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IMPROVING YIELD AND YIELD QUALITY OF FOUR FABA BEAN CULTIVARS GROWN UNDER RAINFALLS
1-APPLICATION OF SOME INORGANIC NUTRIENTS*

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ABSTRACT

Four experiments were carried out at the research field of horticulture Dept, Agriculture & Forestry college, Mosul University, during 2004-2005 growing season to investigate the ability of boosting drought resistance in four faba bean cultivars by foliar spraying of Fe-ethylene diamine-di-o-hydroxy phenyl acetic acid (Fe-EDDHA) at rates of 0,50,100 and 150 mg. L^{-1}; boric acid (H_3BO_3) at rates of 0, 50, 100, 150 and 200 mg.L^{-1}; potassium iodide (KI) at rates of 0, 25, 50, and 75 mg.L^{-1}, phtoFert. at rates of 0, 1, 2 and 3g.L^{-1} at the commence of flowering and was repeated after 2 weeks. Experiment 1 results showed that spraying local Syrian cultivar with 100 mg. L^{-1} Fe-EDDHA appeared to be the most effective treatment. It significantly increased the yield of dry seeds (19.7%), in relation to its corresponding checks. In experiment 2 , the application of 50 mg.L^{-1} H_3BO_3 was the paramount treatment. It exceeded the yield of dry seed of untreated treatment by 28.4%. Experiment 3 results revealed that potassium iodide rates resulted in adverse effects on all detected parameters favorable for aqueduce cultivar growth and yield. Consequently, negative correlation were found in most growth, flowering, pod development, seed fillings and yield component parameters . Experiment 4 results manifested dramatic negative correlations caused by foliar spray of phytoFert rates in most favorable traits for the improvement of plant growth and yield. The worst treatment was 3g.L^{-1}.

INTRODUCTION

Mosul is a northern Iraqi city located between isohyets line of 300 to 400 mm rainfalls with a yearly mean of 381 mm. Unequivocal discrepancies were recorded in rainfalls incidence among years and even among rainfalls months of any given year. Rainfalls are usually commenced on the beginning of November and continues to rise to the end of March then they are gradually declined to inconsiderable quantity on May (Guest, 1966).

The main problem facing production of faba bean under rainfalls in Mosul is the low rainfalls incidence late in the season. Drought is synchronized with gradual increases of temperature which aggravated the adverse effects during seeds filling stage and dramatically reduces the grain yield, since this stage was found to be the most drought susceptible stage(Abdel, 1993; and 1997 and El-Hamadany, 2005). Therefore, application of hardly available inorganic nutrients in the neutral and alkaline soils as that of Iraq and some growth regulators might be very helpful in improving drought resistance of faba bean cultivars to overcome this problem. Subsequently, attempts were made to investigate the ability of different rates of Fe-EDDHA, H_3BO_3, KI and PhytoFert, in improving drought resistance of indeterminate aquadulce, Local Syrian, Babylon and determinate Taka357 faba bean cultivars**.**

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MATERIALS AND METHODS

These experiments were carried out at the Horticultural field of researches, Agriculture & Forestry College, Mosul University during 2004-2005 growing season. Seeds of four faba bean cultivars namely Aquadulce, Local Syrian, Babylon and Taka357 were obtained from the International Center for Agricultural Research in the dry areas (ICARDA), Aleppo, Syria; Agricultural Research Center, Mosul and Iraqi Atomic Energy Organization, Baghdad. Four inorganic plant nutrients and four growth regulators were sprayed twice with in 2 weeks intervals on faba bean plants, started with the commence of flowering, to investigate the ability of enhancing drought resistance of Fe- ethylene-diamine-o-hydroxy phenyl acetic acid (Fe-EDDHA) rates 0, 50 100 and 150 mg l^{-1}. in local Syrian ; boric acid (H_3BO_3) rates 0, 50, 75, 100, 150 and 200 mg.L^{-1}, in Aquadulce; Potassium Iodide (KI) rates 0, 25, 50 and 75 mg.L^{-1} in Aquadulce; phtofert (complete Nutritional Fertilizer) rates 0, 1, 2, and 3g. in Aquadulce.

The rates of each of the 4 chemical compounds were separately experienced in a Randomized Complete Block Design (RCBD) trail. Each treatment was replicated three times and each replicate was represented by 104 plants raised on both sides of a furrow (5X0.8m) with intra hills space of (20cm) , 2 plants per hill.

