J. Agric. Sci. Mansoura Univ., 29 (3): 1407 – 1422, 2004

GROWTH, GREEN PODS YIELD AND SEEDS YIELD OF COMMOM BEAN (*Phaseolus vulgaris* L.) AS AFFECTED BY ACTIVE DRY YEAST, SALICYLIC ACID AND THEIR INTERACTION.

Amer, S.S.A
Vegetable Res. Dept., Hort. Res. Inst., Agric. Res Center. Egypt.

ABSTRACT

Foliar spray of yeast at 0, 1 and 2 g/L levels and salicylic acid (SA) at 0, 50, 100 and 150 ppm were applied to common bean plants c.v Bronco. Obtained results revealed that using 2 g/L of yeast was most effective treatment in plant height, number of leaves, leaf area, fresh and dry weight/plant as well as total chlorophyll content of leaves, and green pods yield and its components except the pod weight, seed yield and its components and weight of 100 seed. However, SA as antioxidant substance retarded the vegetative growth specially when used at the highest used concentrations i.e. 100 and 150 ppm. Obtained results showed that , (SA) at 50 ppm had the best effect on growth, chlorophyll content, and green pods yield and its components except weight of pod, seed yield and its components as well as weight of 100 dry seed. Applying yeast at 2 g/L combining with SA at 50 ppm promoted plant growth, chlorophyll content, and green pods yield and its components except green pod weight, seed yield and its components and weight of 100 dry seed. On the other hand, it was observed that spraying yeast at 2 g/L or salicylic acid at 50 ppm each alone or interacting together had no effect on seed germination percentage and germination rate of dry seeds.

INTRODUCTION

Common bean (*Phaseolus Vulgaris* L.) is widely used as a source of protein and for its high nutritive value for human nutrition in Egypt. In addition, bean represents one of the most important vegetable crops for local consumption and export. Recently, great attention has been focused on the possibility of using natural and safety *substituents* i.e yeast (*Saccharomyces cervisiae*) in order to improve plant growth, green pods yield and its components, as well as seed yield and its quality in addition, to minimize the rate of pollution with chemical compounds. Besides, the yeast as a natural source of cytokinin had stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (Kraig and Haber, 1980; Spencer *et al* 1983.; Castel Franco and Beale, 1983, and Fathy and Farid, 1996). Cytokinin also was found to improve the formation of flowers initiation through its effect on carbohydrates accumulation (Winker *et al*, 1962). Yeast was found to contain sugar and proteins and amino acids, as well as several vitamins (Shady, 1978).

With regard to the effect of active dry yeast on growth characters and chlorophyll content, several studies were established by Hewedy *et al* (1996) on eggplant, Fathy *et al* (2000) on tomatoes and Tartoura (2001) on pea plants, they showed that yeast increased progressively plant height. Hewedy *et al* (1996) on eggplant, El Ghamaring *et al* (1999) and Fathy *et al* (2000) on

tomato and Tartoura (2001) on pea plant found that yeast caused significant increase in number of leaves per plant.

Leaf area was found to increase by foliar application of active dry yeast (Fathy and Farid, 1996 on common bean, Hewedy *et al*, 1996 on eggplant., and Fathy *et al*, 2000 on tomato).

Fathy *et al* (2000) on tomato revealed that fresh weight/plant was increased by using yeast as foliar spray. Similar results were obtained by Tartoura (2001) on pea.

Concerning dry weight/plant, Fathy and Farid (1996) on common bean, El Ghamring *et al* (1999), Fathy *et al* (2000) on tomato and Tartoura (2001) on pea showed that such character was increased by applying yeast as foliar treatment.

Several investigators indicated that chlorophyll content of leaves was affected by adding yeast solution, since high significant increases were obtained by Fathy and Farid, (1996) on common bean, Hewedy *et al*, (1996) on eggplant, Abdel Aziz (1997) and El Ghamring *et al*, (1999) on tomato and Tartoura, (2001) on pea.

Green pods yield was found to be affected by yeast application Fathy and Farid (1996) found that applying yeast increased pod yield/plant and number of pods/plant. Weight of pod, total numbers of pods/plant and total fresh pods yield/fed, were increased by yeast application (Tartoura 2001 on pea). Similar results were obtained by Hewedy *et al* (1996) on eggplant and Abdel Aziz (1997), El Ghamriny *et al* (1999) and Fathy *et al* (2000) on tomato. Seed yield and its components were studied by several scientists to show the effect of yeast on this character as Fathy and Farid (1996) stated that number of seeds and weight of dry seed/ plant were improved by spraying with yeast. Similar trend of response was found by Mekhemar and Al Kahal (2002) on seed yield. Moreover, Hewedy *et al* (1996) on eggplant found that number and weight of seed/fruit as well as seed yield were significantly increased with spraying plants with yeast, whereas the germination percentage and germination rate were not affected by yeast treatment.

Recently, use of antioxidants in plant production could be promising and economic, therefore, they should be given more attention. Many phenolic compounds play an essential role in the regulation of plant growth, development and interaction with other organisms. Harborne; (1980), Hablbrock and Scheel, (1989) stated that phenolic compounds are essential for the biosynthesis of lignin, an importance structural components of plant cell wall. One of these compounds is Salicylic acid (SA). Several studies which were carried out under laboratory or field conditions strongly suggested that SA and Salicylate play an important role in many biological responses in plants. The effect of these substances on the physiology of plants is variable as they promote some processes and inhibit others, (Raskin, 1992). Regarding the effect of SA on growth, Marco *et al* (1998) on soybean revealed that growth of shoots, roots and plant height were significantly increased.

