J. Agric. Sci. Mansoura Univ., 33 (10): 7413 - 7420, 2008

EFFECT OF FOLIAR APPLICATION WITH SOME ANTIOXIDANTS ON GROWTH AND YIELD OF PEA (*Pisum sativum* L.) UNDER EARLY PLANTING CONDITIONS.

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ABSTRACT

Two field trials were conducted at Sherbin area, Dakahlia Governorate, Egypt, during the two successive seasons of 2006 and 2007 to study the effect of some antioxidant foliar treatments on growth and productivity of pea (cv. Master-B). Ascorbic acid (vitamin C), vitamin E (α–Tocopherol), salicylic acid and their combinations were used as antioxidants foliar treatments at 0, 100, 150 and 200 ppm concentrations. The main findings showed that spraying Formula 2, which contains ascorbic acid + vitamin E + salicylic acid (each at 150 ppm) increased plant growth *i.e.* fresh and dry weight per plant. Using formula 2 or formula 3 which contains ascorbic acid + vitamin E + salicylic acid (each at 200 ppm) gave significantly the highest values of leaf chlorophyll, shoot N content, pods setting percentage, average weight of pod, number of seeds/ pod, 100 green seeds weight and fresh pod yield (ton/fed) under early planting conditions.

INTRODUCTION

Peas (*Pisum sativum* L.) is one of the popular vegetable crops and grown as a winter crop in Egypt. Pea plants suffer from yield losses due to early planting which is very important for both of early fresh marketing and exportation. Peas are planted in Egypt as a winter crop; it requires low temperature ranged from 15 to 24 ˚C. Height temperature, during September and October months, (Table 1), at pea early seedling establishment and development stages resulted in thermal damage of pigment-protein complex structure of chlorophyll, such heat stress led to internal disturbance in all of plant physiological processes (Murkowski, 2001) and consequently reduced growth, yield and quality, therefore it becomes necessary to search for further methods that could extensively used to increase heat stress tolerance.

Recently great attention has been focused on natural and safety antioxidants substances, which have the ability to quench free radicals and thereby form a protective screen around plant cells and hence increasing plant resistance to stress, moreover, antioxidants provide adequate protection against the deleterious effects of activated oxygen species (Alscher *et al*., 1997 on sweet pea). Furthermore, treating artichoke with 500 ppm of ascorbic acid controlled weight loss regardless of stem length and improve quality of artichoke (Mencarelli *et al*., 1993). Elizabeth *at al*. (2006) indicated that enhancement of pea seeds vigour response by vitamin C as reflected in both agronomic and biochemical responses, occurred through the stimulation of phenolic-linked antioxidant response that is likely positively modulated through the proline-linked pentose phosphate pathway. Moreover, El-Tohamy and El-Greadly (2007) reported that application of 0.3 ml/l vitamin E improved significantly carbohydrates, total chlorophyll, cytokinins, IAA and GA3 content in snap beans pods and reduced fibbers compared to control plants.

Salicylic acid, is stress signaling compound in plant, treating chili seeds with salicylic acid was effective in inducing seedling resistance to cold stress, manifested as increasing leaf number, plant fresh and dry weight (Benavides *et al*., 2002). Several studies indicated that foliar spray with salicylic acid increased the fresh and dry weights of plant, pod setting and total proteins of leaves and fruits (Sitaramaiah and Pathak, 1981, on tomato, Jasiswal and Bhambie, 1989, on *Vigna radiate* L., Liu Xenia *et al*., 2000 and Sanaa *et al*., 2001 on broad bean). Kalarani *et al*. (2002) reported that foliar application of salicylic acid at 50, 100, 150 or 200 ppm showed its efficiency in inducing tomato early flowering; moreover, fruit set percentage and yield components recorded significantly maximum values with spraying tomato plants with 100 ppm of salicylic acid.

The objective of this study was to evaluate the effect of some natural and safe antioxidant as foliar applications on growth and productivity of pea C.V. Master-B under early planting conditions.