Field soil was clay (56.4% clay, 12.3% sand and 31.3% silt), its field capacity, wilting point and bulk density were 21.8%, 12.9% and 1.6g.cm^{-3}, respectively. One gypsum block was settled at 25 cm depth from top surface of the furrow to track soil moisture fluctuation during the growing season (Ruggiero *et al.,* 1999). After a considerable rain falls on December, 10^{th} ,2004 four seeds were sown in each pit , then plants were thinned to 2 plants per pit on January, 3^{rd}, 2005. Thereafter , di-ammonium phosphate (DAP) was immediately applied at rate of 20 g.m^{-2} and was repeated again on March, 3^{rd}, 2005. At flowering stage, plants had a protective spray of benomyl fungicide at rate of 1g.L^{-1}. At the commence of flowering stage on March, 3^{rd},2005, each replicate of the 4 experiments was sprayed with its corresponding chemical rate and spraying was repeated after 2 weeks. Continuous weed eradications and other cultural practices were manually made. All experiments were terminated on May 5-15^{th} , 2005.

Data on plant height, number of branches on main stem, shedding leaves on main stem, leaflet numbers per leaf, first fruiting node, inflorescence numbers per main stem, pod numbers per plant, pod length, leaflet length and leaflet width were recorded. Leaflet area was calculated from leaflet length and width through linear regression (Abdel, 1994). Leaflet samples were weighed and incubated in 100% relative humidity for 24 h, then they were wiped by a piece of clothes and weighed thereafter, they were oven-dried at 60 C° for 72 h. and their dry weights were recorded to calculate the leaflet water saturation deficit (WSD) and leaflet dry matter percentages. Harvested plants were sun-dried for a week , then they were weighed, pod collected and weighed, thereafter, aborted ovules per pod, aborted seeds per pod and seeds per pod were counted. Finally, 100 seeds and yield of dry seeds. m^{-2} were weighed.

RESULTS AND DISCUSSION

The effects of drought: Meteorological data (Table,1 & Figure,1) shows that rainfalls were ceased, creating drought episodes to extent that plants experienced a very severe drought synchronized with gradual temperature increases which aggravated the adverse effects of water stress to cause drastic growth and yield reductions in comparison to those of adequately irrigated obtained by El-Hamadany (2005). Results revealed that drought displayed more drastic effect on faba bean cultivar of determinate growth habit than that imposed on cultivars of indeterminate growth habit. Similar results were found by Kagure (1993), he postulated that determinate cultivar possesses a single major sink concentrated on the middle portion of the plant and all the photosynthates are channeled to this single dominant sink. However in case of indeterminate cultivar has many source-sink units each consisting of a pod and three compound leaves. The indeterminate type, the photosynthesis rate in the source-sink unit increased as the unit position moved up along the stem. Drought imposed undesired reductions in plant height, leaflet area leaf area index and shedding leaves as a results of plant responses to avoid drought and to sustain survival. The interpretation of the obtained results is that drought tends to inhibit cell elongation rather than cell division and prevent it to approach its ultimate size (Clough and Milthropies, 1975). Thus, drought plants exhibited slow expansion rates in internodes, leaves and other developing organs accompanied by significant reductions in sizes, fresh weight and dry weight. These reduction might be considered as drought avoidance mechanism to lessen transpiration. The results also manifested that the reduction in leaf area is concomitant by paradoxical increases in stomata populations and reductions in their aperture dimensions as attempts to improve the regulations of transpiration and CO_2 exchange through stomata aperture , this phenomenal is anther potent drought avoidance mechanism(Abdel, 1997 ; El-Hamadany, 2005 and Al-Juboori, 2005). Anther drought avoidance mechanism may be inferred from this investigation, which is drought plant tended to prune the leaves of inactive photosynthesis and high transpiration rate, rendering drought leaves only at the top of the plant. These leaves been termed a drought leaf (Karamanos 1978). Shedding of leaves was also stated by El- Beltagy *et al.* (1976) and Hall *et al.* (1977). They attributed that to the accumulation of abscisic acid and ethylene owing to dehydration of plant tissues.

