

### Effect of Sowing Time and Foliar Application of Yeast Extract on Growth and Productivity of Different Cultivars of Faba bean (*Vicia faba L*)

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**E**FFECT of foliar application of yeast extract (5 and 10 g/L) at two sowing times (3<sup>rd</sup> of November and 3<sup>rd</sup> of December) on growth, yield and some biochemical constituents of faba bean cultivars was evaluated during 2012/2013 and 2013/2014 seasons. Foliar application with yeast extract significantly increased growth of faba bean cultivars after 65 and 85 days of sowing compared with the control. Foliar spraying with 10g/L yeast extract increased chlorophyll and phytohormone contents of all faba bean cultivars at the age of 65 days. Yield parameters as well as seeds protein and carbohydrate responded positively to yeast application. Yield parameters data of Giza 3 and Sakha 4 cultivars had the highest values among the five tested cultivars. In addition, the first sowing time (3<sup>rd</sup> of November) induced a higher value of yield parameters compared with the second sowing time (3<sup>rd</sup> of December). It could be recommended that foliar spraying with yeast extract (10g/L) at the first sowing time (3<sup>rd</sup> of November) caused an increase of the final yield parameters and improved seed quality of all faba bean cultivars. However, the effect was more pronounced in Giza 3 and Sakha 4.

**Keywords:** Faba bean, Yeast, Sowing Time, Growth parameters, Chlorophyll, Phytohormones, Yield parameters, Protein, Carbohydrates.

All over the world, using natural and safe environmental substances is a target to improve yield quality and quantity of plants. Yeast is a natural bio-substance which has been recorded to have stimulatory effects on growth and development of bean plants (Amer, 2004). Improving growth and productivity of vegetable crops by application of active yeast extract were reported by Fathy *et al.* (2000), Tartoura (2001), Taha and Omar (2010) and Ahmed *et al.* (2011). Moreover, yeast extract was suggested to participate in a beneficial role during vegetative and reproductive growth through improving flower formation and their set in some plants. This could be due to its high auxin and cytokinins content in addition to the enhancement of carbohydrates accumulation (Barnett *et al.*, 1990). Also, yeast extract was reported to have stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll

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formation (Wanas, 2006). In addition to its contents of sugars, protein and amino acids; yeast extract also contains several vitamins (Mahmoued, 2001).

Sowing Time of seeds has a great effect on growth and productivity of crop plants. In this respect, Gregory and Eastham (1996) indicated that sowing lupin and wheat in their growth seasons resulted in greater shoot weight of the two crops while late sowing (3-6 weeks later) generally reduced both the number of pod/ears per unit area and the number of grains per pod/ear. Nilsson (1987) found that delaying sowing of carrot seeds for 1 or 2 months after the beginning of May resulted in a reduction in the growth of roots and glucose/fructose ratio but higher amounts of hexoses. Sowing date had no influence on sucrose concentration, phosphorus, potassium, calcium and magnesium in root dry matter of carrot up to 137 days from sowing. Rahman *et al.* (2014) observed that in strawberry, delayed planting significantly reduced the yield.

Faba bean (*Vicia faba L.*) is one of the most important leguminous crops grown in winter season in different types of Egyptian soils and it is considered as a basic source of protein for human consumption. So, it is important to try to maximize yield of faba bean. Many trials have been carried out for increasing flowers set, minimizing preharvest abscission of immature fruits of faba bean or other plants by the use of different factors including plant growth regulators and mineral nutrients (Wanas, 2002).

The aim of the present study was to evaluate the efficiency of foliar application of yeast extract at two different sowing times and their interactive effects on growth, yield and quality of five selected faba bean cultivars.

### Material and Methods

Seeds of five faba bean cultivars (Giza 2, Giza 3, Giza 843, Sakha 1 and Sakha 4) were obtained from Agricultural Research Center, Ministry of Agriculture, Giza, Egypt. Two field experiments were carried out at Etay-El-Baroud Agricultural Research Station during two successive growing seasons (2012/2013 and 2013/2014). Seeds were cultivated at two dates, the first was at the third of November and the second was at the third of December. The experiments were laid out in a split plot design. The studied cultivars occupied the main plots. Foliar application of yeast extract were allocated to the sub-plots. All agricultural practices were carried out according to the recommendations of Ministry of Agriculture, Egypt. Yeast extract was prepared from brewer's yeast (*Saccharomyces cerevisiae*), dissolved in water (5 and 10g/L) followed by adding sugar at a ratio of 1: 1 and kept for 24 hr in a warm place for reproduction according to the methods of Morsi *et al.* (2008). The plants were foliar sprayed with two concentrations of yeast extracts after 35 and 50 days from seed sowing using hand operated compressed air sprayer. Five plants were randomly chosen from each treatment after 65 and 85 days of sowing to estimate plant height, shoot fresh and dry weights. In addition, chlorophyll content, endogenous phytohormones, yield parameters, seed protein and carbohydrate contents were measured.