MATERIALS AND METHODS

The field experiments were laid at Sherbin district, Dakahlia, Egypt, during two successive seasons of 2006 and 2007 to investigate the effect of some antioxidants on growth and yield of pea under high temperature stress. The experiment included 13 foliar spray treatments as follows:

1- Control (tap water).
2- Ascorbic acid 100 ppm.
3- Ascorbic acid 150 ppm.
4- Ascorbic acid 200 ppm.
5- Vitamin E 100 ppm.
6- Vitamin E 150 ppm.
7- Vitamin E 200 ppm.
8- Salicylic acid 100 ppm.
9- Salicylic acid 150 ppm.
10- Salicylic acid 200 ppm.
11- Formula (1) Ascorbic + Vitamin E + Salicylic (each at 100 ppm).
12- Formula (2) Ascorbic + Vitamin E + Salicylic (each at 150 ppm).
13- Formula (3) Ascorbic + Vitamin E + Salicylic (each at 200 ppm).

The monthly average temperature during seasonal growth 2006 and 2007, recorded by Shawa weather station, are shown in Table (1). The complete randomized blocks design was used with three replicates. Each experimental unit was 10.5 m^2 consisted of five ridges each of 3.5 m long and 60 cm wide.

On 1st of September during the two seasons, pea seeds (C.V. Master-B) were drilled in the open field into one side ridges at spacing 10 cm. Sprayers were started after 7 days from germination and repeated at 14 days intervals during the growth seasons using spreading agent (Super Film 1 ml/ Liter). The untreated plants (control) were sprayed with tap water using the same spreading agent. All agriculture treatments were followed according to the instructions laid by Egyptian Ministry of Agriculture.

At 60 days from sowing five plants were randomly taken from each plot for determining the vegetative growth parameters *i.e*. plant height, number of leaves, fresh weight and dry weight per plant as well as relative dry weight, calculated as percent of dry weight of each treatment relative to the control. Ten days after the last treatment samples from the fourth upper leaves were taken to determinate the chlorophyll content (SPAD units) , using a portable leaf chlorophyll meter (Minolta Model SPAD 501) according to Murquard and Timpton (1987). Dry weight of shots were used to determine nitrogen (%) according to the methods described by Bremner and Mulvaney (1982), phosphorus (%) was estimated colorimetrically according to Olsen and Sommers (1982) and potassium (%) was also determined flame photometrically as described by Jackson (1967). Five uniform plants of each plot were randomly chosen, labeled to determinate the following parameters, pods setting (percentage), average weight of pod, number of seeds/ pod and 100 green seeds weight. All harvested pods from each plot were used to determinate total yield (ton/fed). Relative yield (percentage) calculated as percent of total yield of each treatment relative to the control.

All obtained data were subjected to statistical analysis according to Gomez and Gomez (1984). Means separation was done by L.S.D. at 0.05 level of probability.

Table (1): The monthly average temperature during seasonal growth 2006 and 2007.

Month	2006		2007	
	Max.	Min.	Max.	Min.
September	30.5	18.6	31.8	19.9
October	29.0	16.2	30.0	17.5
November	25.6	14.6	23.1	11.4
December	19.8	8.3	21.1	8.0

RESULTS AND DISCUSSION

1. Vegetative growth parameters:

Data reported in Table (2) show that foliar spray with formula 2 which contains ascorbic acid + vitamin E + salicylic acid (each at 150 ppm concentration) followed by formula 3 which contains ascorbic acid + vitamin E + salicylic acid (each at 200 ppm concentration) induced significantly plant height, fresh and dry weights/ plant in compared with other applications of antioxidants and control, however the increments did not reach the 5 % level of significant with respect to number of leaves at both seasons respectively. The same data showed also that using formula 2 increased dry weight by 41 % (mean of the two seasons) above control, flowed by foliar spray of formula 3, which showed 29 % of dry weight above control. Such results confirmed by those of Liu Xenia *et al*. (2000) and Sanaa *et al*. (2001), they found that foliar spray with salicylic acid enhanced growth of broad bean. Moreover, Fathy and Khedr (2005) found a suppressive effect of foliar spray with salicylic acid and vitamin E on all growth characters of tomato plants. Akram and Hosni (2007) illustrated that foliar sprays of broad bean plant with vitamin C had a significant increases on shoot growth and number of healthy leaves; 300 mg/

L of vitamin C was the best concentration. El-Tohamy and El-Greadly (2007) showed that foliar application of vitamin E at the higher concentrations *i.e.* 0.3 ml/l improved significantly vegetative growth of snap beans plants. The stimulatory effect of such treatments on vegetative growth parameters and Chemical composition of pea plant might be due to the complementarily stimulatory effect of all used antioxidants; ascorbic acid has effects on many physiological processes including the regulation of growth, differentiation and metabolism of plants (Foyer, 1993). Vitamin E plays a unique role as an antioxidant and a stabilizer for biological membranes, as will as protects chlorophyll (Hess, 1993). Vitamin E is also shown to protect the plant against various environmental stresses such as drought (Price and Hendry, 1987). Salicylic acid stimulates the formation of the pentose-phosphate pathway and glucose-6-phosphate (the main product of Photosynthesis process) as well as the synthesis of protein (McCue *et al*., 2000).