The results displayed high percentages in abscission of flower and pods besides the high numbers of aborted ovules per pod and aborted seeds per pod, particularly in the nodes close to plant apical, despite the reduction observed in the numbers of pod per plant. These results are interpreted on the basis of source-sink of photosynthate partitioning. Lower pods received more assimilate than these located at the upward sequence nodes to the top. This is the reason why faba bean develops lathery pods contains small hard undeveloped seeds. Very close results were reported by Chapman and Peat (1978); Kagure *et al.* (1978) and El-Far (1994). Ming-Zhong (1993) found that the photosynthetic rate of leaves varied at different position and different growth stages for instance, initial flowering stage the photosynthetic rate of upper position leaves was the greatest followed by the middle position leaves and the lower position leaf had the lowest value. The photosynthetic rates were 9.2, 8.3 and 7.4 mg.dm-2.h^{-1} for upper, middle and lower leaves, respectively.

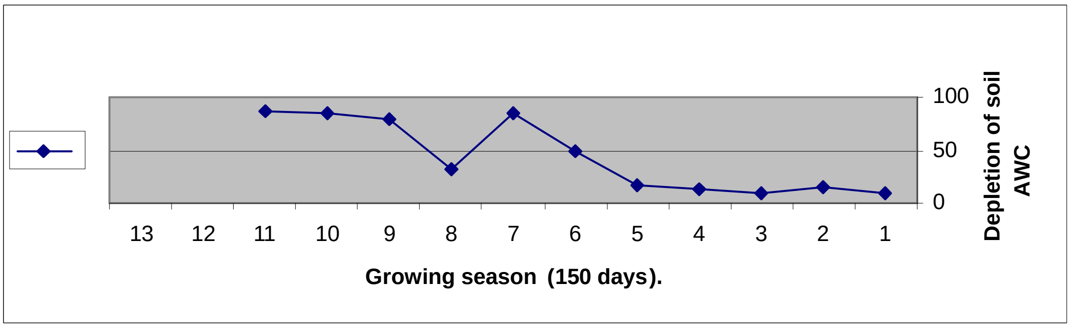

Figure (1): fluctuation of Soil AWC depletion percentages during the growing season

Table (1): Meteorological data during the growing season.

Months	Minimum C°	Maximum C°	Relative Humidity (%)	Rainfalls (mm)
December	6.5	13.1	84	82.2
February	5.1	12.4	81	88.6
January	4.1	16.7	68	62.5
March	5.7	21.5	58	20.5
April	12.3	26.8	48	71.4
May	17.0	34.2	34	37

The effects of Fe-EDDHA: The obtained results confirmed that the ability of Fe-EDDHA in enhancing drought resistance in Local Syrian cultivar . This enhancement obviously explained the positive correlations gained in plant height,(r=0.42), number of branches per plant (r=0.16), number of leaves on main stem (r=0.26), leaflet area (r=0.35), pod length (r=0.082), seeds per pod (r=0.12), pod dry weight (r=0.17), weight of 100 seeds (r=0.12) and yield of dry seeds (r=0.19). Furthermore, drought enhancement was reinforced by the negative correlations obtained in shedding leaves on main stem (r=--0.021), water saturation deficit of leaflet (r=--0.68*), aborted ovules per pod (r=-0.28) and aborted seeds per pod (r=--0.28). However, Fe-EDDHA application tended to reduce leaflet dry matter percentage (r=-0.12), pod numbers per plant (r=-0.0067) and plant dry weight (r=-0.44). Rate of 100 mg.L^{-1} appeared to be the most effective treatment in improving drought resistance. It increased leaflet area (48.5%),leaf area index (111.1%), pod dry weight (21.3%), weight of 100 seeds (5.4%) and yield of dry seeds (19.7%) as compared to untreated check. Followed by 50 mg.L^{-1} treatment which increased pod dry weight (15.6%), plant dry weight (15.5%), numbers of pod per plant (11.8%), pod length (16.4%), weight of 100 seeds (5.6%) and yield of dry seeds (15.5%). In addition to that it showed reduction of (46.3%) in water saturation deficit of leaflet (Table, 2). The achieved results were close to those obtained by Abdel, (1991). The benefit gained from Fe-EDDHA application could be referred to the role of ferrous in plant metabolism and its deficiency resulted in a weak plant stature. The role of iron in substituting Mo as the metal cofactor necessary for the functioning of nitrate reductase the most effective growth enzyme (Prasad and Power 1997), they also reported that iron is an immobile nutrient, its deficiency distinctly seen on young leaves of plant grown in neutral and alkaline soils, this is the perfect description for Iraqi soils. Vegetable crops are very sensitive to low iron availability , in addition to that drought imposes additional adverse effects combined with these of iron deficiency (Kozolowski, 1980). Studies recommended the use of Fe-EDDHA salts on alkali soils to overcome the problem (Prasad and Power, 1997), and on long day plants to sustain vegetative growth and boosting earlier flower initiation in short days (Kinet *et al.,* 1985). Goodwin and Mercer (1985) stated that iron prophyrins are prosthetic groups of cytochromes, hemoglobin in root nodules and enzyme such as catalase. Some times nitrogen application desperately required iron to cure yellowing owing to the role of iron in chlorophyll synthesis. Thus, Improvements in growth and yield of faba bean that achieved by Fe-EDDHA application were expected.

