J. Plant Production, Mansoura Univ., Vol. 7(11): 1221 - 1231, 2016

Response of Some Snap Bean Cultivars to Foliar Application with some Antioxidant Substances for Increasing Productivity and Quality under Local Environments at Early Summer Season.

Hamaiel, A. F. [1]; M. S. Hamada [2]; M. M. B. Shokr[3] and Eman M. M. Abd-Elrhem[3]
[1]Veg. and Flori. Dept., Fac. Agric., Damietta Univ., Egypt.
[2] Gen. Dept., Fac. Agric., Damietta Univ., Egypt.
[3] Veg. Res. Dept., Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.

ABSTRACT

Two field experiments were carried out at El-Baramoon Research Farm, El-Mansoura Horticulture Research Station, Horticulture Research Institute, Agricultural Research Center, Egypt during the early summer season of 2014 and 2015 to study the effect of some foliar applications, i.e., moringa leaf extract (٥٠ ml/l), yeast extract (25 ml/l), salicylic acid (150 ppm) and ascorbic acid (250 ppm) on vegetative growth, pod yield and quality of snap bean cultivars, i.e. Bronco, Polista and Valentino.The results showed that Valentino cultivar had longest plant height, heaviest fresh and dry weight, largest leaf area and gave the highest pod length, number of pods/plant and pod yield (ton/fed) compared with other cultivars in the two seasons. Whereas, the least one was Bronco cultivar in both season. Moreover, Bronco cultivar was the highest in pod weight, total soluble solids (TSS) and vitamin C in both seasons, meanwhile Polista pods had the highest fiber and titrable acidity contents. Whereas, the least one was Valentino cultivar in both seasons. All foliar applications significantly increased all the studied parameters compared with the control treatment. The superior application was salicylic acid followed by ascorbic acid in both seasons, respectively. From the obtained results, it could be concluded that Valentino cultivar sprayed with salicylic acid at 150 ppm three times, i.e., 15 days after planting and repeated each 15 days interval, respectively collected the highest total pod yield /fed and quality.

Keywords: Snap bean cultivars, salicylic acid, ascorbic acid, moringa leaf extract, yeast extract, growth, pod yield, quality.

INTRODUCTION

Snap bean (*Phaseolus vulgaris* L) is one of the most important vegetable crops in Egypt for both local consumption and exportation. It is one of the most important food crops in Egypt and consumed as a cooked vegetable either as dry seeds or green pods. It plays an important role in human nutrition as a cheap source for protein, carbohydrates, vitamins and minerals. Many investigations indicated that bean plants are very sensitive to chilling, drought and heat stress (Dale, 1964, singer *et al.*, 1996 and El-Tohamy *et al*., 1999). However, bean plants are relatively sensitive to environmental stresses that may occur in the field compared with most vegetable crops which negatively affect its growth, yield and even the quality of pods. Under such stressful environmental conditions and the consequences of exposure to relatively low temperature, reduction in yield and different performances could be expected (Buis *et al*., 1988, Fryer *et al*., 1995, Greaves, 1996 and Haldiman, 1998). The degree of plant tolerance to environmental stress varies greatly not only between species but in different varieties of the same species (Wentworth *et al*., 2006). Hence, improving tolerance of bean plants to the possible environmental stresses by using different treatments is important to enhance its growth and maximize the yield. Antioxidants such as salicylic acid, ascorbic acid and some natural materials such as yeast extract and moringa leaf extract act as cofactors for some enzymes, i.e., dismutases, cataleses and peroxidases those catalyzed break down of the toxic H_2O_2, OH, O_2 radicals (Romheld and Marschner, 1991 and Bowler *et al*., 1992).

Moringa leaf extract is known as a miracle plant due to its multiple uses. Beign, rich in amino acids, ascorbate, zeatin (cytokinins), minerals and many other compounds, moringa has several applications in agriculture and medical sciences. Secondary metabolites isolated from this plant promote the plant growth and defense mechanisms against abiotic stresses. Moringa extracts accelerate the growth of plants, strengthen plants and improve resistance against pests and diseases (Hussain *et al*., 2013).

Yeast is natural source of cytokinins and has stimulatory effects on bean plants (Amer, 2004).It has 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. In addition, it participates in a beneficial role during stress due its cytokinins content (Barnett *et al*., 1990).

Ascorbic acid (vitamin C) plays an important role in photosynthesis as an enzymes co-factor including synthesis of gibberellins, abscisic acid, ethylene and anthocyanin and control of cell growth (Smirnoff and Wheeler, 2000). Also, it's a good scavenger of activated oxygen as O_2, OH, $^1O_2$ and reducing hydrogen peroxide (H_2O_2) to water via ascorbate peroxidase reaction (Bodannes and Chan, 1979 and Noctor and Foyer, 1998), as well as, enhancing the accumulation of chlorophyll and delay senescence (Mattagajasingh and Kar, 1989 and Novabour *et al*., 2003).

Salicylic acid (SA) is a phenolic derivative, distributed in a wide range of plant species. It is classified as phenolic growth regulator, a non-enzymatic antioxidant, a signaling or messenger molecule in plants to induce responses of plants to environmental stresses. SA has direct involvement in plant growth, thermogenesis, flower induction and uptake of ions. It affects ethylene biosynthesis, stomata movement and also reverses the effects of ABA on leaf abscission. It has an important role in enhancement the level of chlorophyll and carotenoid pigments, photosynthetic rate and modifying the activity of some important enzymes (Abdel-Ati *et al*., 2000 and Galal *et al*., 2000). Thereby, the present study aimed to use some natural compounds, i.e., moringa leaf, yeast extracts and promotive substances, i.e., ascorbic and salicylic acids as antioxidant substances to improve growth, yield and quality of some snap bean cultivars grown under the early summer season conditions.

MATERIALS AND METHODS

Two field experiments were carried out at El-Baramoon Research Farm, El-Mansoura Horticulture Research Station, Horticulture Research Institute, Agricultural Research Center, Egypt during the early Summer season of 2014 and 2015 to study the effect of some foliar applications, i.e., moringa leaf extract, yeast extract, salicylic acid and ascorbic acid on vegetative growth, pod yield and quality of snap bean cultivars, i.e., Polista, Valentino and Bronco.

The experimental design and treatments:

The experimental layout was split plot system in a randomized complete blocks design with three replicates. These experiments include 15 treatments which were the combination among 3 cultivars and 5 foliar applications. The cultivars were randomly arranged in the main plots, while the foliar applications were randomly distributed in the sub plots. The sub plot area was 10.5 m^2 (3 ridges, each 5 m long and 70 cm width). Seeds of the tested cultivars were sown at the first and second week of February in the first and second season, respectively and thinned on two plants/hill after germination. The treatments were arranged as follow:a. Snap bean cultivars: Polista, Valentino and Bronko. b. Foliar applications: Moringa leaf extract at 50 ml/L, yeast extract at 25ml/L., salicylic acid at 150 ppm/L, ascorbic acid at 250 ppm/L and control (sprayed with tap water). Moringa leaf extract prepared according to Culver *et al*. (2012). Plants of aforementioned cultivars were sprayed three times (15, 30 and 45 days) after planting. Normal agricultural practice of snap bean production was followed according to the recommendations of Egyptian ministry of agriculture.

Data recorded were as follows:

Vegetative growth:

At 55 days after sowing, five plants were randomly marked from each plot for determining the following data: plant height in cm, leaf area according to Koller (1972) and plant fresh and dry weight in gram.