On the other hand, Manthe *et al* (1992) showed that the occurrence of SA at highest concentration in plants affects growth as known in case of *Vicia faba* as treatment with SA higher than 3.5 Mm considerably decreases the

rate of root growth. Also, Pancheva *et al* (1996) on barley plants cleared that leaf and root growth were reduced by applying SA. SA was found also to reduce shoot dry weight accumulation of several crops and weed species (Schettel and Balke, 1983). Concerning, Chlorophyll content, exogenous application of SA caused an increase in photosynthetic rate and chlorophyll content in soybean (Glass and Dunlop, 1974 and Zhao *et al*, 1995). Opposite results were obtained by Pancheva *et al* (1995) since they found that chlorophyll content of barley plants was reduced by SA application.

Concerning yield and its components, Singh and Kaur (1980) revealed that SA application increased pods number and yield of mung bean, Moreover, Moustafa (1999) found that some antioxidants improved tomato fruits weight/plant and total yield/fed Similar results were obtained by Youssef (2000) on potato.

As for seed yield and its components many investigators showed that the highest values of seed yield (ton/fed), 1000 seed weight (g) and dry pod length (cm) were obtained from plants sprayed with (SA) at 200 ppm. In addition, the highest number of seeds/pod was obtained from plants resulted from seeds soaked in (SA) at 200 ppm (Abd Allah, 2001, an pea).

With regard to seed germination, Abdel Ati *et al* (2000) on tomato, found that (SA) application had insignificant effect on tomato seed germination.

This investigation aimed to study the effect of foliar application of active dry yeast and Salicylic acid and their interaction on growth and green pods and dry seed yield and their components as well as seed germination percentage and rate of common bean.

MATERIALS AND METHODS

Two field experiments were conducted at Kaha Farm of Horticulture Research Institute, in Kalubia Governorate during the two successive summer seasons of 1999 and 2000 to study the effect of active dry yeast and salicylic acid as a foliar spray on growth, green pod yield and its components and seed yield and quality of common bean (*phaseolus vulgais* L.).

The soil in this farm is clay loam with pH of 7.8. Common bean seeds cv. Bronco were sown on March, 9 and 5 in 1999 and 2000, respectively. Seeds were sown in hills 10 cm apart on one side of ridges 4.0 m long and 60 cm. width . The experimental unit was consisted of 7 ridges, i.e 3 ridges were used for green pods yield, 3 ridges were used for seed yield, and one ridge was used for vegetative growth characters. The plot area was about 16.8 m^2. The experimental layout was split plot design with 4 replicates. Active dry yeast (ADY) treatments were situated at main plots while Salicylic acid (SA) treatments occupied the sup plots.

The treatments of active dry yeast (ADY) were :

1-Control (spraying with water).
2-Spraying with active dry yeast 1 g/L .
3- Spraying with active dry yeast 2 g/L.

The treatments of salicylic acid (SA) were :

1- Control (spraying with water).

2-Spraying with SA at 50 ppm.
3-Spraying with SA at 100 ppm.
4-Spraying with SA at 150 ppm.

All treatments were sprayed three times at 2,4 and 6 true leaves stage. Active dry yeast were separately sprayed, whereas SA was sprayed two days after yeast application in different levels used. All agricultural practices were done as commonly used.

Preparation of yeast.

Active dry yeast was dissolved in warm water (38°) followed by adding sugar at a ratio 1:1 to activate growth and reproduction of yeast and let stand for 2 hours before spraying.

Data recorded :

(1) Vegetative growth characters :

At full blooming stage a random sample of 5 plants from each experimental plot was taken for determining morphological characters as follows :

1- Plant height (cm).
2- Number of leaves.
3- Leaf area (cm^2).
4-Fresh weight/plant (gm).
5-Dry weight/plant (gm).

(2) Chlorophyll content (a, b and total) (mg/100 gm fresh weight).

(3) Green pods yield and its components :

At the green pods harvest stage the following data were recorded :

1- Green pod weight (gm).
2- Number of green pods per plant.
3- Green pods yield per plant (gm).
4- Green pods yield per Fed (ton).

(4) Seed yield and seed index :

At the seed harvest stage the following data were recorded :

1- Seed yield per plant (gm).
2- Seed yield per plot (kg).
3- Seed yield/fed (kg).
4- Seed index {weight of 100 seed (gm)}.

(5) Germination tests :

1- Germination percentage.
2- Germination rate.

(6) Correlation between some variables :

The correlation coefficient is more readily obtained by using the method mentioned by Warran and Andre (1966) and using their formula for calculating r value as follows:

$$r = \frac{S(xy) - S(x)\,y}{\sqrt{[S(x)^2 - S(x)][S(y)^2 - S(y)\,y]}}$$

Where :

I)x and y = two values of variables.

ii)x and y = the values of mean x and y with respect.

Iii)S (x) and s (y) = س (x) and (y) respectively.

Statistical analysis was performed according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

(1) Growth characteristics:

Data in Table (1) showed that all growth parameters i.e. plant height, number of leaves/plant, Leaf area, fresh weight and dry weight/plant were significantly increased with increasing rate of yeast. It was noticed that yeast at the highest rate of yeast (2 gm/1) gave higher value than the lowest rate and the control during both seasons. These results coincided with those of Hewedy *et al* (1996) on eggplant, Fathy *et al* (2000) on tomatoes and Tartoura (2001) on peas who showed that yeast treatments increased progressively plant height. Also, Hewedy *et al* (1996) on eggplant, El Ghamriny *et al* (1999) and Fathy *et al* (2000) all working on tomatoes and Tartoura (2001) on peas, found that yeast treatments caused significant increase in leaves number. As for leaf area, spraying yeast (Fathy and Farid, 1996) on common bean, (Hewedy, *et al*, 1996) on eggplant and (Fathy *et al*, 2000)on tomatoes gave rise an obvious increase. With regard to fresh weight/plant, it was increased by application of yeast. This result agree with that obtained by Fathy *et al* (2000) on tomato and Tartoura (2001) on pea. Regarding to the effect of yeast on dry weight/plant, Fathy and Farid (1996) on common bean, El Ghanring *et al* (1999), Fathy et al (2000) all working on tomato and Tartoura (2001) on pea, they showed that this character was increased by using yeast treatments.

