptake of broad bean seeds as affected by irrigation intervals and nutrients application and their interaction in different soils (Combined of the two seasons).

Irrigation intervals	Nutrients application	Soil types																			
		Clay					Loamy					Calcareous					Sandy				
		Seed yield kg/fed	Macro nutrients kg/fed		Micro nutrients g/fed		Seed yield kg/fed	Macro nutrients kg/fed		Micro nutrients g/fed		Seed yield kg/fed	Macro nutrients kg/fed		Micro nutrients g/fed		Seed yield kg/fed	Macro nutrients kg/fed		Micro nutrients g/fed	
			N	P	Fe	Mn		N	P	Fe	Mn		N	P	Fe	Mn		N	P	Fe	Mn
Every 15 days	Cont.	1521.80	62.09	7.46	262.21	33.18	1640.20	84.14	9.51	297.37	39.69	750.80	16.22	2.93	98.20	14.57	405.80	7.26	1.26	48.66	6.49
	N	1911.90	94.64	12.04	346.44	57.55	2014.10	119.63	12.49	395.97	73.92	963.70	33.92	3.95	130.97	23.32	594.60	16.23	2.20	73.97	11.83
	P	2110.30	92.22	18.57	390.62	65.84	2354.30	138.20	23.78	461.91	87.58	870.40	26.46	5.05	118.72	20.72	683.20	16.26	3.28	83.90	12.50
	Fe	1800.50	74.90	9.54	358.84	52.93	1987.50	107.13	11.73	428.70	70.36	865.10	25.26	3.46	133.83	19.64	673.40	14.88	2.29	93.74	11.58
	Mn	1784.10	73.66	10.17	318.47	88.31	1835.70	94.91	10.65	339.79	98.76	801.90	22.61	3.29	106.09	28.15	591.70	13.43	2.07	77.28	16.51
	Means	1825.70	64.08	11.32	275.86	59.15	1966.40	108.15	12.98	383.45	73.74	850.40	24.75	3.74	117.36	21.26	589.70	13.33	2.18	75.13	11.74
Every 30 days	Cont.	1480.30	47.37	6.22	239.81	27.24	1560.30	66.94	7.65	265.56	32.61	622.30	11.82	1.93	75.30	9.65	360.60	4.60	1.01	39.72	4.76
	N	1822.60	74.54	8.93	319.50	47.39	1934.60	98.66	10.25	350.16	60.36	850.10	25.84	3.06	109.83	18.79	522.70	12.02	1.57	62.83	7.89
	P	2005.40	71.59	13.84	354.35	50.54	2223.20	107.16	18.23	400.62	71.36	768.70	20.14	3.77	97.70	16.83	631.30	13.07	2.53	75.12	9.60
	Fe	1708.90	58.10	7.52	308.46	42.04	1879.30	86.64	9.58	367.02	56.38	758.60	19.04	2.50	110.68	15.40	600.50	12.07	1.74	79.81	8.83
	Mn	1622.20	55.48	6.96	277.86	50.29	1741.80	78.03	8.71	305.51	71.76	693.20	17.33	2.22	84.78	20.93	520.30	10.51	1.46	61.40	10.56
	Means	1727.90	61.17	8.47	299.27	43.20	1367.80	87.04	10.65	336.95	58.09	738.60	18.47	2.22	95.35	16.32	527.10	8.12	1.63	63.25	8.28
L.S.D for irrigation 5%		25.86	0.79	0.37	5.24	0.05	1.70	0.72	1.28	0.01	3.81	26.13	1.32	0.14	0.26	3.50	18.78	0.02	0.33	0.21	1.03
Means of fertilization	Cont.	1501.10	54.73	6.84	261.01	30.21	1600.30	75.54	5.58	281.47	36.15	686.60	13.94	2.40	86.75	12.11	383.30	5.98	1.15	44.19	5.85
	N	1867.30	84.59	10.49	332.97	52.47	1974.40	109.15	11.37	373.07	67.14	906.90	29.75	3.54	120.40	21.06	558.70	14.08	1.90	68.40	9.86
	P	2057.90	81.91	16.21	372.47	58.19	2288.80	122.68	21.00	431.27	79.47	819.60	23.19	4.43	58.21	18.78	657.30	14.66	2.96	79.51	11.05
	Fe	1754.70	66.50	8.53	333.65	47.49	1933.40	96.89	10.66	397.86	63.37	811.90	22.33	3.00	122.26	21.78	646.00	13.82	2.07	46.87	10.21
	Mn	1703.20	64.58	8.58	298.18	69.30	1788.80	86.47	9.68	322.65	85.26	747.60	19.89	2.69	95.44	21.10	556.00	11.95	1.78	69.34	13.54
L.S.D for fertili. 5%		196.80	2.31	3.47	34.23	6.64	231.00	29.17	3.60	42.61	6.71	98.50	4.85	1.20	8.24	3.62	73.32	4.58	0.61	9.54	2.58
L.S.D for intera. 5%		NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	[illegible]	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.	NS.

