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EFFECT OF FOLIAR APPLICATION WITH YEAST EXTRACT AND ZINC ON FRUIT SETTING AND YIELD OF FABA BEAN (*Vicia faba L*).

Mady, M. A.

Agric. Botany Dept , Fac of Agric, Benha Univ.

mohamed.mady@fagr.bu.edu.eg, www.bu.edu.eg

ABSTRACT

Effect of foliar application with yeast extract (25 and 50 ml/l) and zinc (75 and 150 ppm) on growth and productivity of faba bean cv Giza 3 was evaluated during 2005/ 2006 and 2006/2007 seasons. Results revealed that foliar application with yeast extract and zinc either individually or in mixture significantly increased many growth aspects as number of leaves per plant, dry weights of both stems and leaves per plant and total leaf area as well, at 75 and 95 days after sowing during the two seasons as compared with the control treatments. In addition foliar spraying with yeast extract at 50 ml/l and zinc at 75 ppm increased photosynthetic pigments, NPK, Zn, total sugars, total free amino acids and crude protein content in leaves at 75 and 95 days after sowing. Also, yeast and zinc treatment not only increased endogenous phytohormones (Auxins and cytokinins) but also decreased abscisic acid at 80 days after sowing during second season.

Furthermore, all treatments not only increased number of formed flowers and setted pods per plant, but also showed contradictory effect upon shedding percentage of both flowers and immature pods per plant, consequently that was reversed upon increment of pod weight per plant and final seed yield as well.

Hence, it could be recommended that foliar spraying with yeast extract at 50 ml/l and zinc at 75 ppm can be used to increase the final yield and seed quality of faba bean plants in Egypt.

Key words: yeast extract, zinc, faba bean, chlorophyll, endogenous phytohormones, flowering, pod setting, yield, seed quality

INTRODUCTION

Faba bean (*Vicia faba L.)* is one of the most important leguminous crops grown in winter season in different types of Egyptian soils. Also, it is considered as the basic source of protein for human consumption, so, it is important to get maximize yield of faba bean. In this respect, the phenomena of shedding in faba bean plant especially for its buds, flowers and immature pods usually took place in serious values leading to a great reduction in seed yield of this economic plant. Therefore, plant physiologists and breeders are studying intensitivity the problem of shedding in order to find out a solution for reducing the high percentage of buds, flowers and immature pods abscission to develop into fully mature pods in this plant. Many trials has been carried out for increasing flowers set, minimizing pre- harvest abscission of immature fruits of faba bean or other plants by the use of different factors including plant growth regulators and mineral nutrients (Bastawisy and Sorial, 1998; Abd El-Dayem and El-Deeb, 2000 ; El- Desouky *et al*., 2001 and Wanas 2002).

Recently, many studies indicated that, yeast is natural source of cytokinins and has stimulatory effects on bean plants (Amer, 2004). Moreover, yeast extract was suggested to participate in a beneficial role during vegetative and reproductive growths through improving flower formation and their set in some plants due to its high auxin and cytokinins content and enhancement carbohydrates accumulation (Barnett *et al.,* 1990). Also, it was reported its stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (El- Desouky *et al.*,1998 ; Wanas 2002 and Wanas, 2006), in addition to its content of cryoprotective agent, i.e. sugars, protein , amino acids and also several vitamins (Mahmoued, 2001). Moreover, the improving growth, flowering and fruit set of some plants by using foliar application with yeast extract was reported by Fathy *et al.*, (2000); Abou-Aly, (2005) and Wanas (2006). Also, foliar application with micro nutrients especially zinc not only have major effects upon flower formation and increase yield Gerendas and Sattelmatcher (1990) but also, required for chloroplast formation and sink limitations (Tersahima and Evans, 1988). Furthermore, foliar

spray of zinc and yeast extract represents the more quick and efficient treatments in many cases lead to vigorous vegetative growth and plenty of chemical constituents (El-Sherbeny *et al*, 2007).

Thereby, the present study amid to use foliar spray with zinc and yeast extract on faba bean plants to reduce or diminish the percentage of flowers and immature pods shedding as well as to increase the final seed yield of this economic plant.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental farm of the Faculty of Agriculture at Moshtohor, Benha University during two successive growing seasons (2005/2006 and 2006/2007) to investigate the effects of foliar spraying with zinc and yeast extract on some growth aspects, endogenous phytohormones, flowering, shedding, yield and its chemical components of faba bean (*Vicia faba* L.) cv Giza 3. Seeds of faba bean were secured from the Agricultural Research Center, Ministry of Agriculture, Giza.

Preparation of yeast extract:

Yeast extract was prepared by using a technique allowed yeast cells (pure dry yeast) to be grown and multiplied efficiently during conducive aerobic and nutritional conditions that allowed to produce denovo beneficial bioconstituent, (carbohydrates, sugars, proteins, amino acids, fatty acids, hormones, etc.), then these constituents could release out of yeast cells in readly form by two cycles of freezing and thawing for disruption of yeast cells and releasing their content. Such technique for yeast preparation modified after (Spencer *et al*, 1983). Chemical analysis of yeast extract after Mahmoued (2001) is presented in Table (A).