Pod yield and its components:

Ten plants were randomly marked from each plot for determining the number of pods/plant.

Green pods of each plot were harvested at the proper maturty stage, counted and weighted in each harvest and total fresh pod yield (ton /fed.) was determined. Twenty pods were randomly chosen from each treatment to determine; average weight of pod (gm), pod length (cm) and pod diameter (mm).

Chemical composition of leaves:

A random representative samples of dried foliage from each plot were taken at 55 days after sowing to determine; nitrogen (%) by the method described by Plummer (1978), phosphorus (%) according to the method of Jackson (1958) and potassium (%) using flame photometer according to Piper (1950). Chlorophyll contents were determined according to Lichtenthaler and Wellburn (1983).

Chemical composition of pods:

Randomly samples of pods from each treatment were taken to assay the following characters: Total soluble solids (TSS) was determined by Carl zeiss refractometer, vitamin C (mg/100gf.w.) was determined in juice using 2, 6 dicholorophenol indophenol dye according to A.O.A.C (1990) and titrable acidity (%) was determined by the titration method with 0.1 N sodium hydroxide according to A.O.A.C (1990). Crude fibers were determined as percentage according to Maynard (1970).

Statistical analysis:

All collected data on plot basis were subjected to the statistical analysis according to the method mentioned by Snedecor and Cochran (1968). Data of treatment means were compared using least significant difference (LSD) method as mentioned by Gomez and Gomez (1984) at 5% significance level. All statistical analyses were performed using analysis of variance technique by means of CoStat computer software.

RESULTS AND DISCUSSION

Vegetative growth characters:

Effect of cultivars:

The effect of the three snap bean cultivars on vegetative growth characters, i.e., plant height, leaf area and fresh and dry weights presented in table (1). Such data clearly showed that snap bean cultivars (Valentino, Polista and Bronko) significantly differed in previous studied parameters in both seasons of the study except fresh and dry weight for polista and bronco cvs. In the first season only.

Valentino cultivar recorded the highest values of plant height, leaf area, fresh weight and dry weight in both seasons. Meanwhile, the lowest values of above parameters were noticed with Bronko cv. in both seasons. The differences between snap bean cultivars in vegetative growth parameters refer to their variations in genetic habitat and responses to environmental conditions. Our results are supported by many researchers, i.e., Abdel-Mawgoud *et al.* (2005), Wentworth *et al*. (2006) and Shokr and Fathy (2009), they found that snap bean cultivars differed significantly in their vegetative growth aspects.

Effect of foliar applications:

Data presented in table (1) show the effect of foliar applications, i.e., salicylic acid, ascorbic acid and yeast and moringa leaf extracts on plant height, leaf area and fresh and dry weight of snap bean. The obtained results clearly indicated that all foliar treatments increased the values of vegetative growth habits compared with control treatment in the two growing seasons.

Salicylic and ascorbic acid treatments recorded the highest values of plant height leaf area, fresh weight and dry weight in both seasons compared with yeast and moringa extract treatments. The control plants registered the lowest values of mentioned growth parameters in the two growing seasons.

Table 1. Effect of snap bean cultivars and foliar applications on plant height, leaf area and fresh and dry weight during 2014 and 2015 seasons.

Treatments		Plant height (cm)		Leaf area (cm^2)		Fresh weight (gm)		Dry weight (gm)	
		2014	2015	2014	20145	2014	2015	2014	2015
Cvs	Polista	34.93	35.80	1065.04	1099.68	38.55	45.18	6.99	8.16
	Valentino	35.96	37.40	1098.00	1109.28	41.18	47.68	7.64	9.27
	Bronko	33.93	34.53	1049.65	1070.80	37.04	43.11	6.71	7.51
LSD at 0.05 %		0.272	0.684	8.295	23.010	1.552	1.623	0.447	0.258
Foliar	Salicylic	38.38	38.88	1118.60	1149.40	45.60	52.50	8.61	10.30
	Ascorbic	36.00	37.11	1085.31	1119.73	39.68	48.74	7.48	9.45
	Yeast	34.33	35.33	1062.24	1068.95	37.53	43.06	6.61	7.46
	Moringa	34.22	35.33	1073.70	1101.84	37.33	44.40	6.67	8.01
	Control	31.77	32.55	1017.56	1026.35	34.47	37.91	6.18	6.34
LSD at 0.05 %		0.648	0.575	10.209	17.762	0.634	1.081	0.166	0.210

In general, all foliar treatments significantly improved all studied vegetative growth parameters compared with untreated plants. Similar results were obtained by Shafeek *et al*. (2014), Abdel Azem *et al.* (2015) and Rady *et al*. (2015) for salicylic acid,Abd El-Dayem *et al*. (2015) and Barakat *et al*. (2015) for ascorbic acid, Emongor (2015), Rady *et al*. (2015) and Zaki and Rady (2015) for moringa leaf extract and Abdel-Hkim *et al*. (2012) and Mohamed *et al*. (2013) for yeast extract.

The beneficial effects of salicylic acid (SAon growth may be due to its essential role in the regulation of plant growth, development and interaction with other organisms and it was called a plant hormone (Harborne, 1980 and Raskin, 1992). Indeed, it has a beneficial effect for catching the abundant reactive oxygen species (ROS) that cause senescence and loss of plasma membrane permeability and death of cells within plant tissues (Bodannes and Chan, 1979), a signal transduction or messenger (Klessing and Malamy, 1994) and a growth regulator which participates in the regulation of physiological processes in plants (Umebese *et al*., 2009).

The effect of ascorbic acid on snap bean growth can be discussed on the ground that ascorbic acid seems to enhance biosynthesis of soluble sugars and carbohydrates which are vital steps in stepping up plant tissues (Rady, 2006). Moreover, ascorbic acid has auxinic effect and protects plant cells against free radicals that are responsible for plant senescence (Prusky, 1988 and Elade, 1992) and has effectual role in many metabolic and physiological processes (Shadded *et al*., 1990).

As for moringa leaf extract, its favorable effect on vegetative growth of snap bean might be due to its role as a plant growth stimulator, which it being a rich source of amino acids, essential macro and micro plant nutrients, vitamins, natural antioxidants and plant growth regulators such as zeatin (cytokinins) and gibberellins, it can be effectively exploited as plant growth enhancer (Mahmood *et al*., 2010 and Basra *et al*., 2011). Moreover, moringa leaf extract accelerate the growth of plants, strengthen plants and improve resistance against pests and diseases (Hussain *et al*., 2013). In this contest, Emongor (2015) reported that cytokinins in moringa leaf extract have a role in reducing the plastochron and /or increasing cell division of snap bean plants.

As for the positive effects of yeast extract, it contains different amounts of nutrients, high percentage of protein, considerable amount of vitamin B and natural plant growth regulators such as cytokinins (Nagodawithana, 1991). In addition to the physiological roles of vitamins and amino acids in the yeast extract

which increase the metabolic processes role and levels of endogenous hormones that may promote the vegetative growth parameters.

Effect of interaction between cultivars and foliar applications:

Data presented in table (2) show the effect of interaction between snap bean cultivars and foliar applications on plant height, leaf area and fresh and dry weight characters during 2014 and 2015 seasons.

It is obviously that the combinations between snap bean cultivars and foliar applications were significantly differed in the two seasons of study, except fresh weight in the second season. However, spraying Valentino plants with salicylic acid recorded the highest means of plant height, leaf area, fresh weight and dry weight in the two seasons, respectively.