*Chlorophyll content*

Chlorophyll a and b were colorimetrically determined in fresh leaves of plants at 65 days old according to the method described by Moran and Porath (1980) and calculated as mg/g fresh weight.

*Endogenous phytohormones*

Phytohormones were quantitatively determined in leaves of faba bean at 65 days old in the second season using gas chromatography (GC, Hewlett Packer D, HP 6890 series) according to Shindy and Smith (1975).

*Yield parameters*

After 5 months from sowing, a random plant samples were collected for measuring the plant height, number of branches/plant, number of pods/plant, number of seeds/pod, number of seeds/plant, weight of seeds/plant, weight of 100 seed, biological yield and seed yield/fedan.

*Chemical analysis of seeds*

At harvest, seeds were collected to determine percentage of protein according to the method of Horneck and Miller (1998). Percentage of carbohydrates was determined according to Dubois *et al.*, (1956).

*Statistical analysis*

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

## Results and Discussion

The maximum stimulatory effect of yeast application on faba bean growth was observed in plants treated with 10g/L yeast extract at 65 and 85 days after sowing during the two tested seasons (Table 1). These results are in agreement with those obtained by Ahmed *et al.* (2011) who observed that increasing concentration of active dry yeast up to 5g/L increased the vegetative growth of potato. The stimulatory effect of yeast extract can be attributed to the increased contents of different nutrients as well as the high concentration of protein, vitamin B and natural plant growth regulators such as cytokinins (Fathy and Farid, 1996). The physiological roles of vitamins and amino acids in yeast extract can increase the metabolic processes and levels of endogenous hormones which in turn encourage vegetative growth of faba bean (El-Sherbeny *et al.*, 2007 and Shehata *et al.*, 2012). The present data also indicated that growth parameters of different faba bean cultivars were influenced by the sowing time (Table 1). It was also found that most of the measured growth parameters were increased at the second sowing time (the third of December) during both tested growing seasons. However, it was observed that Sakha 4 cultivar attained the maximum percentage value of plant height (115.4%) and shoot fresh weight (112%) of 65 days old plants at the second season as well as the highest shoot dry weight percentage (13.12%) at 65 days old plants in the first sowing time (3<sup>rd</sup> of November). These results were consistent with Gregory and Eastham (1996)

who found that early sowing of lupin and wheat resulted in greater shoot weight and grain yield. Also, Rahman *et al.* (2014) observed that in strawberry, delayed planting significantly reduced the yield. These results were explained by Perez-de-Camacaro *et al.* (2002) who suggested that reproductive development may antagonize vegetative growth of strawberry, so later cultivated plants might have less time for plant height and leaf production.

**TABLE 1. Effect of yeast extract (5 g/L or 10 g/L) and two sowing times on some growth parameters of faba bean cultivars at 65 and 85 days during two seasons.**