Table 2: Effect of Ascorbic acid, Vitamin E and Salicylic acid foliar applications and their combinations on the vegetative growth parameters of pea plants during 2006 and 2007 seasons.

Treatments	Plant height (cm)	No. leaves/ plant	Fresh weight /plant (gm)	Dry weight /plant (gm)	Relative Dry Weight %
Season (2006)					
Control (tap water)	40.7	12.3	34.3	4.85	100
Ascorbic 100 ppm	41.1	12.5	35.0	4.97	102
Ascorbic 150 ppm	42.9	12.9	32.7	4.71	97.1
Ascorbic 200 ppm	45.8	12.8	35.2	5.01	103
Vitamin E100 ppm	41.9	12.9	33.7	5.06	104
Vitamin E150 ppm	43.3	12.7	37.3	5.32	110
Vitamin E 200ppm	47.3	12.2	35.2	5.23	107
Salicylic 100 ppm	46.1	12.9	35.2	5.36	111
Salicylic 150 ppm	54.7	12.6	38.1	5.85	121
Salicylic 200 ppm	52.2	12.8	35.1	5.41	112
Formula 1	42.0	12.1	33.2	5.19	107
Formula 2	55.6	13.1	42.2	6.74	139
Formula 3	50.5	13.2	37.5	6.04	125
L.S.D. 5%	8.6	NS	3.0	0.54	
Season (2007)					
Control (tap water)	41.1	12.7	24.3	3.43	100
Ascorbic 100 ppm	40.9	13.1	24.6	3.54	103
Ascorbic 150 ppm	41.5	12.1	23.7	3.31	96.8
Ascorbic 200 ppm	44.2	13.7	27.11	3.63	106
Vitamin E100 ppm	38.9	14.3	28.31	3.91	114
Vitamin E150 ppm	43.5	13.5	28.4	3.98	116
Vitamin E 200ppm	43.7	13.6	28.31	4.05	118
Salicylic 100 ppm	43.5	13.3	26.4	4.07	118
Salicylic 150 ppm	48.2	13.4	26.6	4.04	118
Salicylic 200 ppm	46.5	14.0	27.97	4.30	125
Formula 1	42.7	13.1	30.6	4.65	135
Formula 2	51.5	12.4	33.2	4.91	143
Formula 3	49.5	12.8	29.7	4.57	133
L.S.D. 5%	4.8	NS	2.4	0.38	

2. Chemical composition of plant foliage:

Data in Table (3) reveal that using formula 2 which contains ascorbic acid + vitamin E + salicylic acid (each at 200 ppm concentration) or formula 3 which contains ascorbic acid + vitamin E + salicylic acid (each at 150 ppm

concentration) had the highest values of Leaf chlorophyll and shoot N %, the two seasons had the same trend. On the other hand, shoot P % and shoot K% reach the level of significant with formula 2 or formula 3 at the first season of this work.

3- Yield and its Components:

Table 3: Effect of Ascorbic acid, Vitamin E and Salicylic acid foliar applications and their combinations on chlorophyll, N, P and K contents of pea plants during 2006 and 2007 seasons.