Pod yield and its components

Effect of cultivars:

Data in table (3) indicated that all studied cultivars significantly differed in pod yield and its characters in both seasons, except pod length in both seasons of the study. Bronko cultivar registered the highest values of pod length (11.73 and 11.86 cm) and pod weight (6.02 and 6.24 gm) in both seasons while Valentino cultivar recorded the highest values of pod diameter (7.33 and 7.83 mm) in both seasons, respectively. On the other hand the lowest values of pod length (11.13 and 11.53 cm), pod diameter (6.30 and 6.74 mm) and pod weight (4.43 and 4.88 gm) were noticed by Polista cv. in 2014 and 2015 seasons, respectively. As for pod yield, the results illustrated that the highest values of number of pods/plant (14.26 and 16.33) and total pod yield (4.489 and 4.655 ton/fed.) were collected by Valentino cultivar while the lowest (12.80 and 14.53) and (4.32 and 4.48 ton/fed.) were recorded with Bronko cultivar in both seasons, respectively. Although Bronko cv. had the highest values of pod weight, but it recorded the lowest total pod yield because of its less number of pods/plant compared with Valentino and Polista cvs. The differences between cultivars in yield per feddan (table, 3) as a result of their variation in the vegetative growth (table, 1). Such results were noticed by Abdel-Mawgoud *et al*. (2005) and Brunner *et al*. (2014).

Table 2. Effect of interaction between snap bean cultivars and foliar applications on plant height, leaf area and fresh and dry weight during 2014 and 2015 seasons.

Treatments		Plant height (cm)		Leaf area (cm^2)		Fresh weight (gm)		Dry weight (gm)	
		2014	2015	2014	2015	2014	2015	2014	2015
Cvs × Foliar									
Polista	Salicylic	38.33	39.00	1104.50	1133.23	44.26	52.26	8.46	10.16
	Ascorbic	36.33	37.00	1073.73	1127.93	39.23	48.90	7.43	9.43
	Yeast	34.66	36.33	1062.03	1099.90	37.26	43.06	6.63	7.46
	Moringa	34.00	34.66	1064.33	1102.33	37.26	43.43	6.26	7.26
	Control	31.33	32.00	1023.93	1035.00	34.73	38.23	6.16	6.46
Valentino	Salicylic	39.16	40.33	1159.20	1186.46	51.13	55.13	9.26	11.16
	Ascorbic	36.00	38.33	1119.40	1144.50	41.20	49.93	7.96	10.36
	Yeast	35.66	36.33	1078.63	1058.60	38.90	46.00	7.10	8.43
	Moringa	35.33	37.66	1098.06	1115.46	38.10	47.70	7.40	9.56
	Control	33.66	34.33	1038.50	1041.40	36.56	39.63	6.46	6.83
Bronko	Salicylic	37.66	37.33	1092.10	1128.50	41.40	50.11	8.10	9.56
	Ascorbic	35.66	36.00	1062.80	1086.76	38.63	47.40	7.06	8.56
	Yeast	32.66	33.33	1046.06	1048.36	36.43	40.13	6.10	6.50
	Moringa	33.33	33.66	1058.70	1087.73	36.63	42.06	6.36	7.20
	Control	30.33	31.33	990.26	1002.66	32.13	35.86	5.93	5.73
LSD at 0.05 %		1.123	0.996	17.683	30.764	1.098	NS	0.288	0.364

Table (3): Effect of snap bean cultivars and foliar applications on pod length, pod diameter, pod weight, number of pods/plant and total pod yield/fed during 2014 and 2015 seasons.

Treatments		Pod length (cm)		Pod diameter (mm)		Pod weight (gm)		Number of pods/plant		Total pod yield (ton/fed.)	
		2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Cvs	Polista	11.13	11.53	6.30	6.74	4.43	4.88	13.53	15.33	4.385	4.556
	Valentino	11.70	11.80	7.33	7.83	5.67	5.94	14.26	16.33	4.489	4.655
	Bronko	11.73	11.86	7.09	7.66	6.02	6.24	12.80	14.53	4.324	4.486
LSD at 0.05 %		NS	NS	0.099	0.075	0.214	0.217	0.261	0.692	0.018	0.020
Foliar	Salicylic	12.00	12.22	7.25	7.81	5.81	6.21	14.77	16.66	4.643	4.834
	Ascorbic	11.83	12.11	7.27	7.81	5.47	5.82	14.00	15.88	4.510	4.675
	Yeast	11.77	11.88	6.91	7.47	5.33	5.57	13.33	15.22	4.342	4.532
	Moringa	11.22	11.55	7.00	7.45	5.20	5.55	13.44	15.33	4.386	4.587
	Control	10.77	10.88	6.10	6.52	5.06	5.26	12.11	13.88	4.116	4.199
LSD at 0.05 %		0.461	0.416	0.231	0.198	0.167	0.155	0.464	0.441	0.037	0.035

Effect of foliar applications:

The effect of foliar applications with salicylic and ascorbic acids and yeast and moringa leaf extracts on yield and its components of snap bean is presented in table (3). It is obvious from the obtained results that all foliar applications increased all studied parameters, i.e., pod length, pod diameter, pod weight, number of pods/plant and total pod yield/feddan compared with the control in both seasons. Spraying snap bean plants with salicylic acid gave the best results as for pod length (12.00 and 12.22 cm), pod weight (7.25 and 7.81 gm), number of pods/plant (14.77 and 16.66) and total pod yield (4.643 and 4.834 ton/fed.) in both seasons, respectively followed by ascorbic acid while control plants recorded the lowest values in the two seasons of the study. Add to that, ascorbic acid treatment gave the highest values of pod diameter (7.50 and 7.52 cm) and the control plants recorded the lowest values with (7.30 and 6.83 mm) in both seasons, respectively.

These results are in agreement with those obtained with Shokr *et al*. (2014), Abdel Azem *et al.* (2015) and Rady *et al*. (2015) for salicylic acid, Abd El-Dayem *et al*. (2015) and Barkat *et al*. (2015) for ascorbic acid, Emongor (2015) and Zaki and Rady (2015) for moringa leaf extract and Abdel-Hkim *et al*. (2012), Dawa *et al.* (2014) and Khattab *et al*. (2015) for yeast extract.

The stimulatory influence of spraying salicylic acid on yield may be due to its bioregulator effect on ion uptake, cell elongation, cell division, cell differentiations and sink and source regulation, protein synthesis and photosynthetic activity (Blokhina *et al*., 2003 and El-Tayeb, 2005). Moreover, SA increases flower longevity via inhibition of ethylene production (Lesilie and Romani, 1986).

Concerning, ascorbic its effect acid on snap bean yield may be due to its role in the regulation of photosynthesis, enhancing cell division and expansion, root elongation and trans-membranne electron transport (Smirnoff, 2000).

Regarding the positive effect of moringa leaf extract on yield, it might be connected with the role of plant growth regulators in improving crop growth and hence yield (Muhamman *et al*., 2013). Moreover, it contains endogenous cytokinins (zeatin, dihydrozeatin and isopentyladenine) which affect assimilate mobilization and /or distribution and increase pod set and pod number per branch in leguminous crops (Emongor, 2015).

As for yeast, it participate a 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).