Treatment		Season 2012-2013											
		Sowing time (3 November)						Sowing time (3 December)					
		65 days old			85 days old			65 days old			85 days old		
		Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)
Giza 2	Control	53.6	64.21	10.17	59.2	103.13	11.76	52.4	73.71	12.14	72.8	135.19	15.00
	5 g/L	53.8	56.72	10.75	73.4	121.65	16.87	56.8	97.94	13.31	73.0	147.31	21.97
	10 g/L	62.6	76.96	11.38	73.4	122.72	19.20	64.6	144.60	16.08	79.6	203.85	22.44
Giza 3	Control	53.4	56.08	9.87	65.8	94.41	13.48	55.6	80.84	11.99	73.4	137.62	15.25
	5 g/L	56.4	57.04	9.46	63.8	103.98	18.77	52.6	83.56	11.68	76.4	153.90	22.21
	10 g/L	54.2	68.83	11.46	71.2	138.34	21.58	64.8	103.59	12.47	82.0	176.96	21.75
Giza 843	Control	54.0	47.26	7.07	63.4	116.74	12.66	43.2	53.17	7.64	64.2	141.95	19.78
	5 g/L	51.6	54.93	8.28	72.8	166.67	19.59	59.0	77.24	12.60	78.4	164.93	21.14
	10 g/L	58.4	64.65	11.08	67.8	165.55	21.82	53.8	85.86	13.56	77.6	140.33	20.80
Sakha 1	Control	51.2	46.65	7.08	60.6	91.37	12.36	48.8	59.01	9.56	61.8	84.43	12.64
	5 g/L	56.8	54.26	10.67	63.2	149.40	18.85	50.6	72.38	12.01	69.8	124.53	16.93
	10 g/L	55.8	67.01	11.40	67.0	126.87	19.90	56.4	78.40	12.93	68.8	130.30	19.33
Sakha 4	Control	55.2	69.13	9.91	63.0	103.57	14.24	50.8	63.68	8.78	65.0	121.84	14.93
	5 g/L	64.2	64.88	11.67	70.4	163.92	19.66	61.2	90.84	13.89	72.0	143.34	19.15
	10 g/L	68.0	71.68	13.12	69.0	174.50	21.25	58.6	83.84	12.91	82.0	166.38	22.60
LSD	0.05	0.109	0.018	0.014	0.044	0.001	0.022	0.039	0.008	0.015	0.61	0.002	
Treatment		Season 2013-2014											
		Sowing time (3 November)						Sowing time (3 December)					
		65 days old			85 days old			65 days old			85 days old		
		Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Plant height (cm)	Shoot fresh weight (g)	Shoot dry weight (g)
Giza 2	Control	46.4	51.23	7.54	61.6	103.94	12.44	50.6	71.60	8.86	67.8	112.37	15.42
	5 g/L	43.2	57.60	7.67	61.0	105.92	16.32	52.8	80.56	9.32	76.4	115.70	16.01
	10 g/L	48.0	64.74	8.48	63.4	124.86	18.43	63.2	88.12	10.23	84.6	112.76	18.52
Giza 3	Control	44.6	47.01	5.55	56.6	79.77	12.47	48.0	66.30	7.62	71.4	93.44	14.82
	5 g/L	49.6	48.72	6.28	64.0	106.73	17.61	48.6	82.72	8.33	75.2	129.03	19.90
	10 g/L	53.6	67.33	8.24	70.4	123.27	20.95	56.8	78.90	8.67	78.8	198.57	23.88
Giza 843	Control	44.2	46.43	5.61	62.6	90.95	13.70	48.0	66.16	7.11	67.8	115.32	15.84
	5 g/L	47.8	69.86	8.38	62.4	109.92	17.65	55.6	87.12	9.68	79.8	163.81	22.89
	10 g/L	50.8	75.90	9.14	69.8	138.21	19.91	61.4	90.89	9.47	93.6	196.17	23.36
Sakha 1	Control	49.8	47.51	5.30	69.2	87.90	10.44	50.6	76.78	8.90	74.8	133.47	17.60
	5 g/L	53.0	55.84	7.37	69.8	131.33	17.95	55.0	88.55	9.20	83.2	162.53	19.74
	10 g/L	55.6	81.77	10.14	63.4	153.95	19.42	62.0	88.76	9.52	85.0	169.42	22.14
Sakha 4	Control	63.8	80.96	9.04	78.0	132.09	15.49	54.8	81.01	9.07	79.0	137.96	16.43
	5 g/L	64.4	71.44	8.93	79.6	144.54	19.93	59.8	97.04	11.00	81.4	195.19	19.12
	10 g/L	73.6	90.56	10.38	93.8	189.95	23.61	60.0	120.99	13.11	83.2	197.87	22.58
LSD	0.05	0.497	0.039	0.017	0.560	0.018	0.001	0.001	0.024	0.092	0.003	0.034	0.001

Data in Table 2 indicate that chlorophyll a and b positively responded to the different foliar applications of yeast extract during the two assigned seasons. It was found that Giza 3 and Sakha 4 cultivars had the biggest content of chlorophyll a and b when sprayed with 10 g/L yeast extract at the second growing season and first sowing time (3 November). The increase in chlorophyll contents as a result of yeast treatment was reported by many authors (Wanas, 2002; El-Sherbeny *et al.*, 2007 and Mady, 2009) and this could be due to activation of chlorophyll biosynthesis. Our results indicated that chlorophyll a and b contents showed higher values at the first sowing time (3 November) during the two growing seasons compared with the second sowing time (3 December). In this connection, Szczepanek and Olszewski (2009) found that delay of sowing resulted in reduction in the rate of photosynthesis of leaves that can be attributed to less chlorophyll content.