Yeast extract was used at two concentrations, of 25 and 50 ml /l. Also, zinc chelated (%13) was used at two concentrations, of 75 and 150 ppm.

Table (A): chemical analysis of yeast extract after Mahmoued (2001).

Amino acid mg/100g dry weight		Carbohydrates mg/100g dry weight		Vitamins mg/100g dry weight	
Arginine	1.99	**Carbohydrates**	23.2	**Vit.B1**	2.23
Histidine	2.63	**Glucose**	13.33	**Vit.B2**	1.33
Isoleucine	2.31			**Vit.B6**	1.25
leucine	3.09			**Vit B12**	0.15
Lysine	2.95			**Thimain**	2.71
Methionine	0.72			**Riboflavin**	4.96
Phenyl alanine	2.01			**Insitol**	0.26
Threonine	2.09			**Biotin**	0.09
Tryptophan	0.45			**Nicotinic acid**	39.88
Valine	2.19			**Panthothenic acid**	19.56
Glutamic acid	2.00			**Pamino benzoic acid**	9.23
Serine	1.59			**Folic acid**	4.36
Aspartic acid	1.33			**Pyridoxine**	2.90
Cystine	0.23				
Proline	1.53				
Tyrosine	1.49				

Experimental design

The experiment included nine foliar spray treatments, i.e. the control (sprayed with distilled water), 25 and 50 ml/l of yeast extract, 75 and 150 ppm of zinc and interaction between them. The experiments were arranged in randomized complete block design with three replicates. The plot area was 10.5 m^2 (3x 3.5m) with five rows .Faba bean seeds were sowing in hills spaced 15 cm on ridges at the 13^{th} of November in the two seasons. At 20 days after sown, hills were thinned to one seedling per hill. Calcium superphosphate ($15.5\%P_2O_{5)}$ and potassium sulphate ($48\%K_2O$) were added to soil before the sowing in both seasons at the rates of 100 and 50 kg/fed., respectively. Also, nitrogen fertilizer at rate of 20 kg/fed. was applied before the first irrigation in form of urea (46% N). The other required culture practices for growing faba bean were followed as recommended.

All treatments were applied triple as foliar spray on plants at 30, 50 and 70 days after sowing using hand operated compressed air sprayer at the rate of 10 liter/plot.

Sampling and collecting data

Vegetative growth

Five plants were randomly chosen from central row of each plot at 75 and 95 days after sowing in both seasons to estimate plant height (cm), stem dry weight (g)/ plant, number of leaves /plant, leaf and shoots dry weights (g) /plant and total leaf area (cm^2) using the disc method as described by Derieux *et al*., (1973).

Photosynthetic pigments

Chlorophyll a, b and carotenoids were calorimetrically determined in fresh leaves of faba bean plants at 75 and 95 days after sowing during the two seasons according to the methods described by Wettstein (1957) and calculated as mg/g fresh weight.

Chemical composition

Samples of leaves at 75 and 95days after sowing and seeds at harvest were taken to determine total nitrogen (Horneck and Miller, 1998), phosphorus (Sandell, 1950), potassium (Horneck and Hanson, 1998). Crude protein was calculated according to the following equation: Crude protein= total nitrogen x 6.25 (A.O.A.C., 1990). Total sugars and total carbohydrates were determined according to (Thomas and Dutcher, 1924) and (Dubois *et al*., 1956), Also, total free amino acids was determined according to (Rosed, 1957).

Endogenous phytohormones

Endogenous phytohormones were quantitatively determined in faba bean leaves at 80 days after sowing in the second season using High- Performance Liquid Chromatography (HPLC) according to Koshioka *et al*. (1983) for auxin (IAA), and abscisic acid (ABA) while, cytokinins were determined according to Nicander *et al*. (1993).

Yield characteristics

Five plants were randomly chosen in each plot and were marked in the field from the start of flowering to harvest time and the following characteristics were studied and recorded:

a- No. of opened flowers / plant : Counting was started at 60 days of plant age with 3 days intervals until 100 days

b- No. of setted pods/ plant: Counting was started at 75 days of plant age with 3 days intervals until 125 days.

c- No. of survived (mature) pods/ plant: It was recorded at harvest time.

d- flower shedding % = $\frac{\text{Total No. of flowers/ plant – No. of setted pods/ plant x100}}{\text{Total No. of flowers/ plant\}}$

e- pods shedding % = $\frac{\text{Total No. of setted pods / plant - No. of survived pods/ plant X100}}{\text{Total No. of setted pods / plant}}$

f- pods yield (g) / plant, seed weight (g) / pod, seed yield(g)/ plant, and seed index [100 seed weight (g)]were recorded at harvest time.