Effect of interaction between cultivars and foliar applications:

Table (4) shows the effect of interaction between snap bean cultivars and foliar applications on pod length, pod diameter, pod weight, number of pods/plant and total pod yield/feddan of snap bean. It is clear from the previous table that all combinations between cultivars and foliar applications recorded significant differences in all pod yield parameters, except pod weight in the first season and pod length and number of pods/plant in both seasons. Spraying Valentino cv. plants with salicylic acid produced the highest values of pod length, pod weight, number of pods/plant and total pod yield per feddan meanwhile spraying the same cultivar with ascorbic acid gave the highest pod diameter value in both seasons. Moreover, the lowest values of pod length, pod diameter, pod weight, number of pods/plant and total pod yield/fed. were recorded with untreated Polista cv. plants.

Table 4. Effect of interaction between snap bean cultivars and foliar applications on pod length, pod diameter, pod weight, number of pods/plant and total pod yield/fed during 2014 and 2015 seasons.

Treatments		Pod length (cm)		Pod diameter (mm)		Pod weight (gm)		Number of pods/plant		Total pod yield (ton/fed.)	
		2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
Cvs × Foliar											
Polista	Salicylic	11.33	12.00	6.70	7.36	4.96	5.60	١٤.٦٦	١٦.٣٣	4.623	4.810
	Ascorbic	11.33	11.66	6.93	7.13	4.60	4.93	١٤.٣٣	١٦.٠٠	4.510	4.673
	Yeast	11.66	11.66	5.93	6.63	4.16	4.90	١٣.٣٣	١٥.٣٣	4.370	4.576
	Moringa	11.00	11.66	6.16	6.43	4.36	4.70	١٣.٣٣	١٥.٣٣	4.323	4.550
	Control	10.33	10.66	5.76	6.16	4.06	4.26	١٢.٠٠	١٣.٦٦	4.100	4.170
Valentino	Salicylic	12.33	12.33	7.53	8.03	6.10	6.33	١٥.٦٦	١٨.٠٠	4.760	4.950
	Ascorbic	12.16	12.33	7.63	8.26	5.83	6.16	١٤.٦٦	١٦.٦٦	4.570	4.750
	Yeast	11.66	12.00	7.53	7.93	5.50	5.73	١٤.٠٠	١٦.٠٠	4.380	4.543
	Moringa	11.33	11.33	7.50	8.00	5.60	5.80	١٤.٣٣	١٦.٣٣	4.543	4.733
	Control	11.00	11.00	6.46	6.93	5.35	5.66	١٢.٦٦	١٤.٦٦	4.193	4.301
Bronko	Salicylic	12.33	12.33	7.53	8.03	6.36	6.70	١٤.٠٠	١٥.٦٦	4.546	4.743
	Ascorbic	12.0	12.33	7.26	8.03	6.00	6.36	١٣.٠٠	١٥.٠٠	4.450	4.603
	Yeast	12.00	12.00	7.26	7.86	5.93	6.10	١٢.٦٦	١٤.٣٣	4.276	4.476
	Moringa	11.33	11.66	7.33	7.93	6.03	6.16	١٢.٦٦	١٤.٣٣	4.293	4.480
	Control	11.00	11.00	6.06	6.46	5.76	5.86	١١.٦٦	١٣.٣٣	4.056	4.126
LSD at 0.05 %		NS	NS	0.401	0.343	NS	0.290	NS	NS	0.064	0.061

Chemical composition:

Chemical composition of leaves:

Effect of cultivars:

Data in Tables (5 and 6) show the effect of cultivars on leaves content of N, P and K percentages and chlorophyll a and b and total chlorophyll during 2014 and 2015 seasons. Concerning N, P and K, it is obviously from table (5) that all studied snap bean cultivars differed and Valentino cv. registered the highest amount of leaf N, P and K followed by Polista and Bronko cvs., respectively in both seasons. As for chlorophyll a and b and total chlorophyll, the data in table (6) showed that the differences among cultivars were significant in all previous parameters in both seasons. Valentino cv. outclassed other cultivars in all studied chlorophyll pigments in 2014 and 2015 seasons while Bronko cv. was the least one. Similar results were obtained by Hendawey and Younes (2013).

Effect of foliar applications:

Tables (5 and 6) show the effect of foliar applications on leaves content of N, P and K percentages and chlorophyll a, b and total chlorophyll during 2014 and 2015 seasons. Our results in table (5) indicated that plants sprayed with all studied foliar applications, i.e., antioxidants such as salicylic and ascorbic acids and some natural substances such as yeast and moringa leaf extracts increased leaves content of N, P and k percentages in both seasons of study compared with untreated plants.

Table 5. Effect of snap bean cultivars and foliar applications on leaves content of N, K and K percentages during 2014 and 2015 seasons.

Treatments		N (%)		P (%)		K (%)	
		2014	2015	2014	2015	2014	2015
Cvs	Polista	3.22	3.24	0.39	0.40	1.17	1.21
	Valentino	3.25	3.26	0.40	0.42	1.22	1.23
	Bronko	3.21	3.22	0.36	0.37	1.17	1.19
LSD at 0.05 %		0.006	0.040	0.008	0.007	0.131	0.031
Foliar	Salicylic	3.30	3.33	0.41	0.43	1.25	1.26
	Ascorbic	3.29	3.30	0.41	0.43	1.23	1.24
	Yeast	3.29	3.30	0.39	0.40	1.21	1.23
	Moringa	3.29	3.29	0.40	0.41	1.22	1.24
	Control	2.96	2.98	0.32	0.33	1.01	1.08
LSD at 0.05 %		0.006	0.006	0.008	0.010	0.134	0.029

Table 6. Effect of snap bean cultivars and foliar applications on leaves content of chlorophyll a and b and total chloropyll during 2014 and 2015 seasons.

Treatments		Chlorophyll a (mg/gf.w.)		Chlorophyll b (mg/gf.w.)		Total Chlorophyll (mg/gf.w.)	
		2014	2015	2014	2015	2014	2015
Cvs	Polista	1.30	1.32	0.49	0.51	1.79	1.83
	Valentino	1.33	1.34	0.51	0.51	1.84	1.86
	Bronko	1.25	1.26	0.48	0.49	1.74	1.76
LSD at 0.05 %		0.013	0.020	0.003	0.009	0.016	0.019
Foliar	Salicylic	1.36	1.37	0.57	0.58	1.93	1.95
	Ascorbic	1.32	1.34	0.54	0.54	1.86	1.88
	Yeast	1.29	1.31	0.48	0.49	1.78	1.81
	Moringa	1.30	1.31	0.48	0.49	1.79	1.81
	Control	1.18	1.21	0.40	0.41	1.58	1.63
LSD at 0.05 %		0.014	0.016	0.005	0.006	0.015	0.019

However, the dimention order of obtained results were, salicylic acid, ascorbic acid, moringa leaf extract, yeast extract and control, respectively in both seasons. Regarding chlorophyll a, b and total chlorophyll, table (6) explained that all studied foliar treatments had significant effect on previous parameters compared with control in both seasons. Spraying snap bean plants with salicylic acid recorded the highest content of leaf pigments followed by, ascorbic acid, moringa extract and yeast extract, respectively in both seasons, meanwhile the control treatment recorded the lowest contents of these pigments. Similar results were noticed by Nour *et al*. (2012) and Abdel Azem *et al.*(2015) for salicylic acid, Dawa *et al.* (2014) and Abd El-Dayem *et al*. (2015) for ascorbic acid, Emongor (2015) and Zaki and Rady (2015) for moringa leaf extract and Abido and Seadh (2014) and Khattab *et al*. (2015) for yeast extract.