**TABLE 2. Effect of yeast extract (5 g/L or 10 g/L) and two sowing times on chlorophyll content (mg/g f.wt) estimated in 65-day old faba bean cultivars during two seasons.**

Treatment		Season 2012-2013					
		Sowing time (3 November)			Sowing time (3 December)		
		Chl. a	Chl. b	Chl. a+b	Chl. a	Chl. b	Chl. a+b
Giza 2	Control	1.27	0.67	1.94	1.07	0.54	1.61
	5 g/L	1.40	0.76	2.16	1.16	0.53	1.68
	10 g/L	1.51	0.81	2.32	1.24	0.51	1.75
Giza 3	Control	1.29	0.63	1.92	1.20	0.59	1.69
	5 g/L	1.39	0.69	2.08	1.28	0.65	1.93
	10 g/L	1.48	0.79	2.27	1.34	0.73	2.07
Giza 843	Control	1.24	0.64	1.87	1.15	0.55	1.71
	5 g/L	1.36	0.68	2.05	1.17	0.53	1.71
	10 g/L	1.47	0.78	2.25	1.30	0.60	1.90
Sakha 1	Control	1.22	0.64	1.86	1.12	0.50	1.63
	5 g/L	1.47	0.82	2.29	1.26	0.75	1.82
	10 g/L	1.46	0.79	2.25	1.31	0.61	1.91
Sakha 4	Control	1.27	0.67	1.94	1.22	0.52	1.73
	5 g/L	1.36	0.75	2.11	1.35	0.58	1.92
	10 g/L	1.51	0.83	2.34	1.39	0.62	2.01
LSD	0.05	0.001	0.001	0.001	0.007	0.245	0.007
		Season 2013-2014					
Giza 2	Control	1.17	0.65	1.81	0.98	0.49	1.47
	5 g/L	1.26	0.71	1.97	1.00	0.50	1.49
	10 g/L	1.44	0.75	2.19	1.16	0.52	1.68
Giza 3	Control	1.33	0.72	2.04	1.14	0.51	1.65
	5 g/L	1.43	0.83	2.25	1.18	0.63	1.81
	10 g/L	1.65	0.96	2.62	1.25	0.69	1.94
Giza 843	Control	1.25	0.64	1.88	1.20	0.61	1.81
	5 g/L	1.35	0.81	2.15	1.26	0.60	1.86
	10 g/L	1.53	0.84	2.37	1.34	0.63	1.97
Sakha 1	Control	1.29	0.67	1.95	1.16	0.54	1.70
	5 g/L	1.42	0.81	2.23	1.28	0.58	1.86
	10 g/L	1.58	0.86	2.43	1.31	0.62	1.92
Sakha 4	Control	1.34	0.73	2.08	1.22	0.53	1.75
	5 g/L	1.46	0.77	2.23	1.35	0.61	1.97
	10 g/L	1.67	0.92	2.95	1.14	0.67	2.08
LSD	0.05	0.001	0.001	0.002	0.346	0.068	0.083

The yeast extract significantly increased endogenous phytohormones (cytokinin, GA<sub>3</sub> and IAA) of the five faba bean cultivars except GA<sub>3</sub> and IAA that were decreased in sakha 1 treated with 10g/L yeast at the second sowing season (third of December) compared with the control (Table 3). On the other hand, the cultivars Giza 3 and sakha 4 positively responded to foliar application with yeast where they had the highest contents of phytohormones (cytokinin, GA<sub>3</sub> and IAA) especially at the first sowing time (3 November). It was found also that generally, the amounts of phytohormones (cytokinin, GA<sub>3</sub> and IAA) were higher at the first sowing time (3 November) compared with the second sowing time (3 December). In this connection, several authors had reported similar results (Marchner, 1995; Nakhlla, 1998 and El-Tohamy *et al.*, 2008). This could be explained on the basis that vitamins and amino acids found in the yeast extract may increase the metabolic processes and levels of endogenous hormones (Sarhan and Abdullah, 2010).