The enhancing effect of yeast as a foliar spray on vegetative growth, maybe de to being yeast as natural source of cytokinins might enhance cell division and cell enlargement so far increasing the leaf surface area as well as enhancing the accumulation of soluble metabolites as mentioned about the role of cytokinins (Muller and Leopold 1966). Also, yeast is natural source of many growth substances (thiamine, riboflavin, niacin, pyridoxine Hel, pantothenate, bioten, cholin, folic acid and vit.12) and most nutritional elements (Na, Ca, Fe, Mg, K, P, S, Zn, Si) as well as organic compounds (protein, carbohydrate, nucleic acids and lipids (Nagodawithana 1991).

Data in Table (1) cleared that vegetative growth was significantly reduced with increasing the concentration of SA except the concentration of SA (50 ppm) which gave the higher value than control in both seasons of study. These results coincided with those of Manthe *et al* (1992) who showed that SA at a high concentration in plants affects the growth as is known in the case of *Vicia faba* where treatment with SA higher than 3-5 Mm, considerably decreases the rate of root growth. Similar results were obtained by Pancheva *et al* (1995) on root growth of barely plants and Schettel and Balke (1983) on shoot dry weight of several crops and weed species.

Table (1): Vegetative growth of common bean as affected by active dry yeast, salicylic acid and their interaction during the seasons of 1999 and 2000.

Characters / Seasons / Treatments $ADY_{gm/L}$ SA_{ppm}	Plan height (cm)		No. of leaves/plant		Leaf area (Cm2)		Fresh weight/plant (gm)		Dry weight/plant (gm)	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
0	32.02	30.6	10.7	10.4	156.3	153.1	73.9	72.3	13.3	12.8
1	34.20	32.1	12.4	11.7	161.0	159.2	77.7	76.0	14.6	14.1
2	36.02	34.1	14.7	13.2	164.8	161.3	78.8	78.0	16.2	15.4
L.S.D at 5%	**0.61**	**0.27**	**0.054**	**0.082**	**1.91**	**1.10**	**0.082**	**0.054**	**0.047**	**0.147**
0	35.5	33.1	13.8	12.7	165.4	162.5	77.6	77.1	15.5	15.2
50	37.9	35.6	16.0	14.7	171.5	167.0	82.3	81.4	18.7	17.3
100	32.7	31.5	11.4	10.7	157.7	155.2	75.1	72.9	13.2	13.2
150	30.1	28.8	9.2	9.0	148.1	146.9	72.3	70.3	11.3	10.8
L.S.D at 5%	**0.064**	**0.052**	**0.052**	**0.059**	**1.88**	**1.71**	**0.064**	**0.059**	**0.059**	**0.121**
0 / 0	33.5	31.8	11.5	11.1	161.2	156.2	75.2	74.5	14.2	13.8
0 / 50	35.1	33.5	13.7	13.0	165.1	160.9	77.1	76.3	16.5	15.3
0 / 100	30.7	29.7	9.7	9.5	155.5	152.3	73.1	70.3	12.3	12.5
0 / 150	28.8	27.6	8.0	8.0	143.4	142.9	70.3	68.1	10.4	9.7
1 gm / 0	35.7	33.1	13.2	12.5	165.9	164.3	78.3	77.9	15.1	15.2
1 gm / 50	37.2	35.2	15.8	14.9	171.3	168.9	84.4	82.4	18.8	17.5
1 gm / 100	33.3	31.3	11.5	10.6	158.5	156.7	75.6	73.2	13.4	13.1
1 gm / 150	30.5	28.6	9.2	9.1	148.3	147.2	72.7	70.5	11.2	10.5
2 gm / 0	37.3	34.3	16.7	14.5	169.3	167.2	79.5	78.9	17.3	16.6
2 gm / 50	41.4	38.3	18.5	16.4	178.1	171.3	85.5	85.5	20.9	19.2
2 gm / 100	34.2	33.5	13.2	12.0	159.3	156.3	76.6	75.4	14.1	14.2
2 gm / 150	31.2	30.2	10.6	9.9	152.6	150.7	73.9	72.3	12.5	11.9
L.S.D at 5%	**0.112**	**0.091**	**0.091**	**0.102**	**1.99**	**1.85**	**0.112**	**0.102**	**0.102**	**0.210**

ADY = Active dry yeast
SA = Salicylic acid

The retarding effect of SA with increasing the concentrations may be due to the excessive SA causes such toxicity, plants have systems of converting infused SA to its derivatives, salicylic acid B- glucoside (SAG), methyl salicylate (MSA) and SA hydroxylates (Pridham, 1965 and Pierpoint, 1994), Glucosylation of SA occurs in many plant species and is a mode of protective response against the chemical stress of SA (Pierpoint, 1994). The reaction is catalyzed by salicylic acid glucosyltransferase whose expression is induced by exogenously added SA (Lee and Raskin, 1999).

Data in Table (1) also indicated that the interaction between yeast at the rate (2 g/1) and SA at 50 ppm gave the best results for various growth parameters followed by yeast at the rate of (1 g/1) and SA at 50 ppm, as well as zero yeast + SA at 50 ppm comparing with other ones in both seasons of study.