Table (2): The effects of Fe-EDDHA rates on growth and yield of Local Syrian cultivar

Parameters (Y)	Fe-EDDHA rates mg.L^{-1},(X)				Linear equations (y=a+bx).		
	0.0	50	100	150	a	b	r
Plant height (cm)	37.2	38.8	39.0	40.5	37.38	0.0200	0.4200
Branches nos./plan	5.8	6.2	6.1	6.1	5.9	0.0023	0.1600
Leaf nos./ main stem	13.5	12.8	14.4	14.1	13.17	0.0070	0.2600
Shedding leaf/main stem	7.3	5.5	6.7	7.0	6.59	-0.0005	-0.0210
Leaflet nos./leaf	5.4	5.3	5.2	4.9	5.4	-0.0033	-0.3900
Leaflet area(cm^2)	3.3	4.4	4.9	4.5	3.64	0.0085	0.3500
Leaf area index	0.9	1.2	1.9	1.3	1.3	1.0700	0.0036
Leaf WSD (%)	50.9	34.8	37.0	37.8	49.68	-0.1900	-0.6800

Leaflet dry matter (%)	12.7	11.8	11.8	11.6	12.46	-0.0070	-0.1150
Pod nos./plant	5.1	5.7	4.9	5.3	5.26	-0.0002	-0.0067
Pod length (cm)	6.7	7.8	7.4	7.5	7.23	0.0025	0.0820
Aborted ovules/pod	3.1	2.5	3.0	2.7	3.15	-0.0034	-0.2800
Aborted seeds/pod	1.7	1.2	1.5	1.3	1.56	-0.0017	-0.2800
Seed nos./pod	1.8	2.0	2.1	2.0	1.91	0.0011	0.1200
Plant dry weight($g.m^{-2}$)	312.3	354.2	291.1	270.1	335.4	-0.3800	-0.4400
Pod dry weight ($g.m^{-2}$)	65.6	75.8	79.5	71.3	69.71	0.0490	0.1700
Weight of 100 seeds (g)	95.1	100.4	100.2	98.6	97.05	0.0200	0.1200
dry seed Yield ($g.m^{-2}$)	54.2	62.6	64.9	60.7	57.33	0.0440	0.1900

The effect of H_3BO_3: Negative correlations which are favorable for faba bean production were found in first fruiting node (r=-0.09), aborted ovules per pod (r=-0.045) and aborted seeds per pod (r=-0.19). In addition to that, other detected traits desired for growth and yield improvements showed positive correlations, for instance plant height (r=0.31), leaf numbers on main stem (r=0.3), leaf dry matter percentage (r=0.48*), plant dry weigh (r=0.033), pod dry weight (r= 0.009), weight of 100 seeds (r=0.45) and yield of dry seeds (r=0.19). However, undesired positive and negative correlations were observed in leaf water saturation deficit (r=0.51*), shedding leaves on main stem (r=0.26) and setting percentage (r=-0.37). Table (3), results manifested the clear ability of H_3BO_3 in increasing drought resistance of aquadulce faba bean cultivar particularly, when they were sprayed by 50 $mg.L^{-1}$ treatment. It displayed unequivocal discrepancies as compared to control, in plant height (22.5%), number of branches per plant (27.5%), shedding leaves on main stem (21.7%),pod numbers per plant (35.4%),aborted ovules per pod (12%), pod dry weight (39.4%), plant dry weight (42.8%) and yield of dry seeds (28.4%). Followed by 100 and 150 $mg.L^{-1}$ rates which gave similar results over all detected parameters especially, in the yield of dry seeds (133.5 and 138.4, respectively). Whereas, 200 $mg.L^{-1}$ treatment tended to lessen the gained improvement of drought avoidance, nevertheless, still this rate superior to check. Similar results were reported by Abdel (1991), yield improvements were attributed to the boron deficiency in most Iraqi soils owing to their pH and to the role of boron in many metabolic pathways. Tisdale *et al.* (1993) reported that plants grown on neutral and alkaline soils suffer of boron deficiency and foliar application of boron at rates of 0.1 to 0.5$kg.ha.^{-1}$ have to be applied to relief deficiency symptoms. Boron deficiency is observed only in dry season or when water availability is low, however, plant can tolerate higher concentrations, without experiencing harmful effects during cool weather than during warm and humid conditions(Eaton, 1953). The apparent boron ability in improving drought resistance of faba bean aquadulce cultivar that was found in this experiment might be referred to the direct and indirect role of boron in metabolic activities of plant cell. Previous investigations confirmed that boron applications resulted in the improvement of cell wall expansion, pentose shunt pathway, phenolic synthesis, IAA synthesis, cell division, DNA and protein synthesis at root cup, cell elongation and differentiation, lignifications of root elongation region, membrane integrity at root hair region and profuse other metabolic mechanism were reported (Shorrocks, 1991).