**TABLE 3. Effect of yeast extract (5 g/L or 10 g/L) and two sowing times on phytohormones (mg/g f.wt) estimated in 65-day old faba bean cultivars during the second season.**

Treatment		Sowing time (3 November)			Sowing time (3 December)		
		Cytokinin	GA <sub>3</sub>	IAA	Cytokinin	GA <sub>3</sub>	IAA
Giza 2	Control	1.135	0.717	0.655	0.892	0.789	0.558
	5 g/L	1.143	0.916	0.715	0.967	1.052	0.670
	10 g/L	1.749	1.270	0.855	1.249	1.329	0.636
Giza 3	Control	1.210	0.880	0.691	0.997	0.713	0.592
	5 g/L	1.805	1.340	0.805	1.208	0.979	0.647
	10 g/L	2.180	1.975	1.055	1.355	1.162	0.722
Giza 843	Control	1.380	0.853	0.603	1.032	0.719	0.543
	5 g/L	1.914	1.231	0.724	1.305	0.919	0.592
	10 g/L	2.152	1.759	0.987	1.311	1.074	0.676
Sakha 1	Control	1.560	1.368	0.717	1.111	1.061	0.782
	5 g/L	1.833	1.554	1.004	1.352	1.268	0.829
	10 g/L	2.112	1.647	1.017	1.629	0.821	0.681
Sakha 4	Control	1.670	1.953	0.764	1.197	0.912	0.579
	5 g/L	2.515	2.060	1.139	1.519	1.033	0.858
	10 g/L	2.778	2.323	1.751	1.655	1.259	0.852
LSD	0.05	0.018	0.114	0.033	0.012	0.039	0.200

Application of yeast extract at 10g/L resulted in the biggest increases in the measured yield parameters during the two seasons (Tables 4a and 4b). Among the five cultivars, Giza 3 and Sakha 4 showed the highest values for plant height, number of seeds per plant, weight of seeds per plant, biological yield and seed yield per fedan during the two seasons. Sakha 1 cultivar was distinguished by the lowest seed yield per fedan with the two yeast concentrations at both growing seasons compared with the other cultivars. Yeast is a natural source of cytokinins and has stimulatory effects on bean plants (Amer, 2004). Moreover, yeast was suggested to participate in a beneficial role during vegetative and reproductive growths through improving flower formation and yield in some plants (Barnett

*et al.*, 1990; Fathy *et al.*, 2000; Abou-Aly, 2005; El-Tohamy *et al.*, 2008; Mahmoud *et al.*, 2013; Lonhienne *et al.* 2014 and Shalaby and El-Ramady, 2014). The results of the present study showed that yield parameters exhibited higher values at the first sowing time (3 November) of faba bean cultivars in the two growing seasons compared with the second sowing time (3 December). In this connection, Rahman *et al.* (2014) observed that in strawberry, delayed planting significantly reduced the yield. Also, Singh *et al.* (2011) found that planting urdbean during July 15-25 was optimum and delayed planting on August 5 resulted in drastic reduction in seed yield.

**TABLE 4 (a). Effect of yeast extract (5 g/L or 10 g/L) and two sowing times on some yield parameters of five faba bean cultivars during two seasons.**