(2) Chlorophyll content:

Data in Table (2) indicated that chlorophyll content i.e. (a, b and total) was significantly increased by yeast application. It is noticed that the most effective treatments was the rate of (2 g/l), which gave the highest value in this regard in both seasons of study. These results agree with those of Fathy and Farid (1996) on common bean, Hewedy *et al* (1996) on eggplant, Abdel Aziz (1997), El Ghamriny *et al* (1999) all working on tomatoes and Tartoura, (2001) on pea.

The stimulatory effect of yeast might be due to that yeast as a source of cytokinins (Skoog and Miller, 1957) delays the degradation of chlorophyll via the inhibition of chlorophyllase (Ben, 1986) and enhances the synthesis of protein and RNA that are closely related with delaying the aging of leaves (Natio *et al*, 1981).

Also, data in table (2) showed that spraying with SA at 50, 100 or 150 ppm caused a significant increase in chlorophyll content (a + b and total) comparing with control. SA at 50 ppm gave the most effective comparing with other treatments. These results agree with those of Glass and Dunlop, (1974) and Zhao *et al*, (1995) on soybean. The enhancing effect of SA on chlorophyll content may be due to increases in photosynthetic rate that they ascribed to an enhancement of Leaf enzyme activity by SA (Zhao *et al*, 1995 on soybean).

(3) Green pods yield and its components:

Data presented in Table (3) cleared that yeast treatments had no significant effect on green pod weight at both of yeast rates (1 g/1 or 2 g/1) in two years of experimental study. Also, the same data revealed that all spraying yeast treatment gave a significant increase in number of green pods/plant, green pods yield/plant (g) and green pods yield/fed (ton) comparing with the control in both seasons of study. The most effective rate was (2 g/1) which gave higher value than the other one. These results agree with those of Fathy and Farid (1996) on common bean, they found that pods yield/plant and number of pods/plant were increased by addition yeast. Also, Tartoura (2001) on pea, found that total number of pods/plant and total fresh pods yield/fed were increased by using yeast treatments.

Table (2): Chlorophyll content of common bean as affected by active dry yeast, salicylic acid and their interaction during the seasons of 1999 and 2000.

Charact.ers / Seasons / Treatments $ADY_{gm/L}$	SA_{ppm}	Chlorophyll (a) mg/100g F.W		Chlorophyll (b) mg/100g F.W		Total Chlorophyll (a + b) mg/100g F.W	
		1999	2000	1999	2000	1999	2000
0		79.1	77.3	46.5	44.7	125.6	122.0
1		83.7	81.7	50.4	48.3	134.1	130.0
2		88.6	86.4	53.4	50.1	142.0	136.5
L.S.D at 5%		1.31	1.24	1.28	1.14	2.15	2.09
	0	76.2	74.2	44.1	41.9	120.3	116.1
	50	91.7	90.0	57.4	55.4	149.1	145.4
	100	87.2	85.0	50.5	48.4	137.7	133.4
	150	80.0	78.1	48.4	45.1	128.4	123.2
L.S.D at 5%		1.15	1.11	1.23	1.11	2.22	2.15
0	0	70.2	68.5	40.2	38.3	110.4	106.8
	50	87.3	86.1	51.3	49.5	138.6	135.6
	100	83.7	81.4	48.2	46.1	131.9	127.5
	150	75.2	73.4	46.3	44.9	121.5	118.3
1	0	77.3	75.1	44.4	42.1	121.7	117.2
	50	90.6	88.3	58.4	56.7	149.0	145.0
	100	87.8	85.8	50.3	48.4	138.1	134.2
	150	79.3	77.7	48.5	46.1	127.8	123.8
2	0	81.3	78.9	47.7	45.5	129.0	124.4
	50	97.4	95.6	62.4	60.0	159.8	155.6
	100	90.1	87.8	53.2	50.7	143.3	138.5
	150	85.5	83.3	60.4	44.3	135.9	127.6
L.S.D at 5%		1.73	1.66	1.15	1.08	2.07	1.95

ADY = Active dry yeast SA = Salicylic acid

Similar results were obtained by Hewedy *et al* (1999) on eggplant and Abdel Aziz 1997, El Ghamriny *et al* (1999) and Fathy *et al* (2000) all working on tomatoes.

The promotional effect of yeast treatment on yield of common bean could be logically true under the present work conditions since the same treatments increased number of leaves/plant (Table 1) and chlorophylls (Table 2) so far, prolonged the period of actively photoassimilation as well as yield. Furthermore yeast via its cytokinins content (Nagodawithana 1991; Skoog and Miller, 1957) and the high content of Vit.B and minerals might play a role in orientation and translocation of metabolites from leaves towards the reproductive organs. Also, it might play a role in the synthesis of protein and nucleic acids and minimized their degradation (Natio *et al* 1981). All of these occurrences and attributes might lead to the improvement of common bean yield.

With regard to the effect of SA on yield on common bean, data in Table (3) also, illustrated that SA at all concentrations had no significantly effect on green pod weight in both seasons of study, but at the same time it noticed that SA at its concentrations had a promotive effect or significantly effect on number of green, pods/plant green, pods yield/plant (g) and green pods yield/fed (ton) comparing with the control. It appeared that SA at (50 ppm) gave higher value than other one. These finding agree with those of Simgh and Kaur (1980) on yield of mung bean. Moreover, Moustafa (1999) found that SA improved fruit weight of tomatoes, as well as total yield/fed. Similar results were obtained by Youssef (2000) on potato yield. The best effect of SA on yield could be attributed to an increase in flower longevity and inhibition of ethylene biosynthesis in cells plants (Lesilie and Romani, 1986).