Table (3): The effects of H3BO3 rates on growth and yield of Aqueduct cultivar

Parameters (Y)	H_3BO_3 rates mg.L^{-1}(X)					Linear equations (y=a+bx).		
	0.0	50	100	150	200	a	b	r
Plant height (cm)	40	49.0	47.5	46.8	45.3	44.05	0.0560	0.310
Branches nos./plan	4.0	5.1	4.9	4.8	4.4	4.54	0.0036	0.110
Leaf nos./ main stem	13.9	14.7	15.4	15.7	14.8	14.89	0.0180	0.300
Shedding leaf/main stem	5.6	4.5	5.8	5.6	6.0	5.13	0.0120	0.260
Leaflet nos./leaf	6.1	6.2	6.3	6.4	6.2	6.19	0.0020	0.210
Leaflet area (cm^2)	6.8	8.9	8.2	9.5	6.9	7.88	0.0064	0.076
Leaf area index	1.54	2.76	2.6	3.1	1.86	2.18	0.0020	0.024
Leaf WSD (%)	24.7	39.9	30.3	40.7	37.7	29.29	0.1800	0.510*
Leaflet dry matter (%)	13.1	15.1	16.1	15.9	16.5	13.79	0.0500	0.480*
Pod nos./plant	4.8	6.8	4.8	5.3	5.7	5.30	0.0029	0.054
Pod length (cm)	11.7	13.1	12.7	12.8	12.5	12.17	0.0120	0.240
Aborted ovules/pod	2.5	2.2	2.3	2.3	2.3	2.37	-0.0003	-0.054
Aborted seeds/pod	1.7	1.7	1.0	1.7	1.3	1.70	-0.0031	-0.190
Seed nos./pod	3.0	2.8	3.3	3.9	3.2	2.97	0.0009	0.360
Plant dry weight(g.m^{-2})	381.3	544.8	461.5	504.2	416.7	455.60	0.0610	0.033
Pod dry weight (g.m^{-2})	135.7	189.2	160.6	170.1	144.2	160.40	0.0045	0.009
Weight of 100 seeds (g)	104	107.6	113	108.5	108.2	106.43	0.0380	0.450
dry seed Yield (g.m^{-2})	112.2	144.1	133.5	138.4	129.4	125.76	0.0580	0.190
First fruiting node	5.2	4.8	4.6	4.7	5.2	4.98	-0.0020	-0.090
Inflores. no./main stem	5.7	6.6	6.3	6.4	6.8	5.96	0.0140	0.310

The effects KI: Applied potassium iodide rates resulted in adverse effects on most detected traits of growth and yield. Subsequently, undesired negative correlations were obtained in number of branches per plant (r=-0.17), leaves on main stem (r=-0.2), leaf area index (r=-0.57*), setting percentage (r=-0.68*), pod numbers per plant (r=-0.38), pod dry weight (r=-0.042), plant dry weight (r=-0.29), weight of 100 seeds (r=-0.51) and yield of dry seeds (r=-0.098). Moreover, they resulted in undesired positive correlations in aborted seeds per pod and first fruiting node. The only desired negative correlations were seen in leaf water saturation deficit (r=-0.49) shedding leaves (r=-0.76*) and aborted ovules per pod (r=-0.23). The adverse effects on growth and yield of aquadulce cultivar caused by the application of KI rates (Table, 4), might be attributed to either that drought was so severe (Fig, 1), that KI rates could not manage to confront it; iodide ion might be created a toxic ambient conditions in cellular organelles in reference to inactivation of enzymes ; we may have applied the wrong rates or these reasons that were combined together to exhibit the growth and yield reductions. However potassium was sprayed in KH_2PO_4 formula at rates of 0.2 to 0.4%, highly improved photosynthetic rates, source-sink coordination. Increased plant height, stem width and effective branches, when applied at reproductive stage of faba bean (Ming-Zhong *et al.*, 1993). Moreover, soaking faba bean seeds in 0.1% KH_2PO_4 resulted in significant increases in total sugar content, chlorophyll content, fresh weight, numbers of root nodules and grain yield (Ming-Zhong and Fang-Qui, 1993).