Treatment		Season 2012-2013									
		Sowing time (3 November)					Sowing time (3 December)				
		Plant height (cm)	Number of branches / plant	Number of pods / plant	Number of seeds / pod	Number of seeds / plant	Plant height (cm)	Number of branches / plant	Number of pods / plant	Number of seeds / pod	Number of seeds / plant
Giza 2	Control	91.4	3.4	16.8	2.83	47.8	80.2	3.2	20.0	2.84	56.6
	5 g/L	92.0	3.8	17.0	3.23	54.6	79.0	4.0	25.4	2.60	56.8
	10 g/L	92.8	4.0	21.6	2.76	58.4	81.0	4.2	19.8	2.93	57.4
Giza 3	Control	109.6	3.0	17.2	2.73	46.4	81.0	2.0	10.2	2.78	28.2
	5 g/L	110.8	3.2	18.0	2.91	52.6	82.8	3.4	18.4	2.46	42.4
	10 g/L	115.4	3.4	20.4	3.24	66.0	90.8	3.2	21.4	2.86	61.0
Giza 843	Control	91.4	4.0	15.6	2.80	45.2	67.6	2.6	10.4	2.78	28.4
	5 g/L	94.4	4.2	17.8	2.68	47.4	80.0	5.2	23.4	2.53	59.0
	10 g/L	101.0	4.2	19.0	3.15	60.2	81.0	5.2	20.4	2.68	53.8
Sakha 1	Control	81.8	3.8	15.8	2.96	46.6	65.6	2.6	8.4	2.96	26.8
	5 g/L	91.0	4.4	16.2	2.92	47.4	70.6	2.4	9.4	3.47	33.6
	10 g/L	92.8	5.8	26.2	2.60	56.8	69.2	3.0	14.4	3.05	42.4
Sakha 4	Control	98.4	3.4	15.4	3.03	45.2	75.4	3.2	15.6	2.71	42.0
	5 g/L	98.6	3.4	15.8	2.92	45.6	80.2	3.0	16.4	2.72	44.8
	10 g/L	105.2	4.6	24.6	2.67	69.2	83.4	3.2	18.4	2.79	51.2
LSD	0.05	0.517	0.124	0.001	0.892	0.001	0.267	0.167	0.131	0.810	0.071
		Season 2013-2014									
Giza 2	Control	101.0	3.4	13.0	2.97	38.0	78.6	3.2	14.6	2.88	42.0
	5 g/L	105.2	3.8	18.6	2.63	49.2	86.8	3.6	17.8	2.74	48.8
	10 g/L	119.0	4.0	23.2	2.94	68.0	92.6	3.4	20.0	2.69	53.4
Giza 3	Control	103.4	2.8	14.0	2.98	42.2	94.0	2.4	13.4	2.70	35.6
	5 g/L	112.2	3.0	18.0	2.81	50.4	99.6	3.4	16.2	3.28	48.6
	10 g/L	121.2	3.6	21.4	2.86	64.2	100.0	4.4	20.2	3.24	65.0
Giza 843	Control	110.4	3.8	13.8	3.07	40.4	88.6	3.8	12.8	2.95	36.8
	5 g/L	117.2	4.8	16.4	2.84	47.0	102.4	3.8	16.4	3.69	59.2
	10 g/L	113.0	5.2	20.4	3.05	60.8	104.6	4.4	18.8	3.04	57.6
Sakha 1	Control	103.2	2.6	11.2	2.89	32.4	80.4	2.6	10.4	3.21	32.8
	5 g/L	105.0	3.0	13.2	2.70	35.6	84.4	3.2	11.4	3.46	39.6
	10 g/L	124.2	2.8	14.0	3.30	46.0	84.8	3.2	14.4	2.93	40.8
Sakha 4	Control	114.0	3.2	16.6	3.50	57.4	91.6	2.8	10.8	3.70	39.6
	5 g/L	123.8	4.2	23.2	3.05	70.8	93.2	3.6	13.4	2.98	38.8
	10 g/L	138.2	4.2	24.0	2.96	71.0	101.4	4.4	16.2	3.08	49.8
LSD	0.05	0.017	0.238	0.020	0.101	0.038	0.144	0.024	0.009	0.553	0.016

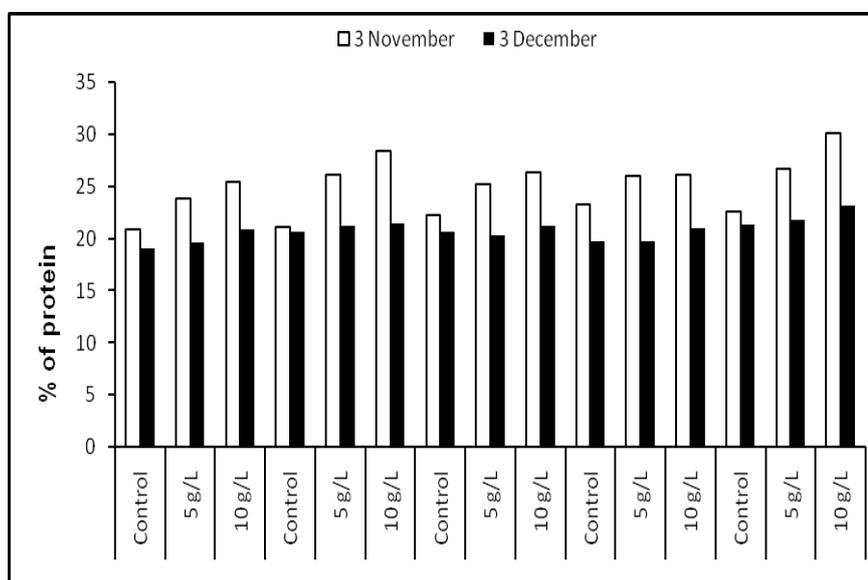
**TABLE 4(b).** Effect of yeast extract (5 g/L or 10 g/L) and two sowing times on some yield parameters of five faba bean cultivars during two seasons.