Concerning the effect of the interactions between yeast and SA treatments, data in Table (3) indicated that there was no significant effect on green pod weight (g) at all their combinations in both seasons of study. But, the same data showed that all these interactions had significantly effect on number of green pods/plant, green pod weight/plant and green pods yield/fed comparing with control. Also, it was noticed that the best treatment of interaction was yeast at the rate (2 g/1) with SA at (50 ppm) comparing with other one during both seasons.

(4) Dry seed yield and seed index:

Data in Table (4) show the effect of yeast treatments on dry seed yield and seed index, it was noticed that yeast treatments at all rates i.e. 1 g/1 and 2 g/1 had significantly effect on dry seed yield i.e, seed yield/plant, seed yield/plot and seed yield/fed as well as seed index (weight of 100 dry seeds) when comparing with control in both seasons of study. The best rate gave the higher value was (2 g/1). This finding coincided with those of Fathy and Farid (1996) Mekhemar and Al Kahal (2002) all working on common bean, as well as Hewedy *et al* (1996) on eggplant. These results could be attributed to yeast as natural sources of cytokinins which enhance the accumulation of soluble metabolites (Muller and Leopold; 1966). or that yeast is natural source of many growth substances, in addition the most nutritional elements as well as organic compounds (Nagodawithana 1991).

Table (3): Green pods yield and its components of common bean as affected by active dry yeast, salicylic acid and teir interaction during the seasons of 1999 and 2000.

Characters / Seasons / Treatments $ADY_{gm/L}$ SA_{ppm}	Green pod weight (gm)		No. of green pods / plant		Green pods yield / plant (gm)		Green pods yield /fed (ton)	
	1999	2000	1999	2000	1999	2000	1999	2000
0	6.9	6.7	7.8	7.3	53.47	49.47	3.386	3.133
1	7.0	6.8	8.9	8.1	62.39	55.88	3.951	3.539
2	7.1	6.9	9.6	9.2	67.76	63.10	4.291	3.996
L.S.D at 5%	**N.S**	**N.S**	**0.061**	**0.094**	**0.128**	**0.238**	**0.027**	**0.019**
0	6.9	6.7	7.9	7.3	54.56	49.42	3.455	3.129
50	7.0	6.8	9.6	9.1	67.59	62.29	4.280	3.944
100	7.0	6.8	9.0	8.5	63.60	58.62	4.077	3.712
150	7.0	6.8	8.4	7.9	59.09	54.27	3.741	3.437
L.S.D at 5%	**N.S**	**N.S**	**0.059**	**0.070**	**0.083**	**0.260**	**0.026**	**0.016**
0 / 0	6.8	6.7	7.1	6.5	48.28	43.55	3.057	2.758
0 / 50	6.9	6.8	8.5	8.1	58.65	55.08	3.714	3.488
0 / 100	6.9	6.8	9.0	7.6	52.20	51.68	3.496	3.273
0 / 150	6.9	6.8	7.5	7.0	51.75	47.60	3.277	3.014
1 / 0	6.9	6.8	8.0	7.2	55.20	48.96	3.496	3.100
1 / 50	7.1	6.9	9.8	9.0	69.58	62.10	4.406	3.933
1 / 100	7.1	6.9	9.1	8.5	64.61	58.65	4.091	3.714
1 / 150	7.0	6.9	8.6	7.8	60.20	53.82	3.812	3.408
2 / 0	7.0	6.8	8.6	8.2	60.20	55.76	3.812	3.531
2 / 50	7.1	6.9	10.5	10.1	74.55	69.69	4.721	4.413
2 / 100	7.1	6.9	10.0	9.5	71.00	65.55	4.496	4.151
2 / 150	7.1	6.9	9.2	8.9	69.32	61.41	4.136	3.889
L.S.D at 5%	**N.S**	**N.S**	**0.102**	**0.121**	**0.145**	**0.451**	**0.045**	**0.029**

ADY = Active dry yeast
SA = Salicylic acid

Table (4): Dry seed yield and seed index of common bean as affected by active dry yeast, salicylic acid and their interaction during the seasons of 1999 and 2000.

Characters / Seasons / Treatments $ADY_{gm/L}$	SA_{ppm}	Seed yield / plant (gm)		Seed yield / plot (kg)		Seed yield / fed (kg)		Seed index (gm)	
		1999	2000	1999	2000	1999	2000	1999	2000
0		10.9	10.0	1.302	1.200	687.1	633.3	20.2	19.3
1		11.5	10.6	1.380	1.275	728.3	672.9	21.2	20.2
2		11.9	11.1	1.431	1.341	755.2	707.7	21.8	20.8
L.S.D at 5%		**0.02**	**0.01**	**0.07**	**0.05**	**3.11**	**2.33**	**0.038**	**0.031**
	0	10.5	9.5	1.260	1.144	664.9	603.7	18.4	17.5
	50	12.4	11.8	1.496	1.416	789.5	747.3	23.2	22.2
	100	11.6	10.9	1.400	1.308	738.8	690.3	22.1	21.1
	150	11.0	10.1	1.328	1.220	700.8	643.8	20.6	19.7
L.S.D at 5%		**0.04**	**0.03**	**0.01**	**0.03**	**2.51**	**2.11**	**0.102**	**0.099**
0	0	10.0	9.0	1.200	1.080	633.3	570.0	17.0	16.4
	50	11.9	11.1	1.428	1.332	753.6	703.0	22.2	21.1
	100	11.0	10.3	1.320	1.236	696.6	652.3	21.2	20.3
	150	10.5	9.6	1.260	1.152	665.0	608.1	20.5	19.6
1	0	10.5	9.6	1.260	1.152	665.0	608.0	18.4	17.5
	50	12.5	11.8	1.500	1.416	791.6	747.3	23.7	22.8
	100	11.9	10.9	1.428	1.308	753.6	690.3	22.4	21.3
	150	11.1	10.2	1.332	1.224	703.0	646.0	20.3	19.4
2	0	11.0	10.0	1.320	1.200	696.6	633.3	19.9	18.8
	50	13.0	12.5	1.560	1.500	823.3	791.6	23.8	22.7
	100	12.1	11.5	1.452	1.380	766.3	728.3	22.8	21.6
	150	11.6	10.7	1.392	1.284	734.6	677.6	21.0	20.3
L.S.D at 5%		**0.05**	**0.03**	**0.02**	**0.03**	**1.12**	**2.17**	**0.017**	**0.011**

ADY = Active dry yeast
SA = Salicylic acid

Moreover, it improved number of leaves (Table 1) and chlorophyll content (Table 2) which in turn reflected on the seed yield.