Statistical analysis

Data obtained in this study were statistically analyzed by using the least significant differences test (L.S.D) according to (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

Growth characteristics:

The growth parameters of faba bean plants as plant height, number of leaves, total leaf area, stem and dry weights per plant were significantly increased by all foliar application with zinc or yeast extract at 75 and 95 days after sowing during the two seasons as shown in Table (1). The combination between yeast extract and zinc foliar application with all concentration gave the highest values of growth parameters at 75 and 95 days after sowing during the two growing seasons as compared with either individual foliar application or control plants. Maximum stimulatory effect was existed in plants those treated with 50 ml/L yeast extract and zinc at 75 ppm as foliar application during the two seasons.

Such enhancement effect of zinc and yeast extract might be attributed to the favorable influence of them on metabolism and biological activity and their stimulating effect on photosynthetic pigments and enzyme activity which in turn encourage vegetative growth of faba bean (Wanas, 2002 and El-Sherbeny *et al*. , 2007).

Table: (1): Effect of zinc and yeast extract (Y.E.) on some growth characteristics of faba bean (*Vicia faba L.*) at 75 and 95 days after sowing during two seasons.

Characteristics / Treatment		Days after sowing															
		75								95							
		Plant height (cm)	No. of leaves / plant	Total leaf area (cm^2)/ plant	Stem dry weight (g)/ plant	Leaf dry weight (g)/ plant	Shoots dry weight (g)/ plant	Dry matter distribution %		Plant height (cm)	No. of leaves / plant	Total leaf area (cm^2)/ plant	Stem dry weight (g)/ plant	Leaf dry weight (g)/ plant	Shoots dry weight (g)/ plant	Dry matter distribution %	
								stem	Leaves							stem	Leaves
		Season 2006															
Control		46.42	23.40	586.7	4.70	3.84	8.54	55.04	44.96	90.25	65.75	1648	11.50	10.68	22.18	51.85	48.15
Zn	75 ppm	54.80	28.20	713.4	5.25	4.69	9.94	52.82	47.18	98.80	71.40	1790	13.80	11.55	25.35	54.44	45.56
	150 ppm	58.75	26.80	662.4	5.15	4.44	9.59	53.70	46.30	107.4	69.80	1757	15.55	11.34	26.89	57.83	42.17
Y.E.	25m/L	56.48	30.25	771.1	5.80	5.14	10.94	53.02	46.98	105.4	75.20	1877	14.65	12.21	26.86	54.54	45.46
	m/L50	57.40	29.45	735.1	5.94	5.04	10.98	54.10	45.90	108.8	73.15	1834	15.75	11.81	27.63	57.00	43.00
Y.E. 25m/L+ Zn 75ppm		59.60	33.70	862.2	6.90	5.73	12.63	54.63	45.37	110.9	77.90	1953	16.90	12.65	29.55	57.19	42.81
Y.E. 25m/L+ Zn 150ppm		57.80	31.40	794.2	6.50	5.36	11.86	54.81	45.19	103.5	74.85	1876	15.45	12.38	27.83	55.52	44.48
Y.E. 50m/L+ Zn 75ppm		60.40	35.40	899.1	7.25	6.01	13.26	54.68	45.32	115.7	80.20	1987	18.90	12.97	31.87	59.30	40.70
Y.E. 50m/L+ Zn 150ppm		57.70	32.70	821.6	6.45	5.53	11.98	53.84	46.16	109.4	76.25	1903	16.35	12.34	28.69	56.99	43.01
LSD	0.05	2.75	1.52	38.42	0.12	0.28	0.45	1.05	1.10	2.15	1.19	33.75	0.15	0.30	0.55	1.25	1.22
		Season 2007															
Control		51.70	25.15	614.7	4.85	4.11	8.96	54.13	45.87	92.31	66.4	1617	12.15	10.79	22.94	52.96	47.04
Zn	75 ppm	56.80	28.35	738.2	5.28	4.65	9.93	53.17	46.83	99.82	72.17	1763	14.75	11.67	26.42	55.83	44.17
	150 ppm	57.60	27.30	684.3	5.20	4.51	9.71	53.55	46.45	108.7	70.35	1721	15.40	11.42	26.82	57.42	42.17
Y.E.	25m/L	58.32	31.10	781.2	6.47	5.09	11.56	55.97	44.03	106.4	67.80	1672	14.95	11.01	25.96	57.59	42.41
	m/L50	59.45	30.70	775.9	6.15	5.06	11.21	54.86	45.14	104.0	72.24	1782	15.10	11.73	26.83	56.28	43.72
Y.E. 25m/L+ Zn 75ppm		58.70	34.25	870.5	7.10	5.58	12.68	55.99	44.01	112.2	75.40	1842	16.85	12.24	29.09	57.92	42.08
Y.E. 25m/L+ Zn 150ppm		60.20	31.75	810.4	6.60	5.16	11.76	56.12	43.88	107.9	68.25	1668	15.45	11.04	26.49	58.32	41.68
Y.E. 50m/L+ Zn 75ppm		61.75	36.40	915.4	7.38	5.97	13.35	55.28	44.72	114.4	79.50	1943	18.28	12.91	31.19	58.61	41.39
Y.E. 50m/L+ Zn 150ppm		56.40	32.90	825.3	6.75	5.35	12.10	55.76	44.24	110.5	78.20	1911	16.50	12.75	29.25	56.41	43.59
LSD	0.05	2.40	1.38	30.70	0.14	0.19	0.38	1.10	1.15	2.30	1.28	36.4	0.17	0.26	o.49	1.24	1.27