Treatment		Season 2012-2013							
		Sowing time (3 November)				Sowing time (3 December)			
		Weight of seeds / plant	Weight of 100 seed (gm)	Biological yield (weight of shoot)	Seed yield /fedan (ton)	Weight of seeds /plant	Weight of 100 seed (gm)	Biological yield (weight of shoot)	Seed yield /fedan (ton)
Giza 2	Control	38.34	73.02	79.8	2.65	33.88	61.12	60.0	2.21
	5 g/L	46.54	87.58	87.0	2.76	33.66	61.29	65.4	2.25
	10 g/L	48.13	93.77	99.6	2.95	33.92	64.71	60.8	2.57
Giza 3	Control	39.13	86.23	77.2	2.78	19.02	73.05	32.2	1.36
	5 g/L	47.36	93.36	84.6	3.00	33.72	73.39	61.4	2.20
	10 g/L	56.11	92.31	121.2	3.19	40.64	73.77	63.4	2.71
Giza 843	Control	47.72	88.00	80.6	2.58	20.59	71.42	32.6	1.43
	5 g/L	49.61	87.11	85.6	3.14	38.57	71.87	71.8	2.40
	10 g/L	57.81	95.37	110.8	3.15	37.98	73.95	81.8	2.60
Sakha 1	Control	41.66	85.68	72.2	2.86	20.58	71.80	30.2	1.44
	5 g/L	42.03	86.53	72.8	2.77	27.63	69.01	34.0	2.12
	10 g/L	49.48	91.23	102.6	3.02	32.49	72.61	39.0	2.52
Sakha 4	Control	36.35	93.28	66.2	2.37	35.80	81.05	58.8	2.41
	5 g/L	39.05	94.89	69.6	2.70	38.91	78.79	57.6	2.30
	10 g/L	63.02	96.22	132	3.21	43.51	85.57	62.4	2.56
LSD	0.05	0.002	0.058	0.001	0.004	0.025	0.752	0.151	0.003
		Season 2013-2014							
Giza 2	Control	34.35	70.19	56.84	2.37	33.31	79.42	48.45	2.23
	5 g/L	42.35	86.02	80.78	2.80	34.80	82.12	60.74	2.51
	10 g/L	56.50	87.46	108.10	3.07	36.16	86.49	56.61	2.59
Giza 3	Control	30.70	75.60	57.30	2.71	24.93	76.18	43.38	1.72
	5 g/L	43.85	94.84	76.81	2.93	34.17	82.21	58.08	2.36
	10 g/L	57.72	98.47	97.58	3.20	41.50	86.84	70.00	2.68
Giza 843	Control	32.47	81.00	62.18	2.50	22.62	69.65	41.77	1.55
	5 g/L	43.20	86.84	87.92	2.85	37.70	68.81	68.38	2.47
	10 g/L	50.97	89.30	79.79	3.05	40.16	80.74	77.96	2.49
Sakha 1	Control	30.05	82.92	46.46	2.10	27.07	75.64	43.88	1.87
	5 g/L	33.47	80.02	46.10	2.49	28.19	81.35	41.47	1.97
	10 g/L	39.15	83.94	69.99	2.74	31.50	86.40	47.77	2.36
Sakha 4	Control	42.03	75.11	72.51	2.82	33.12	84.17	48.70	2.18
	5 g/L	58.47	82.54	108.54	3.10	35.81	84.99	50.19	2.23
	10 g/L	71.74	108.09	121.14	3.29	44.33	88.20	57.91	2.61
LSD	0.05	0.010	0.011	0.029	0.009	0.011	0.051	0.041	0.002

The data presented in Fig. 1 and 2 showed that the applied concentrations of yeast increased the percentage of protein and carbohydrate in the seeds of all faba bean cultivars at the two sowing times compared with control plants. Moreover, the highest amounts of protein and carbohydrates contents were shown in Giza 3 and Sakha 4 cultivars when treated with 10g/L yeast at the first

sowing time. This could be explained on the basis that that yeast treatment increased metabolic processes such as protein and carbohydrates synthesis parallel with the increased content of phytochromes. In this respect, El-Desouky *et al.* (1998) and Wanas (2006) reported the stimulatory effects of yeast on protein synthesis. Marzauk *et al.* (2014) also found that foliar application of yeast resulted in an increase in broad bean seeds content of nitrogen and protein percentage. Barnett *et al.*, 1990 reported that yeast has a stimulatory effect on carbohydrates accumulation.

In conclusion, stimulation of faba bean growth was observed in plants treated with 10g/L yeast extract at 65 and 85 days after sowing during the two seasons. The application of yeast extract of 10g/L resulted in the biggest increases in yield parameters during the two seasons. The data showed that the applied concentrations of yeast increased the percentage of protein and carbohydrate in the seeds of all faba bean cultivars at the two sowing time. Giza 3 and Sakha 4 cultivars showed the maximum values of yield parameters especially plant height, number of seeds per plant, weight of seeds per plant, biological yield and seed yield per fedan during the two seasons. The yeast extract significantly increased endogenous phytohormones (cytokinin, GA<sub>3</sub> and IAA) of all faba bean cultivars except GA<sub>3</sub> and IAA that were decreased in sakha 1 treated with 10g/L yeast at the second sowing season. It could be recommended that foliar spraying with yeast extract (10g/L) at the first sowing time (3<sup>rd</sup> of November) can be used to increase the final yield and seed quality of both Giza 3 and Sakha 4 cultivars.