Table 7: Macro and micro nutrients in straw uptake of broad bean straw as affected by irrigation intervals and nutrients application and their interaction in different studied soils (Combined of the two season).

Irrigation Intervals	Nutrients application	Soil types																			
		Clay					Loamy					Calcareous					Sandy				
		Straw yield Ton/fed	Macro nutrients kg/fed		Micro nutrients g/fed		Straw yield Ton/fed	Macro nutrients kg/fed		Micro nutrients g/fed		Straw yield Ton/fed	Macro nutrients kg/fed		Micro nutrients g/fed		Straw yield Ton/fed	Macro nutrients kg/fed		Micro nutrients g/fed	
			N	P	Fe	Mn		N	P	Fe	Mn		N	P	Fe	Mn		N	P	Fe	Mn
Every 15 days	Cont.	1.82	8.38	5.65	69.39	18.40	1.94	10.67	8.15	79.18	23.48	1.07	4.38	3.10	33.79	10.16	0.71	2.27	1.78	18.40	5.7[illegible]
	N	2.21	18.35	8.40	97.96	40.24	2.32	21.35	11.37	103.74	37.60	1.27	7.13	4.07	48.64	12.61	0.90	4.41	2.70	29.40	8.0[illegible]
	P	2.41	12.29	16.63	109.67	42.18	2.65	16.18	20.69	114.85	40.84	1.18	5.55	6.85	44.74	11.57	1.00	4.10	4.90	32.29	8.7[illegible]
	Fe	2.10	8.82	7.77	145.16	34.24	2.27	12.96	8.87	168.04	31.61	1.17	5.04	3.64	71.91	11.03	0.98	3.60	2.75	57.38	7.8[illegible]
	Mn	2.08	8.54	7.92	89.62	47.31	2.13	11.30	8.31	88.04	57.13	1.11	4.66	3.44	40.05	23.74	0.89	3.10	2.40	27.20	17.1[illegible]
	Means	2.13	11.27	9.14	102.02	36.13	2.26	14.49	11.09	91.91	38.26	1.16	5.34	3.48	39.48	13.93	0.90	2.96	2.87	32.26	9.5[illegible]
Every 30 days	Cont.	1.72	6.89	5.16	54.91	15.15	1.84	9.20	7.36	64.59	19.14	0.97	3.68	2.42	26.46	8.24	0.71	2.13	1.63	15.42	5.5[illegible]
	N	2.11	13.69	6.74	85.95	32.44	2.23	19.58	9.12	89.45	29.37	1.18	5.88	3.53	37.50	10.58	0.78	3.29	2.19	22.06	6.6[illegible]
	P	2.31	10.86	11.79	95.44	33.74	2.55	14.30	17.61	106.71	35.99	1.09	4.58	5.35	33.62	9.61	0.91	3.28	3.91	25.49	7.9[illegible]
	Fe	2.00	8.61	6.61	120.15	24.43	2.15	14.00	6.89	147.96	25.63	1.07	4.51	3.22	58.16	9.34	0.89	3.12	2.41	44.83	6.5[illegible]
	Mn	1.99	8.34	6.36	77.66	42.31	2.03	10.97	6.30	77.61	41.07	1.02	4.07	2.95	29.39	21.42	0.79	2.67	2.04	21.20	12.2[illegible]
	Means	1.67	7.84	6.00	71.05	24.18	2.16	13.61	9.29	96.80	30.60	1.07	4.47	2.88	36.86	11.72	0.82	2.86	2.37	25.30	7.8[illegible]
L.S.D for irrigation 5%		0.01	0.11	2.16	0.10	0.79	0.12	0.73	0.19	1.66	1.37	N.S	0.15	0.90	1.69	1.00	0.01	0.56	0.30	1.93	0.5[illegible]
Means of fertilization	Cont.	1.77	7.64	5.41	62.15	16.78	1.89	9.94	7.76	71.89	21.31	1.02	4.03	2.76	30.13	9.20	0.71	2.20	1.71	16.91	5.65[illegible]
	N	2.16	16.02	7.57	91.96	36.34	2.27	20.47	10.25	96.60	33.49	1.22	6.51	3.80	43.02	11.60	0.84	3.85	2.45	25.73	7.33[illegible]
	P	2.36	11.58	14.21	102.55	37.96	2.60	15.24	19.15	110.78	38.42	1.14	5.07	6.10	39.18	10.59	0.96	3.69	4.41	28.89	8.31
	Fe	2.05	8.72	7.19	132.66	29.34	2.21	13.48	7.88	158.00	28.62	1.12	4.78	3.43	65.04	10.19	0.94	3.36	2.58	51.11	7.19[illegible]
	Mn	2.04	8.44	7.14	83.64	44.81	2.08	11.14	7.31	82.83	50.10	1.06	4.37	6.39	34.72	22.58	0.84	2.89	2.22	24.20	14.7[illegible]
L.S.D for fertil. 5%		0.37	1.41	1.81	7.24	4.31	0.67	3.09	1.95	5.52	2.94	N.S	1.01	1.10	5.91	2.38	0.02	0.76	0.55	1.91	1.92
L.S.D for Intera. 5%		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Addition of any element for any soil tended to increasing uptake of the same element in broad bean straw compared with control. The loamy soil recorded the highest values of nutrients uptake than the other soils, while the lowest one was sandy soil. The increases of nutrients uptake by nutrients application in straw, might be due to the effect of any element addition in increasing the straw dry weight as a result of a good healthy of plant. This finding agrees with that of El-Mawaredi *et al.* (1980), El-Naggar *et al.* (1991) and Hanna *et al.* (1996).