As for, the effect of SA treatments on dry seed yield and seed index data in table (4) illustrated that all concentration of SA gave significantly increments in dry seeds/plant, seed yield/plot, seed yield/fed and seed index comparing with control in both seasons of study. Although, these increases decreased with increasing the SA concentration. The most effective treatment was the concentration of SA at (50 ppm), it gave higher values than other one. These results agree with Abd Allah, (2001) on pea. These increases could be explained on the being that SA increases flower longevity and inhibits ethylene biosynthesis in cell plants (Lesilie and Romani, 1986). In this direction Raskin (1992) found that SA had a promotive effect on organogenesis tobacco callus where it was shown that SA in combination with Kinetin and IAA promoted bud formation.

With regard to the effect of the interaction between yeast and SA treatments, data in Table (4) cleared that various combinations between yeast and SA significantly enhanced seed yield/plant, seed yield/plot, seed yield/fed and seed index when comparing with control. Although, these increases were reduced with increasing SA concentrations. In this respect, combination of yeast 2 g/l and SA at 50 ppm gave higher value than the other concentrations.

(5) Germination tests:

Data in Table (5) indicated that yeast treatments had no significant effects on both of germination percentage and germination rate during both seasons of study. These finding agree with Hewedy *et al* (1996) on eggplant.

Table (5): Germination tests of common bean seeds as affected by active dry yeast, salicylic acid and their interaction during the seasons of 1999 and 2000.

Characters / Seasons / Treatments: $ADY_{gm/L}$ / SA_{ppm}	Germination %		Germination rate (Day)	
	1999	2000	1999	2000
0	98.1	98.1	6.6	6.3
1	98.1	98.2	6.6	6.4
2	98.1	98.2	6.6	6.4
L.S.D at 5%	N.S	N.S	N.S	N.S
0	98.1	98.0	6.5	6.2
50	98.1	98.3	6.7	6.5
100	98.1	98.2	6.6	6.4
150	98.2	98.1	6.6	6.4
L.S.D at 5%	N.S	N.S	N.S	N.S
0 0	98.0	98.0	6.5	6.2
0 50	98.1	98.3	6.7	6.4
0 100	98.2	98.2	6.7	6.4
0 150	98.2	98.1	6.6	6.4
1 0	98.1	98.1	6.6	6.2
1 50	98.1	98.3	6.7	6.5
1 100	98.1	98.3	6.7	6.5
1 150	98.2	98.2	6.6	6.5
2 0	98.2	98.1	6.6	6.3
2 50	98.2	98.3	6.7	6.6
2 100	98.1	98.3	6.6	6.5
2 150	98.2	98.1	6.6	6.5
L.S.D at 5%	N.S	N.S	N.S	N.S

ADY = Active dry yeast SA = Salicylic acid

In respect to the effect of SA treatments on germination percentage and germination rate, it was cleared that SA had insignificant effect on these parameters in both season of study. These findings coincided with Abdel Ati *et al* (2000) on seed tomatoes.

With regard to the interaction between yeast and SA treatments, it was evident that the interaction between both of them had no significant effects on two tests in both seasons of study.

(6) Correlation studies:

Data in Table (6) show that the correlation coefficient between, No. of Leaves and Leaf area, total/chlorophylls, green pods yield/fed and seed yield/fed were positively linear correlation. There was a positive relationship between the leaf area and each of total chlorophyll, green pods yield/fed and seeds yield/fed. Also, the relationship between total chlorophylls and each of green pods yield/fed and seed yield/fed were positive relationship. It is clearly evident from such data in Table (6) that these correlations between different variables were of statistically significant effect at the 5% level and are considered as useful parameters under the conditions in both seasons.

Table (6): Correlation coefficient between some variables during the seasons of 1999 and 2000.

	Source	r	
		1999	2000
	(A) No. of Leaves		
	Leaf area	0.959^{+}	0.971^{+}
	Total chlorophylls	0.607^{+}	0.619^{+}
(3)	Green pods yield/fed	0.595^{+}	0.552^{+}
	Seed yield/fed	0.737^{+}	0.593^{+}
	Total effect	**2.898^{+}**	**2.735^{+}**
	(B) Leaf area		
	Total chlorophylls	0.532^{+}	0.530^{+}
(2)	Green pods yield/fed	0.473^{+}	0.450^{+}
	Seed yield/fed	0.516^{+}	0.495^{+}
	Total effect	**1.521^{+}**	**1.475^{+}**
	(C) Total chlorophyll		
(1)	Green pods yield/fed	0.928^{+}	0.894^{+}
	Seed yield/fed	0.986^{+}	0.989^{+}
	Total effect	**1.914^{+}**	**1.883^{+}**
	L.S.D at 5%		

Generally, it could be concluded that yeast at (1 g/l) or (2 g/l), improved the vegetative growth characters as well as green pods yield and seed yield. Yeast at 2 g/l had the best effect in this respect. On the contrary, SA had a retarding effect on vegetative growth characters, specially at 100 and 150 ppm levels. At the same time SA at 50 ppm gave the best results in plant growth, green pod yield and seed yield. The various combinations between yeast and SA significantly enhanced green pod yield and seed yield/Fed and their components except the weight of pod which seemed not to be affected

by the interaction between yeast and SA at different combinations. In this respect the most pronounced effect was observed when the yeast at 2 g/l was combined with SA at 50 ppm.