In addition, the percentage of dry matter distribution in leaves was significantly increased in all treatments as compared with control plants at 75 days after sowing while it was decreased during the two seasons at 95 days after sowing. The enhancement of vigorous growth of faba bean leaves at 75 days after sowing may be attributed to the improvement of photosynthesis process that let to accumulation of more dry matter in leaf these assimilate could temporally stored to the account of next will form flowers and pods . Meanwhile, at 95 days after sowing, leaves dry weight slightly decreased as compared with the control plants this may be due to foliar application with zinc or yeast extract enhanced partitioning of photoassimilates from leaves (source) to flowers and immature fruits (sink) (Hopkins, 1995).In other meaning that reduction could be attributed to the rate of evocation and translocation of different assimilates from source to sink organs. These results are in agreement with those obtained by (Bastawisy and Sorial, 1998 and Wanas, 2002).

Photosynthetic pigments

Data in Table (2) indicate that different photosynthetic pigments as chlorophyll a, b and carotenoids were positively responded to the different foliar application with zinc and yeast extract at 75 and 95 days after sowing during the two assigned seasons. Also, the interaction between yeast extract and zinc gave the highest values in this respect, as compared with the control plants. Moreover, increase of chlorophylls and carotenoids content may be enhanced photosynthesis efficiency and that is a good explain to the increasing of dry matter production. Also, this enhancement could be an indicator for expectable high yielded fruits.

Minerals and some bioconstituents

With regard to the mineral content in faba bean leaves, data in Table (3) clearly indicate that foliar application with zinc and / or yeast extract increased NPK and zinc content at 75 and 95 days after sowing during 2006 and 2007 seasons. Foliar application with yeast extract at 50 ml/l and zinc at 75 ppm ranked the first in this respect. Yeast extract and zinc may be increased absorption of different elements by roots and also their translocation and accumulation in leaves.

Table: (2): Effect of zinc and yeast extract (Y.E.) on photosynthetic pigments (mg/ g F.W.) of faba bean (*Vicia faba L.*) leaves at 75 and 95 days after sowing during two seasons.

Characteristics / Treatment		Days after sowing											
		75						95					
		Chlorophylls			Carotenoids	Chl a+ b / Carotenoids	Total pigments	Chlorophylls			Carotenoids	Chl a+ b / Carotenoids	Total pigments
		a	b	a+b				a	b	a+b			
		Season 2006											
Control		0.524	0.375	0.899	0.414	2.172	1.313	0.412	0.311	0.723	0.364	1.986	1.087
Zn	75 ppm	0.685	0.425	1.110	0.472	2.352	1.582	0.602	0.460	1.062	0.375	2.832	1.437
	150 ppm	0.690	0.435	1.125	0.520	2.164	1.645	0.670	0.455	1.125	0.386	2.915	1.511
Y.E.	25m/L	0.735	0.447	1.182	0.530	2.230	1.712	0.695	0.490	1.185	0.394	3.008	1.579
	m/L50	0.720	0.480	1.200	0.556	2.158	1.756	0.711	0.521	1.232	0.417	2.954	1.649
Y.E. 25m/L+ Zn 75ppm		0.740	0.510	1.250	0.585	2.137	1.835	0.715	0.545	1.260	0.426	2.958	1.686
Y.E. 25m/L+ Zn 150ppm		0.816	0.595	1.411	0.611	2.309	2.022	0.750	0.567	1.317	0.540	2.439	1.857
Y.E. 50m/L+ Zn 75ppm		0.942	0.614	1.556	0.640	2.431	2.196	0.840	0.590	1.430	0.597	2.395	2.027
Y.E. 50m/L+ Zn 150ppm		0.753	0.570	1.323	0.615	2.151	1.938	0.750	0.570	1.320	0.582	2.269	1.902
LSD	0.05	0.11	0.09	0.12	0.08	0.18	0.15	0.10	0.12	0.13	0.09	0.17	0.18
		Season 2007											
Control		0.567	0.384	0.951	0.450	2.113	1.401	0.430	0.322	0.752	0.355	2.118	1.107
Zn	75 ppm	0.695	0.432	1.127	0.495	2.277	1.622	0.642	0.450	1.092	0.384	2.844	1.476
	150 ppm	0.711	0.470	1.181	0.535	2.207	1.716	0.665	0.468	1.133	0.390	2.905	1.523
Y.E.	25m/L	0.742	0.482	1.224	0.564	2.170	1.788	0.684	0.475	1.159	0.445	2.605	1.604
	m/L50	0.759	0.510	1.269	0.575	2.207	1.844	0.710	0.530	1.240	0.540	2.296	1.780
Y.E. 25m/L+ Zn 75ppm		0.750	0.590	1.340	0.598	2.241	1.838	0.735	0.565	1.300	0.575	2.261	1.875
Y.E. 25m/L+ Zn 150ppm		0.844	0.622	1.466	0.640	2.291	2.106	0.742	0.615	1.357	0.620	1.189	1.977
Y.E. 50m/L+ Zn 75ppm		0.960	0.635	1.595	0.680	2.346	2.275	0.855	0.674	1.529	0.680	2.249	2.209
Y.E. 50m/L+ Zn 150ppm		0.817	0.627	1.444	0.635	2.274	2.079	0.740	0.642	1.382	0.662	2.088	2.044
LSD	0.05	0.12	0.13	0.14	0.07	0.16	0.12	0.14	0.13	0.11	0.10	0.22	0.19