Effect of interaction between snap bean cultivars and foliar applications:

Tables (7 and 8) show the effect of interaction between snap bean cultivars and foliar applications on leaves content of N, P and K percentages and chlorophyll a, b and total chlorophyll during 2014 and 2015 seasons. Spraying Valentino cv. with salicylic acid recorded the highest values of N, P, K and chlorophyll a, chlorophyll b and total chlorophyll contents in both

seasons, except P content in second season, in which sprayed Valentino cv. with ascorbic acid came in the first place. The control plants of Bronko cv. recorded the lowest values in all studied characters.

Table 7. Effect of interaction between snap bean cultivars and foliar applications on leaves content of N, P and K percentages during 2014 and 2015 seasons.

Treatments		N (%)		P (%)		K (%)	
		2014	2015	2014	2015	2014	2015
Cvs × Foliar							
	Salicylic	3.29	3.34	0.40	0.40	1.26	1.26
	Ascorbic	3.29	3.30	0.38	0.39	1.22	1.23
Polista	Yeast	3.28	3.31	0.38	0.38	1.20	1.23
	Moringa	3.28	3.29	0.37	0.38	1.20	1.23
	Control	2.96	2.99	0.29	0.30	0.99	1.10
	Salicylic	3.34	3.36	0.44	0.46	1.27	1.28
	Ascorbic	3.32	3.33	0.44	0.47	1.25	1.25
Valentino	Yeast	3.30	3.31	0.38	0.39	1.23	1.25
	Moringa	3.31	3.32	0.43	0.44	1.24	1.25
	Control	2.98	3.00	0.34	0.35	1.10	1.15
	Salicylic	3.28	3.29	0.41	0.43	1.24	1.25
	Ascorbic	3.28	3.29	0.41	0.42	1.23	1.23
Bronko	Yeast	3.28	3.28	0.41	0.42	1.22	1.23
	Moringa	3.27	3.27	0.40	0.41	1.22	1.25
	Control	2.94	2.95	0.33	0.33	0.95	0.99
LSD at 0.05 %		0.010	0.011	0.014	0.007	0.023	0.050

Chemical composition of pods:

Effect of cultivars:

Results in table (9) show the effect of cultivars on pod quality characters, i.e., vitamin C, total soluble solids (TSS), acidity and fiber. Same data declared that all cultivars were differed in all studied parameters.

Table 8. Effect of interaction between snap bean cultivars and foliar applications on leaves content of chlorophyll a and b and total chlorophyll during 2014 and 2015 seasons.

Treatments		Chlorophyll a (mg/gf.w.)		Chlorophyll b (mg/gf.w.)		Total Chlorophyll (mg/gf.w.)	
		2014	2015	2014	2015	2014	2015
Cvs × Foliar							
	Salicylic	1.37	1.39	0.58	0.58	1.96	1.98
	Ascorbic	1.34	1.35	0.55	0.56	1.90	1.92
Polista	Yeast	1.30	1.33	0.48	0.50	1.79	1.83
	Moringa	1.31	1.33	0.45	0.47	1.77	1.81
	Control	1.15	1.22	0.41	0.41	1.56	1.64
	Salicylic	1.39	1.40	0.58	0.59	1.98	1.99
	Ascorbic	1.35	1.36	0.55	0.56	1.90	1.92
Valentino	Yeast	1.34	1.37	0.50	0.51	1.84	1.88
	Moringa	1.34	1.35	0.49	0.50	1.84	1.85
	Control	1.22	1.22	0.40	0.41	1.63	1.64
	Salicylic	1.32	1.33	0.54	0.56	1.87	1.90
	Ascorbic	1.28	1.29	0.51	0.51	1.79	1.81
Bronko	Yeast	1.23	1.25	0.47	0.47	1.71	1.73
	Moringa	1.24	1.25	0.51	0.51	1.76	1.76
	Control	1.16	1.20	0.40	0.40	1.56	1.60
LSD at 0.05 %		0.025	0.029	0.010	0.010	0.016	0.033

It is clear from the table (9) that the highest values of vitamin C were obtained from Bronko cv. pods and the highest values of total soluble solids were determined in Valentino cv. pods while Polista cv. pods recorded the lowest values of vitamin C and total soluble solids in both seasons. On the other hand, the highly acidity and fiber contents were Polista and Bronko cvs. Pods and the lowest in acidity and fiber content was Valentino pods in both seasons. The differences among cultivars in their pod quality are a result of their variation in growth, ion uptake and responses to other environmental conditions. In this contest, Abdel-Mawgoud *et al.* (2005) reported that snap bean cultivars differed in their pod quality.

Effect of foliar applications:

The effect of salicylic and ascorbic acids and moringa leaf and yeast extracts foliar applications on chemical compositions of pods, i.e., vitamin C, total

soluble solids, acidity and fiber contents is presented in table (9). Such results revealed that all foliar applications significantly increased total soluble solids (TSS) and vitamin C, meanwhile decreased acidity and fiber contents compared with control in both seasons. Pods of the plants treated with ascorbic acid and salicylic acid took the first place for vitamin C and TSS contents, respectively and the least was pods of untreated plants in which acidity and fiber contents increased.

Table 9. Effect of snap bean cultivars and foliar applications on pods content of vitamin C, acidity, total soluble solids and fiber during 2014 and 2015 seasons.

Treatments		Vitamin C (mg/100gf.w.)		TSS (%)		Acidity (%)		Fiber (%)	
		2014	2015	2014	2015	2014	2015	2014	2015
	Polista	9.50	9.82	4.88	5.30	0.431	0.405	5.92	5.72
Cvs	Valentino	9.96	10.57	5.76	5.94	0.360	0.352	4.52	4.43
	Bronko	11.50	12.25	5.50	5.70	0.381	0.364	7.07	6.58
LSD at 0.05 %		0.276	0.278	0.454	0.232	0.005	0.017	0.032	0.119
	Salicylic	10.73	11.44	5.88	6.32	0.345	0.345	5.42	5.19
	Ascorbic	10.97	11.67	5.63	5.83	0.368	0.351	5.98	5.69
Foliar	Yeast	10.60	11.00	5.33	5.44	0.386	0.364	5.38	5.04
	Moringa	10.58	10.82	5.33	5.58	0.391	0.374	5.77	5.60
	Control	8.71	9.46	4.72	5.05	0.453	0.434	6.63	6.36
LSD at 0.05 %		0.202	0.232	0.339	0.378	0.008	0.007	0.073	0.083

About acidity and fiber contents, pods of control plants recorded the highest values in both seasons compared with other treatments, whereas pods of plants sprayed with salicylic acid recorded the lowest values in both seasons. These results are similar to that recorded by Shokr and AbdElhamid (2009) and Shokr *et al.* (2014) for salicylic acid, Abd El-Dayem *et al*. (2015) and Barkat *et al*. (2015) for ascorbic acid, El-Sherbini (2015) for moringa leaf extract and Shokr and AbdElhamid (2009) for yeast extract.