REFERENCES

Abd Allah, E.M.M. (2001). Response of seed yield, Dry yield components and seed quality of pea to some antioxidant treatments. J. Agric. Sci. Mansoura Univ., 26 (3) 1675-1685.

Abdel Ati, Y.Y., S.H. Gad El-Hak., A.A. Galal and Y.M.M. Moustafa (2000). Effect of some antioxidant compounds on some horticultural characters of four new F1 hybrids of tomato. J. Agric. Sci. Mansoura Univ., 25 (3): 1673-1692.

Abdel Aziz, M.A (1997). Response of tomato plants to nitrogen fertilizer levels and growth regulators. M. sc. Thesis. Dept of vegetable crops. Faculty of Agric. Cairo Univ. Egypt.

Ben, J. (1986) Colour and pigment changes in the skin of Golden delicious apples after kinetin and Alar treatments. Acta. Hort., 179: 827-828 (C.F. Plant growth Reg. Abst. 13: 459).

Castelfranco, P.A. and S.I. Beale (1983). Chlorophyll biosynthesis recent advances and areas of current interest. Ann. Rev. Plant Phsiol, 34:241-278.

El-Ghamriny, E.A. H.M.E, Arisha and K.A., Nour (1999). Studies on tomato flowering, fruit set, yield and quality in summer season. 1-spraying with Thiamine, Ascorbic Acid and yeast. Zagazig. J. Agric. Res. Vol 26 (5): 1345-1364.

Fathy, E.S.L. and S. Farid (1996). The possibility of using Vitamin Bs and yeast to delay senescence and improve growth and yield of common beans (*Phaseolus vulgaris*, L.). J. Agric. Sci. Mansoura, Univ. 21 (4): 1415-1423.

Fathy, EL.S.L.EL.S ; S. Farid and S.A. EL-Dosouky. (2000). Induce cold tolerance of outdoor tomatoes during early summer season by using adenosine triphosphate (ATP), yeast, Other material and chemical treatments to improve their fruiting and yield. J. Agric. Sci. Mansoura, Univ. 25 (1): 377-401.

Glass, D., and J. Dunlop., (1974). Influence of phenolic acid on ion uptake, plant physiol. 54: 855-858.

Hablbrock, K and D, Scheel, (1989). Physiology and molecular biology of phenylpropanoid metabolism. Ann. Rev. plant physiol. Plant Mol. Biol. 40:347-369.

Harborne, J.B, (1980). Plant phenolics in secondary plant products E.A. Bell. B.N. Charlwood. pp 329-402 Berlin Springer-Verlag 674 pp.

Hewedy, A.M.; M. Hafez, and M.A. Morsy (1996). Response of eggplant to some stimulants and bread yeast. First Egyptian Hungarian Horticultural Kafr EL-Shekh, Egypt, 15-17 Sept.

Kraig. E and J.E. Haber. (1980). Messenger ribonucleic acid and protein metabolism during sporulation of *Saccharomyces cerevisiae*. J. Bacterial., 144: 1098-1112.

Lee, H. and I. Raskin. (1999). Purification, cloning and expression of a Pathogen inducible UDP-glucose:Salicylic acid glucosyltransferase from tabacco. J. Biol. Chem.. 274: 36637-36642.

Lesilie, C.A. and R.J. Romani (1986). Salicylic acid a new inhibitor of ethylene biosynthesis. Plant cell Reptr., 5: 144-146.

Manthe, B., M. Schulz and H. Schnabl. (1992). Effects of salicylic acid on growth and stomatal movements of *Vicia faba*.L,. evidence for salicylic acid metabolization. J. chem.. Ecol. 18: 1525-1539.

Marco Antonio Gutierrez, C; C.T. Lopez and A. Largue. Saavedra, (1998). Effects of salicylic acid on the growth of roots and shoots in soybean. Plant physiol. Biochem. 36 (8) 563-565.

Mekhemar, G.A.A; and A.A, AL-Kahel (2002). Enhancement of growth, modulation and yield of bean plants by soil inoculation with *Saccharomyces cerevisiae*. Bull of Fac. of Agric,-Cairo-Univ; 53 (3) 489-501.

Moustafa, Y.M.M. (1999). Improving the productivity of tomato by producing F1 hybrids and using some antioxidant treatments. Ms thesis in vegetable crop. Dept. Hort. Fac. Agric. EL-Minia Univ. pp. 125.

Muller, K and A.C. Leopold (1966). Correlative aging and transport of P^{32} in com leaves under the influence of kinetin plant, 68; 167-185.

Nagodawithana, W.T. (1991). Yeast technology. Universal foods corporation Milwaukee, Wisconsin. Published by Van Nostrand Reinhold. New York. P. 273.

Natio, K.; S.Nagamo, K, Furye and H. Suzuki (1981). Effect of benzyladenine on RNA and protein synthesis in intact bean leaves at various stages of ageing. Physiol. Plant, 52: 343-348.

Pancheva, T.V., L.P. Popova and A.N. Uzunova (1996). Effect of salicylic acid on growth and photosynthesis in barley plants. J. plant physiol. Vol 149 pp 57-63.

Pierpoint, W.S. (1994). Salicylic acid and its derivatives in plants: medicines, metabolites and messenger molecules. Adv. Bot. Res. 20: 163-235.