Table: (3): Effect of zinc and yeast extract (Y.E.) on some nutrients and bioconstituents in leaves of faba bean (*Vicia faba L.*) at 75 and 95 days after sowing during two seasons.

Characteristics / Treatment		Days after sowing															
		75								95							
		N mg/g D.W	P mg/g D.W	K mg/g D.W	Zn µg/g D.W	Zn Uptake	Total sugar mg/g F.W	Total free amino acid mg/ g F.W	Crude protein mg/g D.W	N mg/g D.W	P mg/g D.W	K mg/g D.W	Zn µg/g D.W	Zn Uptake	Total sugar mg/g F.W	Total free amino acid mg/ g F.W	Crude protein mg/g D.W
Season 2006																	
Control		28.42	2.54	21.50	31.14	119.6	55.79	12.24	177.6	22.30	2.15	18.42	28.65	306.0	52.13	13.60	139.4
Zn	75 ppm	31.25	3.35	22.66	55.44	260.0	70.44	13.75	195.3	32.70	3.20	20.96	58.70	678.0	60.42	14.35	204.4
	150 ppm	30.73	3.70	22.70	56.75	252.0	78.15	14.15	192.1	31.40	3.27	21.80	59.25	671.9	65.18	14.80	198.1
Y.E.	25m/L	32.40	3.94	23.55	53.60	275.5	81.45	16.20	202.5	31.80	3.42	21.98	60.45	738.1	70.42	16.70	198.8
	m/L50	33.50	3.80	23.80	54.40	274.2	85.70	16.65	209.4	32.75	3.55	22.15	60.80	722.3	73.66	16.98	204.7
Y.E. 25m/L+ Zn 75ppm		33.70	4.15	25.33	58.79	336.9	86.25	16.95	210.6	32.40	3.60	22.75	62.15	786.2	81.67	17.58	202.5
Y.E. 25m/L+ Zn 150ppm		33.95	4.20	25.90	59.65	319.7	87.35	17.38	212.2	33.10	3.67	22.84	62.33	771.7	85.40	17.69	206.9
Y.E. 50m/L+ Zn 75ppm		35.42	4.92	27.40	66.80	401.5	98.40	18.70	221.4	33.70	3.80	23.26	67.42	875.1	86.11	19.40	210.6
Y.E. 50m/L+ Zn 150ppm		32.75	4.32	26.25	61.40	339.5	85.57	16.40	204.7	31.95	372	22.70	62.56	772.0	80.70	18.25	199.7
LSD	0.05	2.15	0.95	2.15	10.42	88.70	9.11	1.25	17.30	2.19	0.75	1.85	9.44	99.40	8.16	1.20	14.30
Season 2007																	
Control		27.90	2.70	20.75	33.70	97.4	60.22	13.10	174.4	24.13	2.24	19.40	26.24	283.1	50.02	12.80	150.8
Zn	75 ppm	32.40	3.45	22.80	52.80	246.0	73.14	14.50	202.5	30.70	3.11	20.75	75.35	669.3	59.75	14.69	191.9
	150 ppm	31.52	3.90	23.20	56.40	254.4	77.25	14.70	197.0	32.42	3.28	21.40	60.45	690.3	62.43	14.95	202.6
Y.E.	25m/L	32.90	4.12	23.84	48.98	249.3	83.23	15.84	205.6	31.60	3.57	21.84	61.70	679.3	69.48	15.90	197.5
	m/L50	32.95	4.25	23.92	49.75	251.7	85.33	15.95	205.9	31.48	3.65	21.93	61.20	717.9	72.50	16.30	196.8
Y.E. 25m/L+ Zn 75ppm		33.80	4.70	24.65	61.84	345.1	85.75	17.85	211.3	32.20	3.69	22.25	62.50	765.0	77.48	16.48	201.3
Y.E. 25m/L+ Zn 150ppm		34.45	4.88	26.30	61.88	319.3	86.40	18.75	215.3	32.55	3.72	22.50	63.40	699.9	79.95	17.82	203.4
Y.E. 50m/L+ Zn 75ppm		34.96	4.98	28.12	63.48	379.0	93.95	20.50	218.5	32.90	3.76	22.80	65.44	844.4	80.25	18.40	205.6
Y.E. 50m/L+ Zn 150ppm		31.70	4.72	27.50	62.15	332.5	87.30	18.20	198.1	32.70	3.56	22.35	63.72	812.4	78.50	17.15	204.4
LSD	0.05	1.98	1.05	2.30	11.70	92.75	9.15	1.20	18.90	2.10	0.84	1.75	8.77	97.35	7.19	1.23	16.44