**Fig. 1.** Effect of yeast extract (5 g/L or 10 g/L) and two sowing times (3 November or 3 December) on the percentage of protein of faba bean seeds.

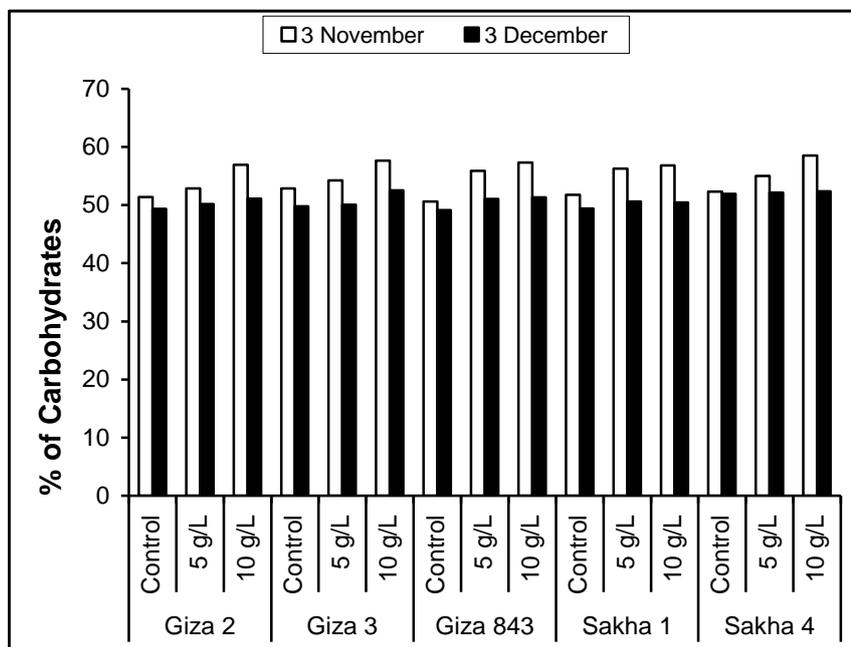


Fig. 2. Effect of yeast extract (5 g/L or 10 g/L) and two sowing times (3 November or 3 December) on the percentage of carbohydrates of faba bean seeds.

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## تأثير ميعاد الزراعة والرش بمستخلص الخميرة على نمو و انتاجية أصناف مختلفة من البلى الفول

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فى هذا البحث تم دراسة تأثير الرش بمستخلص الخميرة بتركيزات (٥ و ١٠ جرام/لتر) فى أوقات زراعة مختلفة (٣ نوفمبر و ٣ ديسمبر) على النمو و الإنتاجية و بعض المحتويات الكيميائية لأصناف الفول البلى فى موسمين للزراعة (٢٠١٢/٢٠١٣ و ٢٠١٣/٢٠١٤). أوضحت النتائج أن الرش بالخميرة أحدث زيادة معنوية فى نمو الأصناف المختلفه من الفول البلى عند عمر ٦٥ و ٨٥ يوم. بالإضافة إلى ذلك فقد وجد أن الرش بالخميرة و خاصة ١٠ جرام/لتر أحدث زيادة فى محتوى الكلوروفيل و الهرمونات للأصناف المختلفة من الفول عند عمر ٦٥ يوم. إزدادت إنتاجية الفول و محتوى البذور من البروتين و المواد الكربوهيدراتية عند المعاملة بتركيزات الخميرة المختلفه. أوضحت النتائج أن أصناف جيزه ٣ و سخا ٤ أعطت أعلى إنتاجيه مقارنة بالأصناف الأخرى. بالإضافة إلى ذلك فإن إنتاجية أصناف الفول فى ميعاد الزراعة الأول (٣ نوفمبر) أعطت قيم أعلى مقارنة بميعاد الزراعة الثانى (٣ ديسمبر). وبناء على ذلك ينصح بزراعة الفول البلى فى ميعاد الزراعة الأول (٣ نوفمبر) مع الرش بمستخلص الخميره (١٠ جرام/لتر) لزيادة الانتاجية والحصول على بذور عالية الجودة خاصة لأصناف جيزه ٣ و سخا ٤.