The favorable effect of salicylic acid on pod quality may be due to its influence on physiological and biochemical processes including, photosynthesis, ion uptake, membrane permeability, enzyme activities, flowering, energy production and growth and development of plants (Arberg, 1981). The synergistic effect of ascorbic acid on leaf total chlorophylls content may be attributed to its major role in increasing its endogenous concentrate on which regulate and protect photosynthetic processes (Farago and Brunhold, 1994)and in turn probably led to more synthesis of pigments including total chlorophylls and carotenoids content. Moreover, the enhancing effect of ascorbic acid on pod quality probably related to its major role in multivarious metabolic processes such as photosynthesis and regulating co-enzymatic reactions by which carbohydrates and proteins are metabolized (Barakat *et al*., 2015).

The positive effect of moringa leaf extract on pod quality of snap bean might be due to its content of cytokinins, which facilitates the mobilization of nutrients to the pods and vitamins A, B (1, 2, 3, 6 and 7), C, D, E and K, minerals include calcium, copper, iron, potassium, magnesium, manganese and zinc and more than 40 natural antioxidants (Makkar and Becker, 1996, Mahmood *et al*., 2010 and Kumari *et al*., 2011). The enhancement effect of yeast extract on N, P and K may be attributed to

its stimulatory effects on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (El- Desouky *et al*.,1998 and Wanas, 2006), in addition to its content of cryo protective agent, i.e. sugars, protein, amino acids and also several vitamins (Mahmoud, 2001).

Effect of interaction between snap bean cultivars and foliar applications:

The effect of interaction between snap bean cultivars and foliar applications on total soluble solids (TSS), vitamin C, acidity and fiber contents of snap bean pods is shown in table (10). It is obvious that the interaction treatments recorded differences in all studied parameters, except TSS in both seasons and acidity in the first season. Regarding vitamin C and TSS contents in pods, Valentino cv. plants treated with ascorbic and salicylic acids recorded the highest values, respectively in both seasons while Polista cv. untreated plants recorded the lowest values.

Moreover, acidity and fiber contents of pods were highly in Polista cv. untreated plants, whereas Valentino cv. plants received salicylic acid recorded the lowest values in both seasons. From the obtained results, it could be concluded that Valentino cultivar sprayed with salicylic acid at 150 ppm three times, i.e., 15 days after planting and repeated each 15 days interval, respectively collected the highest total yield /fed.

Table 10. Effect of interaction between snap bean cultivars and foliar applications on pods content of vitamin C, acidity, total soluble solids and fiber during 2014 and 2015 seasons.

Treatments		Vitamin C (mg/100gf.w.)		TSS (%)		Acidity (%)		Fiber (%)	
		2014	2015	2014	2015	2014	2015	2014	2015
Cvs × Foliar									
	Salicylic	9.83	10.13	5.33	5.83	0.389	0.370	5.34	5.29
	Ascorbic	10.00	10.40	5.06	5.33	0.400	0.374	6.03	5.66
Polista	Yeast	9.73	10.00	5.00	5.33	0.431	0.392	5.46	5.18
	Moringa	9.86	9.96	5.00	5.33	0.433	0.408	5.66	5.54
	Control	8.06	8.60	4.00	4.66	0.502	0.484	7.10	6.92
	Salicylic	10.30	11.006	6.33	6.80	0.328	0.321	4.26	4.20
	Ascorbic	10.50	11.26	6.00	6.16	0.347	0.332	4.69	4.56
Valentino	Yeast	10.23	10.53	5.66	5.66	0.353	0.350	3.89	3.83
	Moringa	10.06	10.33	5.66	5.75	0.360	0.356	4.56	4.50
	Control	8.70	9.66	5.16	5.33	0.413	0.402	5.20	5.05
	Salicylic	12.06	13.13	6.00	6.33	0.346	0.345	6.66	6.09
	Ascorbic	12.43	13.36	5.83	6.00	0.359	0.348	7.21	6.85
Bronko	Yeast	11.83	12.46	5.33	5.33	0.375	0.350	6.80	6.10
	Moringa	11.83	12.16	5.33	5.66	0.381	0.360	7.10	6.75
	Control	9.36	10.13	5.00	5.16	0.445	0.416	7.58	7.11
LSD at 0.05 %		0.350	0.401	NS	NS	NS	0.013	0.127	0.144

REFERENCES

A.O.A.C. (1990). Association of Official Agricultural Chemists. Methods of Analysis, 15th edition, Washington, D.C.USA.

Abdel – Mawgoud, A. M. R., El-Desuki, M., Salman, S. R. and Abou - Hussein, S. D. (2005). Performance of some snap bean varieties as affected by different levels of mineral fertilizers. J.Agron., 4(3): 242-247.

Abdel-Ati, Y.Y., Gad El-Hak, S.H., Galal, A. A. and Moustafa, Y. M. M. (2000). Effect of some antioxidant compounds on some horticultural characters of four new F_1 hybrids of tomato. J. Agric.Sci. Mans. Univ,. 25: 1673-1692.

Abdel-Azem, H.S., Shehat, A.S.M., El-Gizawy, A.M., AbouEl-yazied, A. and Adam, S.M.(2015). Snap bean response to salicylic acid and putrescence used separately and jointly under tow sowing dates. Middle East J.Appl.Sci., 5(4): 1211-1221.

AbdEL-Deyem, H.M.M., Mady, M.A.M., AbdE-All, M.M.M. and Eid, R.S.M. (2015). Effect of some antioxidants, potassium arbuscular mycorrhize on growth, yield and quality of snab bean plant grown under water stress levels. Annals of Agric. Sci.Moshtohor, 53(1): 15-30.

Abdel-Hkim, W.M., Moustafa, Y.M.M., and Gheeth, R.H.M. (2012). Foliar application of some chemical treatments and planting date affecting snap bean (*Phaseolus vulgaris* L) plant growth in Egypt. J.Hort.Sci & Ornamen. Plants, 4(3): 307-317.

Abido, W.A.E. and Seadh , S. E. (2014). Rate of variations between field bean cultivars to sowing dates and foliar spraying treatments. Science International, 2(1): 1-12.

Amer, S.S.A. (2004). Growth, green pods yield and seeds yield of common bean (*Phaseolus vulgaris* L.) as affected by active dry yeast, salicylic acid and their interaction .J.Agric .Sci.Mans. Univ., 29(3): 1407-1422.

Arberg, B. (1981). Plant growth regulators monosubstituted benzoic acid. Swed. Agric. Res., 1: 93-105.

Barakat, M.A.S., Osman, A.Sh., Semide, W.M. and Gyushi, M.A.H. (2015). Influence of potassium humate and ascorbic acid on growth, yield and chemical composition of common bean (*Phaseolus vulgaris* L.) grown under reclaimed soil conditions. International Journal of Academic Research , 7(1): 192-199.

Barnett, J.A., Payne, R.W. and Yarrow, D. (1990). Yeast, chatacteristies and identification. Cambridge University Press, London, PP: 999.

Basra, S. M. A., Iftikher, M. N. and Afzal, I. (2011). Potential of moringa (*Moringa oleifera*) leaf extract as priming agent for hybrid maize seeds. Int. J. Agric. Biol., 13:1006-1010.

Blokhina, O., Virolinen, E. and Fagersted, K.V. (2003). Antioxidants, oxidative damage and oxygen deprivations stress. Ann.Bot., 91: 179-194.

Bodanns, R.S. and Chan, P.C. (1979). Ascorbic acid as a scavenger of singlet oxygen .FBES Lett,105: 195-196.

Bowler, C., Montogh, M.V. and Inze. D. (1992). Superoxide dismutase and stress tolerance.Ann.Rev.Plant Physiol. Plant Mol.Biol., 48: 223-250.