Pridham. J.B. (1965) Low molecular weight phenols in higher plants, Annu. Rev. plant physiol. 6: 13-36.

Raskin. I. (1992). Role of salicylic acid in plants. Annu. Rev. plant physiol. Plant Mol. Biol- 43: 439-463.

Schettel. N.L. and N.E. Balke. (1983). Plant growth response to several allelopathic chemical. Weed Sci. 31, 293-298.

Shady, M.A. (1978). The yeasts, Adv. Cour, for Post Grad. St. In Microbiol. pp: 146-247, Agric. Bot. Dept., Fac. of Agric. Mansoura Univ.

Singh G. and M. Kaur. (1980). Effect of growth regulatars on podding and yield of mung bean (*Vigna radiata*. L). Wilczek, Indian. J. plant physiol. 23: 366-370.

Skoog, E and C.O. Miller (1957). Biological action of growth substances Cambridge Univ. press Camb. 1957-2000.

Snedecor, G.W. and W.G. Cochran, (1980). Statistical methods applied to experiments in agriculture and biology 5th ed. Seventh reprinting. The IOWA sate Univ. press. Ames, IOWA, USA.

Spencer, T.F.T.; S.M. Dorothy and A.R.W. Smith (1983). Yeast genetics, Fundamental and applied aspects. pp. 16-18. ISBNO-387-90973-9. Springer-Verlag New York, USA.

Tartoura, E.A.A. (2001). Response of pea plants to yeast extract and two sources of N-Fertilizers. J. Agric. Sci. Mansoura Univ.; 26 (12): 7887-7901.

Warren, H.L. and G.C,Andrew(1966).Measurement of correlation between two variables, field plot technique second printing.PP78-79.

Winkler, A.J.; J.A. Cook; W.M. Kiewer and L.A. Lider (1962). General viticulture Univ. Calf. Press, USA.

Youssef, N.S. (2000). Response of potato plants grown conventionally and in tissue culture to some antioxidant treatments. Ph.D thesis in vegetable crops. Dept. Hort. Fac. Agric. EL Minia Univ. pp 123.

Zhao H.J. X.W. Lin., H.Z, Shi and S.M. Chang. (1995). The regulating effects of phenolic compounds on the physiological characteristics and yiels of soybean. Acta Agron. Sci. 21: 351-355.

دراسة على تأثير الرش بالخميرة وحمض السلسليك والتفاعل بينهما على النمـــو الخضرى ومحصول القرون الخضراء والمحصول البذرى ومكوناتهما للفاصوليا

عامر سليمان سليمان عامر

شعبة بحوث الخضر – معهد بحوث البساتين – مركز البحوث الزراعية

أجريت تجربتان حقليتان بمزرعة بحوث الخضر بقها – محافظة القليوبية فى الموسم الصيفـــى ١٩٩٩ ، ٢٠٠٠ بهدف دراسة تأثير رش نباتات الفاصوليا صنف (برنكـــو) بمحلـــول الخمـــيرة بمعـــدل صفـــر ، ١ جرام/لتر، ٢ جرام/لتر وكذلك الرش بحمض السلسليك بتركيز صفر ، ٥٠ ، ١٠٠ ، ١٥٠ جزء فى المليـــون على صفات النمو الخضرى ومحتوى الأوراق من الكلورفيل ومحصول القرون الخضراء ومكوناته وكذلـــك المحصول البذرى ومكوناته وأيضا وزن ١٠٠ بذرة وكذلك نسبة ومعدل إنبات البذور وقد دلت النتائج علـــى أن الرش بكل من الخميرة بمعدل ٢ جرام/لتر أو حمض السلسليك بتركيز ٥٠ جزء فى المليون كل على حـده وكذلك التأثير المشترك بينهما على النتائج الأتيـــــــــــــة :

١- أدى الرش بالخميرة بمعدل ٢ جرام/لتر وكذلك الرش بحمض السلسليك بتركيز ٥٠ جزء فى المليـــون كـــل على حده إلى زيادة معنوية فى النمو الخضرى فمثلا فى طول النبات – عدد أوراق النبات – مساحة الورقـــة – الوزن الطازج والجاف للنبات مقارنة بالمعاملات الأخرى . كما أدت إلى زيـــادة محتـــوى الأوراق مـــن الكلورفيل .

٢- كما أدى الرش بالخميرة ٢ جرام/لتر أو حمض السلسليك ٥٠ جزء فى المليون منفردين إلى زيادة معنويـــة فى محصول القرون الخضراء فمثلا فى عدد قرون النبات – محصول النبات من القرون –وأيضا محصـــول الفدان .

٣- كما أدى الرش بالخميرة ٢ جرام/لتر أو حمض السلسليك ٥٠ جزء فى المليون منفردين إلى زيادة معنويـــة فى المحصول البذرى/للنبات وكذلك محصول القطعة التجريبية ومحصول الفدان ووزن ١٠٠ بذرة .

٤- لم يتأثر وزن القرن وكذلك نسبة ومعدل إنبات البذور بالرش بالخميرة أو حمض السلسليك سواء منفرديـن أو نتيجة التفاعل المشترك بينهما .

٥- كما أدى التأثير المشترك بينهما إلى زيادة معنوية كبيرة فى النمو الخضرى وكذلك محتوى الكلورفيـــل فـــى الأوراق ومحصول القرون الخضراء ومكوناته وأيضا زيادة المحصول البذرى ومكوناته ووزن ١٠٠ بذرة

٦- كما لوحظ أن التركيزات المرتفعة من حمض السلسليك وهى (١٠٠ ، ١٥٠) جزء فى المليون تؤدى إلـــى إنخفاض تدريجى فى القيم متناسبا مع زيادة التركيز.