Treatments	Leaf chlorophyll (SPAD units)	Shoot N %	Shoot P %	Shoot K %
Season (2006)				
Control (tap water)	44.7	3.53	0.24	2.28
Ascorbic 100 ppm	47.2	3.59	0.26	2.35
Ascorbic 150 ppm	44.5	3.51	0.22	2.41
Ascorbic 200 ppm	49.0	3.76	0.24	2.34
Vitamin E100 ppm	48.1	3.62	0.23	2.13
Vitamin E150 ppm	50.1	3.74	0.21	2.24
Vitamin E 200 ppm	50.5	3.56	0.24	2.55
Salicylic 100 ppm	51.8	3.61	0.22	2.47
Salicylic 150 ppm	50.2	3.53	0.23	2.51
Salicylic 200 ppm	53.5	3.83	0.22	2.54
Formula 1	48.5	3.64	0.23	2.35
Formula 2	56.3	3.92	0.29	2.61
Formula 3	55.6	3.90	0.25	2.57
L.S.D. 5%	4.3	0.26	0.04	0.16
Season (2007)				
Control (tap water)	44.0	2.79	0.21	2.22
Ascorbic 100 ppm	43.5	2.87	0.22	2.35
Ascorbic 150 ppm	44.7	2.83	0.24	2.33
Ascorbic 200 ppm	45.3	2.89	0.23	2.28
Vitamin E100 ppm	47.6	3.11	0.22	2.34
Vitamin E150 ppm	48.6	3.21	0.21	2.47
Vitamin E 200 ppm	46.7	3.15	0.21	2.44
Salicylic 100 ppm	45.4	2.80	0.24	2.38
Salicylic 150 ppm	46.5	2.85	0.27	2.77
Salicylic 200 ppm	49.2	2.89	0.22	2.56
Formula 1	47.4	2.98	0.23	2.34
Formula 2	51.3	3.46	0.25	2.48
Formula 3	53.2	3.39	0.22	2.37
L.S.D. 5%	4.0	0.20	N.S.	NS

Data presented in Table (4) show that the individual application of ascorbic acid has no effects on all studied characters compared with control, the same data showed also that the highest pods setting percentage, average weight of pod, number of seeds/ pod, 100 green seeds weight and fresh pod yield ton/fed were resulted by foliar application of formula 2 which contains ascorbic acid + vitamin E + salicylic acid (each at 200 ppm concentration) or formula 3 which contains ascorbic acid + vitamin E + salicylic acid (each at 150 ppm concentration), pods yield increased by 20.25 % and 17.75% (means of the two seasons) as a result of applying formula 2 or formula 3, respectively, relative to the control. The results were in the same line in both seasons and were in agreement with the findings of Jasiswal and Bhambie (1989) on *Vigna radiate* L., Sanaa *et al*. (2001) on broad bean, Kalarani *et al*. (2002) and Fathy and Khedr (2005) on tomato.

Akram and Hosni (2007) reported that pod number per plant of broad bean were 33 %, 44 %, 44 %, 55 % and 33 % higher on plants received 50, 100, 200, 300 and 400 mg/ L of vitamin C additions respectively compared

with control. Fathy and Khedr (2005) reported that vitamin E and salicylic acid had beneficial effects on increasing tomato fruit yield / plant and total yield / fed. Furthermore, El-Tohamy and El-Greadly (2007) showed that yield of snap beans plants increased especially at the higher concentrations of vitamin E *i.e.* 0.3 ml/l treatments.

The enhancing effect of the applied treatments of antioxidants on pea yield and its components could be logically true under the present work conditions since, such treatments improved the vegetative growth parameters and chemical composition of plant foliage compared with control (Tables 2). The effect of salicylic acid on pods sitting may be due to the stimulatory effect of salicylic acid on IAA (Oxine) and IPA (Cytokinin) in leaves (Liu Xin *et al*., 2000) and activates floral bud formation (Ren *et al,* 1999).

The promotional effect of salicylic acid on yield and its components could be logically true under the present work conditions since; such treatment improved the vegetative growth parameters compared with control (Tables 2 and 3).

In addition, salicylic acid stimulate the phenolic synthesis, phenolic secondary

Table 4: Effect of ascorbic acid, vitamin E and salicylic acid foliar applications and their combinations on yield components of pea plants during 2006 and 2007 seasons.