Brunner, B., Brady, K., Flores, L. and Beaver, S. (2014). Yield performance of eight snap bean genotypes grown under an organic management system in the tropics. J. Agric. Univ.P.R., 98(1): 15-20.

Buis, R., Barthou, H. and Roux, B. (1988). Effect of temporary chilling on foliar and culinary growth and productivity in soybean (*Glycine max*). Annals of Botany, 61: 705-715.

Culver, M. Fanuel, T. and Chiteka, A. Z. (2012). Effect of moringa extract on growth and yield of tomato. Greener Journal Of Agricultural Sciences, 2(5): 207-211.

Dale,J.E.(1964). Some effect of alterating temperature on the growth of French bean plants.Ann.Bot.,8:127-135.

Dawa, K. K., Farid, S. M. and EL-Bauomy, A.E. (2014). Effect of biofertilizers inoculation methods and some foliar application treatments on yield and quality of pea plants. J Plant Production, Mans. Univ., 5(11): 1957-1975.

Elade, Y. (1992). The use of antioxidants to control gray mould (*Botrytis cinerea*) and white mould (*Sclerotinia scleotiorum*) in various crops. Plant Pathol., 141: 417-426.

El-Desouky, S.A., Wanas, A.L. and Khedr, Z.M. (1998). Utlization of some natural plant extracts of garlic and yeast as seed-soaked materials to squash (*Cucurbita pepo* L).1-effect on growth, sex expression and fruit yield and quality. J.Agric.Sci.Moshtohor, Zagazig Univ.,35(2):839-854.

El-Sherbini, M.A.A. (2015). Physiological studies on sugar pea (*Pisum sativum* L). Ph.D. Thesis, fac. Agric., Mans.Univ., Egypt, 107pp.

El-Tayeb, M.A. (2005). Response of barley grains to the interactive effects of salinity and salicylic acid. Plant Growth Regul., 45: 215-224.

EL-Tohamy, W.A., Schnitzler, W.H., EL-Behairy, U.A. and Singer, S. M. (1999). Effect of long-term drought stress on growth and yield of bean plants (*Phaseolus vulgaris* L.). Journal of Applied Botany-Angewandte Botanik, 73: 173-177.

Emongor, V. E. (2015). Effect of moringa (*Moringa olifera*) leaf extract growth, yield and yield components of snap bean (*Phaseolus vulgaris*). JAST, 6(2): 114-122.

Farago, S. and Brunhold, C. (1994). Regulations of thiol contents in maize roots by intermediates and effectors of glutathione synthesis. J. plant Physoil., 144: 433-437.

Fryer, M. J., Oxborouph, K., Martin, B., Ort, D. R. and Baker, N. R. (1995). Factor associated with depression of photosynthetic, quantum efficiency in maiz at low growth temperature. Plant Physiology, 108: 761-767.

Galal, A. A., Gad EL-Hak, S. H., Abdel-Ati, Y.Y. and Mostafa, Y. M. M. (2000). Response of new tomato hybrids to some antioxidants and early blight. The 2nd Scientific Conference of Agricultural Sciences, Assuit, Egypt, PP: 673-686.

Gomez, K.A. and Gomez, A.A. (1984). Statistical procedures for agricultural research.John Wiley and Sons, Inc., 680 pp.

Greaves, J. A. (1996). Improving suboptimal temperature tolerance in maiz-the scarch for variation. Journal of Experimental Botany, 47:307-323.

Haldiman, p. (1998). Low growth temperature induced changes to pigment composition and photosynthesis in *Zea mays* genotypes differing in chilling sensitivity. Plant Cell and Environment,21:200-208.

Harborne, J.B. (1980). Plant phenolics. In secondary plant products. E.A.Bell. B.V.Charlwood, PP 329-402. Berlin: Springer Veriag, 674pp.

Hendawey, M.H. and Younes,A.M.A. (2013).Biochemical evaluation of some faba bean cultivars under rainfed conditions at El- Sheikh Zuwayid. Annals of Agricultural Science, 58(2): 183-193.

Hussain, M., Farooq, M., Shahzad, M.A., Basra, S.m.A. and Lee, D. (2013). Application of moringa alleopathy in crops sciences. In: Cheema et al (eds), Allelopathy. Springer Berlin Heidelberg, pp: 57-58.

Jackson, N.l. (1958).Soil Chemical Analysis.Constable. Ltd. Co., London, pp:498.

Khattab, E.A., El-Dewiny, C.Y., Afifi, M.H. and Khalifa, R. Kh. M. (2015). Response of some varieties of faba bean to yeast and algae and eheir impact on yield and its components. Middle East journal of Agriculture 4(4): 907-913.

Klessige,D.F. and Malamy, J. (1994). The salicylic acid signal in plant. Plant Mol. Biol., 26:1439.

Koller, H.R. (1972). Leaf area leaf weight relationships in the soybean canopy. Crop Sci., 12: 180-183.

Kumari, R., Kaur, I. and Bhatnagar, A. K. (2011). Effect of aqueous extract of *Sargassum johnstonii* setchell and gardner on growth, yield and quality of *Lycopersicon esculentum* Mill. J. App. Phycol., 23: 623-633.

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

Lichtenthaler, H. k. and Wellburn, A. R. (1983). Determinations of total carotenoids and chlorophylls a and b of leaf extracts in different solvents. Biochem. Soc. Trans., 11(5): 591-592.

Mahmood, K. T. , Mugal, T. and Haq, I. U. (2010). *Moringa oleifera*: A natural gift: A review. J. Pharm. Sci. Res., 2: 775-781.

Mahmoud, T.R. (2001). Botanical studies on the growth and germination of mahnolia (*Magnolia grandiflora* L.) plants. M. Sci. Thesis., Fac. Agric. Moshtohor, Zagazig Univ., Egypt.

Makkar, H. P. S. and Becker, K. (1996). Nutritional value and antinutritional compounds of whole and ethanol extracted *Moringa oleifera* leaves. Anim. Feed Sci. Technol., 63: 211-228.

Mattagajasingh, S.N.andKar, M.(1989).Changes in the antioxidant system during the greening of etiolated wheat leaves. J.Plant Physiol.,134: 656-660 .

Maynard, A.J. (1970). Methods in food analysis. Academic Press New York, London, 176 pp.

Mohmed, A. R., EL-Desuki, M. M. Abdel-Mouty, M. and Ali, A. H. (2013). Effect of compost levels and yeast extract application on the pea plant growth, pod yield and quality .J. Appl. Sci. Res., 9(1): 149-155.

Muhamman, M. A., Auwalu, B. M., Manga, A. A. and Jibrin, J. M. (2013). Effects of aqueous extract of moringa (*Moringa oleifera* Lam.) and nitrogen rates on some physiological attributes and yield of tomato. International Journal of Chemical Environmental and Biological Science,(1): 67-74.

Nagodowithana, W. T. (1991). Yeast technology. Universal foods corporation Milwaukee, Wisconsin. Published by Van Nostrsnd Reinhold New Yourk, 237pp.

Noctor, G. and Foyer, C.H. (1998).Ascorbat and glutathione: keeping active oxygen under control .Ann. Rev.Plant Physiol. Plant Mol. Biol.,49:249-279.

Nour, K. A. M., Mansour, N.T.S. and Eisa, G. S. A. (2012). Effect of some antioxidants on some physiological and anatomical characters of snap bean plants under sandy soil conditions. New York Science Journal, 5(5): 1-9.