Regarding the interaction between irrigation intervals and nutrients application on nutrients uptake by straw of broad bean, the results in Table 7 showed that insignificant differences on nutrients uptake of straw broad bean.

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تأثير فترات الري وإضافة بعض العناصر الغذائية علي إنتاجيه الفول البلــدي، وتركيز وامتصاص العناصر وبعض العلاقات المائية لأنواع مختلفة من الأراضي.

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أجرى هذا البحث خلال موسمين متتالين (٢٠٠١ ، ٢٠٠٢) بمجموعــة ليزيمتــرات بمحطــة البحــوث الزراعية بالجميزة (أبعاد الحوض الواحد ٢م طول ، ١م عرض ، ٢م ارتفاع). استخدمت الأراضي الطينية ثقيلة القوام – الطميية متوسطة القوام – الأراضي الجيرية نسبة كربونات الكالسيوم بها أكثر من ٢٠% والأراضــي الرمليــة الخالية من الأملاح.

استخدم تصميم القطع المنشقة لكل نوع من الأراضي لدراسة تأثير فترات الري (الري كل ١٥ يوم ، الري كل ٣٠ يوم) في القطع الرئيسية ، وإضافة بعض العناصر الكبرى والصغرى (النتروجين بمعدل ٢٠ كجم ن/ف فــي صورة سلفات امونيوم، الفوسفور بمعدل ١٥ كجم فو٢أ٥/ف في صورة سوبر فوسفات أحــادى الكالســيوم ، الحديــد والمنجنيز بمعدل ٢٠ كجم/ف ، ١٠ كجم/ف في صورة سلفات علي التوالي في القطع التحتية (المنشــقة) ويمكــن تلخيص أهم النتائج المتحصل عليها فيما يلي:-

١- أوضحت النتائج أن أعظم محصول للفول البلدي تم الحصول علية عند استخدام معاملة الري كل ١٥ يوم وذلك مع إضافة عنصري النتروجين والفوسفور كل علي حدة لكل أنواع الأراضي تحت الدراسة، وكان أعلي محصول قد سجل عند الزراعة في الأراضي الطميية وذلك بالمقارنة بأنواع الأراضي الأخرى .

٢- لقد زادت مياه الري الكلية المضافة مع تقارب فترات الري لكل أنواع الأراضي ومعاملة الري كل ١٥ يوم أظهرت اعلي قيمة لمياه الري الكلية المضافة.وكانت الأراضي الرملية أعلي تسجيلا لمياه الري الكلية المضافة عن الأراضي الأخرى ، في حين أن الأراضي الطينية سجلت أقل كمية لمياه الري الكلية المضافة.

٣- سجلت النتائج أن أعلي استهلاك مائي تم الحصول علية عندما استخدم معاملة الــري كــل ١٥ يــوم مــع إضــافة النتروجين لكل أنواع الأراضي تحت الدراسة ، بينما سجل أعظم استهلاك مائي في الأراضي الجيرية ، بينما اقــل قيمة له كان مع الأرض الرملية.

٤- وأشارت النتائج إلي أن اعلي قيمة لكفاءة استخدام المياة بالنسبة لبذور الفول البلدي تم الحصول عليها مــن معاملــة الري كل ٣٠ يوم مع إضافة عنصر الفوسفور لجميع أنواع الأراضي . ولقد سجلت أعظم قيمة لكفاءة اســتخدام المياه مع الأراضي الطينية والطميية بالمقارنة بالأراضي الأخرى .

٥- تم الحصول علي اعلي القيم لتركيز وامتصاص أي عنصر لبذور وقش الفول البلدي مع الري كل ١٥ يوم مع إضافة نفس العنصر بالمقارنة بالعناصر الأخرى المضافة. وكان اعلي قيم لتركيز وامتصاص العناصــر الغذائيــة تــم الحصول علية مع الأرض الطميية ويتبعها الأرض الطينية، واقل تركيز وامتصاص للعناصر الغذائية ســجل مــع الأرض الرملية.

توصى هذة الدراسة لزيادة إنتاجية محصول البذور والقش للفدان من الفول البلدي واعلي قيم للعناصر وذلك بالري كل ١٥ يوم مع إضافة السماد النتروجيني والفوسفاتي منفردين تحت ظروف الأراضي تحت الدراسة.