On the other hand, foliar application with two concentrations of zinc and yeast extract gave the best values of total sugars, total free amino acids and crude protein content in leaves of faba bean at the two time of determination during the two seasons. In this respect, the high content of total sugars and some bioconstituents considered as a direct result for high rates of photosynthesis with great efficiency, that was preceded with large photosynthetic area (Table,1) and high content of photosynthetic pigments (Table, 2) .

In addition, these results have an economic values because they increases of chlorophylls, sugars and protein in leaves of faba bean could reflect upon the reduction of flower shedding percentage and increasing pod setting. Similar results were obtained by Mahady (1990); Xia and Xiong (1991) and Wanas (2002).

Endogenous phytohormones

Endogenous phytohormones of faba bean leaves as affected by foliar application with yeast extract or zinc are shown in Table (4). According to these results, all promoters (Auxins and cytokinins) were increased by using yeast extract and zinc, yet, abscisic acid was decreased. Foliar application with yeast extract at 50 ml/l and zinc at 75 ml/l gave the maximum values in Auxins and cytokinins while gave the highest reduction of abscisic acid in leaves of faba bean at 80 days after sowing during 2007 season. Other studies have been got similar results (Davis and Zhang, 1991; Marchner, 1995 and Nakhlla, 1998). They concluded that Zn is required for the synthesis of IAA. Also, yeast extract has been reported to be rich source of vitamins, phytohormones and many other growth factors (El-Desoukey *et al,* 1998).

Reproductive growth and yield components

Flowering, Shedding and pod setting

As shown in Table (5) all foliar application with zinc and yeast extract were significantly increased total number of flowers per plant compared with control ones. The only exception was that insignificant increase, existed with Zn at 75 ppm during 2006 and 2007 seasons. Also, combination between yeast extract and zinc gave the highest increase in number of flowers per plant but application of zinc at 75 days showed the lowest increase in this respect.

Table: (4): Effects of zinc and yeast extract (Y.E.) on endogenous phytohormones of faba bean (*Vicia faba L.)* leaves at 80 days after sowing during the second season.

Characteristics / Treatment		Auxins			Cytokinins			Abscisic acid		
		µg/g F.W	% Relative to the control	%±	µg/g F.W	Relative to the control	%±	µg/g F.W	Relative to the control	%±
Control		97.30	100	-	18370	100	-	1.12	100	-
Zn	75 ppm	98.80	101.54	1.54+	19.22	102.78	2.78+	0.80	71.3	28.57-
	150 ppm	102.70	105.55	5.55+	21.50	114.97	11.97+	0.85	75.89	24.11-
Y.E.	25m/L	109.45	112.49	12.4+	23.44	125.35	25.35+	0.77	68.75	31.25-
	m/L50	104.33	107.23	7.23+	25.80	137.97	37.97+	0.70	62.50	37.50-
Y.E. 25m/L+ Zn 75ppm		112.25	115.36	15.36+	26.18	140.00	40.00+	0.65	58.04	41.96-
Y.E. 25m/L+ Zn 150ppm		118.40	121.69	21.69+	26.32	140.75	40.75	0.46	41.07	58.93-
Y.E. 50m/L+ Zn 75ppm		127.24	130.77	30.77+	27.40	146.52	46.52+	0.34	30.36	69.64-
Y.E. 50m/L+ Zn 150ppm		117.30	120.56	20.56+	23.50	125.67	25.67+	0.38	33.93	66.07-

Table: (5): Effect of zinc and yeast extract (Y.E.) on flowering, and fruit seeting, yield and its components of faba bean (*Vicia faba L.*) plants during two seasons.