Novabpour, S., Morris, K., Allen. R., Harrison, E. and Wollaston, V. (2003). Expression of senescence enhanced genes in response to oxidative stress. Journal of Experimental Botany, 54: 2285-2292.

Piper, C. S. (1950). Soli and plant analysis. Inter. Sci., Pull, New York, 368pp.

Plummer, D.T. (1978). An introduction to practical biochem. McGraw-Hill Book Company (U. K.) Ltd., London, 362 pp.

Prusky, D. (1988). The use of antioxidants to delay the onset of anthracnose and stem end decay in avocado fruits after harvest. Plant Dis., 72: 382-384.

Rady, M. M. (2006). Efficiency of growth and productivity of sunflower plants as affected by ascorbic acid under saline reclaimed soil conditions. 2nd conf. on farm integrated pest Managemnt, Fac. Agric., Fayoum Univ., Egypt, pp: 186-200.

Rady, M.M., Mohamed, G.F., Abdalla, A.M. and Ahmed, Y.H.M. (2015). Integated application of salicylic acid and *moringa oleifera* leaf extract alleviates the salt- induced adverse effects in common bean plants. Journal of Agricultural Technology, 11(7): 1595-1614.

Raskin, I. (1992). Salicylate, a new plant hormone. Plant Physiol., 99: 799-803.

Romheld, V. and Marschner, H. (1991). Function of micronutrients in plant. In Micro-Nutrients in agriculture, 2nd Ed Motived, J.J. Cox F.R., Shuman, L.M. and Welch,R.M.Eds.Soil Science Society of America Madison,W.,PP.297-328.

Shadded, L. M. A., Radi, A. F., Abdel-Rahman, A. M. and Azooz, M. M. (1990). Response of seeds of *Lupinus termis* and *Vicia faba* to the interactive effect of salinity and ascorbic acid on pyridoxines. Plant and soil, 122: 177-183.

Shfeek, M.R., Helmy, H. I. , Ahmed, A.A. and Shalaby, M. A. F. (2014). Productivity of snap bean plants by spraying of some antioxidants materials under sandy soil conditions in plastic house. Middle East J. Agric. Res., 3(1): 100-105.

Shokr, M.M.B. and Abdelhamid, M.T. (2009). Using some antioxidant substances for enhancing thermotolerance and improving productivity of pea (*Pisum sativum* L) plants under local environment of early summer season. Agricultural Research Journal. Suez Canal University, 9(1): 1-9.

Shokr, M.M.B. and Fathy, EL.L.EL. (2009). Some foliar applications for improving snap bean (*Phaseolus vulgaris* L) quality and yield at Fall season. Agric. Sci. Mansoura Univ., 34 (5): 5089- 5106.

Shokr, M.M.B., Elsaid, EL.M. and Shafeek, M.R. (2014). Effect of some stimulative substances as foliar applications on snap bean (*Phaseolus vulgaris* L.) productivity under milder thermo-stress of local summer season. Middle East J.Appl.Sci., 4(2): 175-180.

Singer, S .M., EL-Tohamy, W.A., Abo-Hadid, A.F., Markhart, A.H. and Li, P.H. (1996). Chilling and water stress injury in bean (*Phaseolus vulgaris* L.) is reduced by pretreatment with CaCl, mefluidide, KCL and MgCL.Egypt. J.Hort., 23:77-87.

Smirnoff, N. and Wheeler (2000). Ascorbic acid in plants:biosynthesis and function. Critical Review in plant Sciences, 19:267-290.

Snedecor, G. W. and Cochran, W. G. (1968). Statistical Methods. Lowa State. Univ. press, Amme., USA, 6th Ed., 393pp.

Umebese, C.E.,Olatimilehin, T.O. and Ogunsusi, T.A. (2009). Salicylic acid protects nitrate reductase activity, growth and prolinein amaranth and tomato plants during water deficit. Amer. J. Agri. Biolo. Sci., 4(3): 224-229.

Wanas, A.L. (2006). Trails for improving growth and productivity of tomato plants grown in winter. Annals Agric. Sci. Moshtohor, 44(3): 466-471.

Wentworth, M., Murchie, E.H., Gray, J.E., Villegas, D., Pastenes, C., Pinto, M. and Horton, P. (2006). Differential adaptation of two varieties of common bean to abiotic stress ll.Acclimation of Photosynthesis .Journal of Experimental Botany, .57(3): 699-709.

Zaki, S. S. and Rady, M. M. (2015). *Moringa oleifera* leaf extract improves growth, physio-chemical attributes antioxidant defence system and yields of salt stressed *Phaseolus vulgaris* L. plants. Int. J. Chemtech Res., 8(11): 120-134.

استجابة بعض أصناف الفاصوليا للرش ببعض مضادات الأكسدة لزيادة الإنتاجية والجودة تحت الظروف المحلية في العروة الصيفي المبكرة .

علي فتحى حمايل[١] ، محمد سعد حمادة [٢]، محمود محمد بدوي شكر[٣] و إيمان محمد محمود عبد الرحيم [٣]

١- قسم الخضر والزينة - كلية الزراعة - جامعة دمياط.

٢- قسم الوراثة - كلية الزراعة - جامعة دمياط.

٣- قسم بحوث الخضر- معهد بحوث البساتين.

أجريت تجربتين حقليتين بالمزرعه البحثية بالبرامون التابعة لمحطة بحوث البساتين بالمنصوره – معهد بحوث البساتين – مركز البحوث الزراعية خلال موسمي ٢٠١٤-٢٠١٥ في العروه الصيفي المبكرة لدراسة تأثير بعض مواد الرش مثل مستخلص أوراق المورينجا (٥٠ مل / لتر) ؛ مستخلص الخميرة (٢٥ مل / لتر) ؛ حمض السالسليك (١٥٠جزء فى المليون) و حمص الأسكوربيك (٢٥٠ جزء فى المليون) علي النمو الخضري و المحصول و الجوده علي بعض أصناف الفاصوليا مثل البرونكو و البوليستا و الفلانتينو.أظهرت النتائج ما يلي :أن صنف الفلانتينو أعطي أعلي القيم في كل من ارتفاع النبات ؛ الوزن الطازج و الجاف ؛ المساحة الورقية ؛ طول القرن ؛ عدد القرون لكل نبات و محصول القرون للفدان بالمقارنة بالأصناف الأخري خلال موسمي الدراسة بينما أعطي البرونكو أقل القيم علاوة علي ذلك أعطي صنف البرونكو أعلي القيم في وزن القرن ؛ المواد الصلبة الذائبة الكلية و فيتامن ج خلال موسمي الدراسة ، بينما أعطى صنف البوليستا أعلي القيم في محتوي القرون من الألياف و الحموضة ، بينما الفلانتينو سجل أقل القيم خلال موسمي الدراسة.أظهرت النتائج أن جميع معاملات الرش أعطت زيادة معنوية فى جميع الصفات المدروسة مقارنة بالكنترول ، وتفوق حمض السالسليك على باقى معاملات الرش فى صفات النمو الخضرى ، المحصول ومكوناته وكذلك صفات الجودة للقرون ، وجاء حمض الأسكوربيك فى المرتبة الثانية فى هذه الصفات خلال موسمي الدراسة.مما سبق نستنتج أن صنف الفلانتينو الذي تم رشه بحمض السالسليك بتركيز١٥٠جزء فى المليون أعطي أعلي القيم في انتاج محصول الفدان من القرون الطازجة.