Table (4). The effects of KI rates on growth and yield of Aquadulce cultivar.

Parameters (Y)	KI rates mg.L⁻¹,(X)				Linear equations (y=a+bx).		
	0.0	25	50	75	a	b	r
Plant height (cm)	41.6	40.9	40	44.4	40.60	0.0300	0.15000
Branches nos./plan	4.5	4.1	3.9	4.2	4.18	-0.0039	-0.1700
Leaf nos./ main stem	14.0	13.1	13.8	13.2	13.78	-0.0060	-0.2000
Shedding leaf/main stem	7.7	6.5	6.1	5.4	7.51	-0.0290	-0.760*
Leaflet nos./leaf	5.9	5.8	5.4	6.2	5.74	0.0016	0.07000
Leaflet area(cm^2)	5.5	6.2	6.5	7.0	5.61	0.0190	0.46000
Leaf area index	1.4	1.3	1.3	1.6	1.27	-0.0028	-0.570*
Leaf WSD (%)	66.4	74.3	61.3	58.4	70.63	-0.1840	-0.4900
Leaflet dry matter (%)	14.1	12.9	16.6	17.2	13.4	0.0540	0.5100*
Pod nos./plant	5.8	4.2	3.5	4.3	5.23	-0.0200	-0.3800
Pod length (cm)	10.1	9.9	9.5	10.8	9.85	0.00059	0.12000
Aborted ovules/pod	2.3	1.7	1.7	2.0	2.07	-0.0040	-0.2300
Aborted seeds/pod	1.3	1.0	1.0	1.3	1.17	0.00001	0.00001
Seed nos./pod	2.2	2.3	2.3	2.5	2.16	0.0036	0.25000
Plant dry weight($g.m^{-2}$)	304.2	197.2	150.0	208.3	259.70	-1.2667	-0.2900
Pod dry weight ($g.m^{-2}$)	137.7	149.4	138.7	137.3	142.55	-0.0475	-0.0420
Weight of 100 seeds (g)	118.6	110.1	98.6	106.4	115.63	-0.1920	-0.510*
dry seed Yield ($g.m^{-2}$)	116.7	125.2	104.4	116.9	121.47	-0.0170	-0.0980
Inflors. Nos/ main stem	5.4	5.2	4.8	6.0	5.09	0.0064	0.19000
Setting (%)	35.2	34.0	30.0	29.1	36.70	-0.1400	-0.680*

The effects of PhytoFert: The application of phytofert rates resulted in drastic negative correlations in most detected traits favorable for the improvements of drought avoidance. 3 $g.L^{-1}$ rate was the worst treatment. It showed (Table 5) apparent reductions in leaf numbers per main stem (16.1%), leaflet area (9.7%), leaf area index (38.5%), pod dry weight (24.5%), plant dry weight (100.2%) and yield of dry seeds (30.1%). The adverse effects might be referred to the low ability of phytofert rates to ameliorate the severe drought which converted them to a toxic level owing to tissue dehydration or we did not apply the wright rates.

Table (5): The effects of PhytoFert on growth and yield of Aqudulce cultivar.