Characteristics / Treatment		Number of flowers / plant	% of flower shedding/ plant	Number of stetted pods/ plant	% of pods shedding/ plant	Number of mature pods/ plant	Weight of pod (g)	Pod yield (g)/ plant	Weight of seeds / pod	Seed yield (g)/ plant	Seed index (g)
		Season 2006									
Control		81.30	72.76	22.15	33.63	14.70	2.70	39.69	2.11	31.02	70.30
Zn	75 ppm	86.50	70.23	25.75	32.27	17.44	2.73	47.61	2.27	39.59	72.42
	150 ppm	89.25	68.07	28.50	30.35	19.85	2.76	52.44	2.31	45.85	72.90
Y.E.	25m/L	94.35	66.26	31.48	32.50	21.25	2.71	57.59	2.33	49.51	75.35
	m/L50	94.75	66.78	31.55	30.59	21.90	2.72	59.57	2.35	51.47	79.40
Y.E. 25m/L+ Zn 75ppm		95.40	66.25	32.10	33.18	21.45	2.81	60.28	2.40	51.48	77.20
Y.E. 25m/L+ Zn 150ppm		96.48	66.47	32.35	31.62	22.12	2.84	62.82	2.34	51.76	78.50
Y.E. 50m/L+ Zn 75ppm		98.20	64.66	34.70	30.55	24.10	2.98	71.82	2.44	58.80	81.11
Y.E. 50m/L+ Zn 150ppm		97.84	68.11	31.20	31.09	21.50	2.82	60.63	2.35	50.53	75.18
0.05	0.05	5.431.85	2.48	2.95	1.70	2.50	0.12	0.13	0.12	3.25	1.70
		Season 2007									
Control		79.15	72.46	21.80	35.09	14.15	2.62	37.07	2.04	28.87	69.80
Zn	75 ppm	84.75	70.86	24.70	29.55	17.40	2.71	47.15	2.20	38.28	71.50
	150 ppm	88.90	67.49	28.90	31.66	19.75	2.73	53.92	2.26	44.64	71.98
Y.E.	25m/L	93.25	65.15	32.50	33.85	21.50	2.68	57.43	2.28	49.02	72.48
	m/L50	94.20	64.67	33.20	34.58	21.72	2.69	58.43	2.31	50.17	72.57
Y.E. 25m/L+ Zn 75ppm		94.80	64.19	33.95	31.96	23.10	2.74	63.29	2.29	52.90	73.90
Y.E. 25m/L+ Zn 150ppm		95.70	64.28	34.18	31.98	23.25	2.85	66.26	2.31	53.71	74.55
Y.E. 50m/L+ Zn 75ppm		102.1	65.33	35.40	28.19	25.42	2.90	73.72	2.35	59.74	80.44
Y.E. 50m/L+ Zn 150ppm		96.70	66.13	32.75	27.28	23.82	2.76	65.74	2.32	55.26	75.17
LSD	0.05	5.70	2.63	3.25	1.65	2.75	0.14	0.16	0.16	3.40	1.85

On the other hand, the percentage of flower shedding was significantly reduced with all foliar application treatments exception that of zinc at 75 ppm during the two seasons. Concerning number of setted pods per plant was significantly increased with different treatments as their assigned concentrations during the two growing seasons compared with control plants (Table, 5).

Also, the enhancement of pod development and the formed fruits reached its maximum values by using foliar application with yeast extract at 50 ml/l and zinc at 75 ppm. Therefore, the percentage of pod shedding and number of mature pods per plant also behaved as the same as percentage of flower shedding and number of setted pods per plant .Thereby, yeast extract at 50 ml/l and zinc at 75 ppm treatments gave the highest value during the two seasons.

It could be concluded that, reduction in shedding percentage of flowers and pods as well as enhancement of pod setting and development which obtained with yeast extract at 50 ml/l and zinc at 75 ppm treatments may be due to the high content of total sugars and protein in leaves (sources) as well as endogenous auxins and cytokinins especially at full blooming and setting stages.

In addition, yeast extract treatments were suggested to participate beneficial role during vegetative and reproductive growths through improving flower formation and their set in some plants due to its high auxins and cytokinins content and its beneficial effect on carbohydrates accumulation (Barnett *et al*, 1990). Also, its contents of cryoprotective agents i.e. sugars and amino acids as well as, several vitamins (Shady, 1978 and Mahmoued, 2001).

Yield components

Data in Table (5) also show that pod weight, pod yield (g) per plant, weight of seeds per pod and plant and seed index were significantly increased with different foliar application treatments. Also, yeast extract at 50 ml/l and zinc at 75 ppm showed similar trend as they gave the highest increases in yield components during the two seasons.

NPK and some bioconstituents of seeds

As shown in Table (6), application of yeast extract or zinc increased NPK, crude protein and total carbohydrates content in seeds. The interaction between yeast extract and zinc was more effective

when compared with individual foliar application regarding different estimated NPK and other constituents.

Foliar application with yeast extract and zinc treatments improved seed yield of faba bean plants (Table, 5) due to increasing flower formation and the reduction of flowers and pod shedding as well as increasing their ability to accumulate more bioconstituents (Table, 6). These positive effects of yeast extract and zinc treatments upon seed yield and its characteristics could be considered as a reversion of their effects upon the early vigorous growth of faba bean plants (Table, 1). Other studies also, reported nearly similar results. (Mahady, 1990; Sakr *et al.*, 1996, Fathy *et al.*, 2002 and wanas, 2002).