Parameters (Y)	Phytofert rates g.l⁻¹,(X)				Linear equations (y=a+bx).		
	0.0	1	2	3	a	b	r
Plant height (cm)	41.6	44.4	40	40.9	42.7	-0.653	-0.130
Branches nos./plan	4.5	4.8	3.9	4.1	4.69	-0.230	-0.390
Leaf nos./ main stem	14.4	13.3	13.8	12.4	14.33	-0.570	-0.600*
Leaflet nos./leaf6.8	5.8	6.2	5.4	5.8	5.90	-0.100	-0.180
Leaflet area(cm^2)	6.8	7.0	6.5	6.2	6.99	-0.230	-0.180
Leaf area index	1.7	1.9	1.3	1.2	1.80	-0.200	-0.190
Leaf WSD (%)	54.4	61.4	58.9	58.1	56.94	0.840	0.190
Leaflet dry matter (%)	11.5	12.6	16.4	15.3	11.69	1.510	0.610*

Pod nos./plant	5.7	4.3	4.4	4.2	5.35	-0.466	-0.360
Pod length (cm)	11.3	10.8	9.5	9.9	11.21	-0.370	-0.560*
Aborted ovules/pod	2.0	2.0	2.0	2.0	----	----	-----
Aborted seeds/pod	1.7	1.7	1.3	1.7	1.87	-0.130	-0.320
Seed nos./pod	2.4	2.5	2.3	2.3	2.43	-0.040	-0.110
Plant dry weight($g.m^{-2}$)	212.1	187.5	154.2	105	218.20	-35.580	-0.500*
Pod dry weight ($g.m^{-2}$)	119.6	119.6	104.4	96.1	122.78	-0.270	-0.270
Weight of 100 seeds (g)	102.5	101.4	100.7	102.5	101.90	-0.070	-0.014
dry seed Yield ($g.m^{-2}$)	100.6	95.2	83.6	77.6	101.38	-8.140	-0.014
Inflors. nos/ main stem	6.0	6.0	4.8	5.2	6.08	-0.387	-0.460
Setting (%)	33.6	29.1	30.0	34.0	31.37	0.200	0.046
First fruiting node	4.8	4.9	5.4	5.0	4.89	0.090	0.310

تحسين الإنتاج ونوعيته لأربعة أصناف من الباقلاء النامية تحت الأمطار
١- استخدام بعض المغذيات اللاعضوية

قيصر جعفر عبد
قسم البستنة وهندسة الحدائق ، كلية الزراعة والغابات ، جامعة الموصل ، العراق

الخلاصة

أجريت أربعة تجارب في حقل الأبحاث التابع لقسم البستنة وهندسة الحدائق ، كلية الزراعة والغابات ، جامعة الموصل خلال فصل النمو ٢٠٠٤ – ٢٠٠٥ لدراسة قدرة تحسين مقاومة الجفاف في أربعة أصناف من الباقلاء بواسطة رش المجاميع الخضرية بمحاليل حديد الاثيلين ثنائي امين ثنائي هيدروكسيل فنيل حامض الخليك (Fe-EDDHA) وبمعدلات صفر و ٥٠ و ١٠٠ و ١٥٠ و ٢٠٠ ملغم / لتر وحامض البوريك (H_3BO_3) وبمعدلات صفر و ٥٠ و ١٠٠ و ١٥٠ و ٢٠٠ ملغم / لتر وايوديد البوتاسيوم (KI) وبمعدلات صفر و ٢٥ و ٥٠ و ٧٥ ملغم /لتر وبالسماد ألورقي المتكامل Phytofert وبمعدلات صفر و ١ و ٢ و ٣ غم /لتر عند شروع الأزهار وإعادة الرش بعد ٢ أسبوع . أظهرت نتائج تجربة ١ بأن رش صنف الباقلاء سوري محلي بمحلول ١٠٠ ملغم / لتر Fe-EDDHA كان أكثر المعدلات فعالية حيث أدى إلى حصول زيادة معنوية في حاصل البـ ور الجاف (١٩ %) مقارنة مع النباتات غير المعاملة . أظهرت نتائج تجربة ٢ بأن معدل ٥٠ ملغم /لتر حامض البوريك كان الأفضل حيث تفوق على معاملة المقارنة بمقدار ٢٨ % في حاصل البـ ور الجاف . أظهرت نتائج تجربة ٣ بأن استخدام ايوديد البوتاسيوم أدى إلى حصول انخفاض سلبي في جميع الصفات المدروسة والمفضلة في نمو وحاصل صنف كوالجي وعليه وجدت علاقة خطية سلبية في معظم الصفات المدروسة في النمو والأزهار ونمو القرنات وملئ البـ ور ومكونات الحاصل . أظهرت نتائج تجربة ٤ حصول انخفاض معنوي في الصفات المدروسة عند الرش بالفايتوفيرت حيث كانت العلاقات الخطية سلبية وكان معدل ٣ غم / لتر من أسوء المعاملات .

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