Hence, because in the present study sufficient improvement of both vegetative and reproductive growth as well as seed yield being obtained by the used of yeast extract and zinc were applied three times by the method of foliar spraying.

Thereby, the present study strongly admit the use of foliar application with yeast extract at 50 ml/l and zinc at 75 ppm at 30, 50 and 70 days after sowing of faba bean plants for getting the highest yield and seed quality.

Table: (6): Effect of zinc and yeast extract (Y.E.) on some NPK and some bioconstituents in seeds of faba bean (*Vicia faba L.)* during the two seasons.

Characteristics / Treatment		N (%)		P (%)		P (%)		Crude protein (%)		Total carbohydrate mg/g D.W	
		Seasons									
		2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control		3.14	3.18	0.33	0.36	4.50	4.66	19.63	19.88	490.80	496.35
Zn	75 ppm	3.90	3.85	0.37	0.38	4.96	4.86	24.38	24.06	575.20	580.70
	150 ppm	3.95	3.97	0.39	0.40	4.88	4.94	24.69	24.81	566.85	565.40
Y.E.	25m/L	4.20	4.44	0.44	0.42	5.11	5.25	26.25	27.75	540.75	570.80
	m/L50	4.45	4.60	0.48	0.47	5.44	5.55	27.81	28.75	570.80	562.75
Y.E. 25m/L+ Zn 75ppm		4.66	4.72	0.49	0.46	5.65	5.72	29.13	29.50	535.25	540.35
Y.E. 25m/L+ Zn 150ppm		4.75	4.78	0.51	0.52	5.74	5.70	29.69	29.88	545.60	550.15
Y.E. 50m/L+ Zn 75ppm		4.85	4.80	0.56	0.54	5.96	5.98	30.31	30.00	514.20	520.70
Y.E. 50m/L+ Zn 150ppm		4.75	4.70	0.49	0.47	5.66	5.69	29.69	29.38	530.70	432.20
LSD	0.05	0.17	0.19	0.09	0.07	0.15	0.18	2.35	2.48	20.66	22.40

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تأثير الرش الورقي بمستخلص الخميرة والزنك على عقد الثمار ومحصول الفول

محمد أحمد ماضي

قسم النبات الزراعي - كلية الزراعة- جامعة بنها- مصر.

أجريت تجربتي حقل لدراسة تأثير الرش الورقي بمستخلص الخميرة بتركيز ٢٥ و ٥٠ مل/ لتر والزنك بتركيز ٧٥ و١٥٠ جزء في المليون على نمو وإنتاجية نباتات الفول صنف جيزة ٣ قيمت خلال موسمي النمو ٢٠٠٥/ ٢٠٠٦ و٢٠٠٦/ ٢٠٠٧.

وقد أظهرت النتائج إن الرش الورقي بمستخلص الخميرة والزنك كلا بمفردة أو مخلوطة زيادة معنوية فى العديد من صفات النمو مثل عدد الأوراق/ نبات والوزن الجاف لكل من الساق والأوراق لكل نبات وكذلك مساحة الأوراق عند ٧٥ و٩٥ يوم من الزراعة خلال موسمي الدراسة.

بالإضافة إلى ذلك أدى الرش الورق بمستخلص الخميرة بتركيز ٥٠ مل / لتر مع الزنك بتركيز ٧٥ جزء في المليون إلى زيادة محتوى الأوراق من صبغات البناء الضوئي والنيتروجين والفوسفور والبوتاسيوم والزنك والسكريات الكلية والأحماض الامينية الحرة وكذلك البروتين الخام عند ٧٥ و٩٥ يوم من الزراعة وكذلك أدت هذه المعاملة إلى زيادة المحتوى الداخلي من الهرمونات النباتية (الاوكسينات و السيتوكينينات) وكذلك أدت إلى انخفاض المحتوى الداخلي لحمض الابسيسك وذلك عند ٨٠ يوم من الزراعة خلال موسم النمو الثاني. علاوة على ذلك أدى استخدام جميع المعاملات إلى زيادة عدد الإزهار المتكونة وعدد الثمار العاقدة/ نبات في حين أظهرت تأثيرا عكسيا على النسبة المئوية لتساقط الإزهار والثمار الغير ناضجة وبالتالي انعكس ذلك على زيادة محصول القرون وكذلك محصول البذور النهائي للنبات.

وبناء على ذلك يمكن التوصية بإستخدام الرش الورقي بمستخلص الخميرة بتركيز ٥٠ مل/ لتر مع الزنك بتركيز ٧٥ جزء في المليون بهدف زيادة المحصول النهائي وجودة محصول البذور لنباتات الفول في مصر.