Treatments	Pods setting (%)	Average weight /pod (gm)	No. seeds/ pod	100 green seeds weight	Fresh pod yield (ton/ fed)	Relative yield (%)
Season (2006)						
Control (tap water)	71.2	7.28	7.04	49.3	2.59	100
Ascorbic 100 ppm	73.1	7.15	7.14	47.4	2.65	102.3
Ascorbic 150 ppm	72.5	7.07	7.27	49.1	2.63	101.5
Ascorbic 200 ppm	71.6	7.29	7.53	48.6	2.89	111.5
Vitamin E100 ppm	74.1	7.84	7.93	50.4	2.91	112.4
Vitamin E150 ppm	72.1	8.01	7.42	49.7	2.66	102.7
Vitamin E 200 ppm	73.9	7.85	7.92	48.3	2.65	102.3
Salicylic 100 ppm	75.1	7.78	7.55	49.6	2.75	106.2
Salicylic 150 ppm	81.4	7.94	7.56	51.0	2.85	110.0
Salicylic 200 ppm	80.2	8.04	8.06	54.5	2.92	112.7
Formula 1	77.8	7.06	7.89	50.5	2.83	109.3
Formula 2	82.9	8.40	8.11	54.9	3.10	119.6
Formula 3	83.1	8.31	8.23	56.7	3.08	118.9
L.S.D. 5%	2.4	0.31	0.22	4.1	0.25	
Season (2007)						
Control	73.5	6.17	6.71	46.2	2.53	100
Ascorbic 100 ppm	74.5	6.78	6.91	44.7	2.59	102.4
Ascorbic 150 ppm	75.0	7.26	7.14	45.8	2.66	105.1
Ascorbic 200 ppm	72.5	7.42	7.17	45.5	2.56	101.2
Vitamin E100 ppm	74.5	7.54	7.83	50.0	2.72	107.5
Vitamin E150 ppm	73.8	7.78	7.69	46.2	2.64	104.3
Vitamin E 200 ppm	72.4	7.53	6.99	46.1	2.66	105.1
Salicylic 100 ppm	81.4	7.46	7.55	47.2	2.56	101.1
Salicylic 150 ppm	83.6	7.51	7.95	49.5	2.83	111.9
Salicylic 200 ppm	81.9	7.73	7.97	48.7	2.90	114.6
Formula 1	79.5	7.21	7.81	48.6	2.84	111.1
Formula 2	88.4	8.07	8.41	53.3	3.06	120.9
Formula 3	85.9	8.01	8.34	52.4	2.95	116.6
L.S.D. 5%	4.9	0.48	0.42	3.2	0.17	

metabolites and proline contents (McCue *et al*., 2000) those that in closely relation with hot tolerance. All of those attributes might lead to the improvement of pea yield and its components. Moreover, Salicylic acid can increase plant susceptibility to disease (Ali, 1995), increase antioxidant enzymes (Li *et al*., 1998), delaying the breakdown of pigments (Nabila, 1999).

REFERENCES

Akram A.A and A.M. Hosni (2007). Effect of vitamin C growth and yield of broad beans exposed to ambient ozone in KSA. J. Agriculture and Biological Sciences, 3 (3): 195-199.

Ali, M. A. (1995). Induction of resistance to control plant diseases that infect cucurbits. Conf. Agric. Res. Pro. Serving Soc., Fayoum, Cairo Univ., Fac. Agric., Fayoum, Nov., 15, ARE 98-99.

Alscher, R.G., J.L. Donahue, and C.L. Cramer. (1997). Reactive oxygen species and antioxidants: Relationships in green cells. Physiol. Plant, 100: 224-233.

Benavides, M.A.; F. Ramirez-Godina, V. Robledo-Torres, H., Ramirez Rodriguez and R.K. Maiti (2002). Chili seed treatment with salicylic and sulfosalicylic acid modified seedling epidermal anatomy and cold stress tolerance. Crop Research (Hisar), 24 (1):19 – 25.

Bremner, J. M., and C. S. Mulvaney. (1982). Total nitrogen. In: Page, A. L., R. H. Miller and D. R. Keeney (Eds). Methods of Soil Analysis. Part 2, Amer. Soc. Agron. Madison, W I. USA, 595- 624.

Elizabeth, B.; M. Patrick, K. Young-In and S.Kalidas (2006). Effect of vitamin C and folic acid on seed vigour response and phenolic linked antioxidant activity, Bioresource technology, 28 July.

El-Tohamy, W. A. and N. H. M. El-Greadly (2007). Physiological Responses, Growth, yield and quality of snap beans in response to foliar application of yeast, vitamin E and zinc under sandy soil conditions. Australian Journal of Basic and Applied Sciences, 1 (3): 294-299.

F.A.O. (1980). Soils and Plant Analysis. Soils Bulletin 38 (2):250.

Foyer, C.H. (1993). Ascorbic acid. In. R.G. Alscher and J.L. Hess (eds.) Antioxidants in higher plants. pp CRC Press, Inc. Florida, 31-58.

Fathy, El-S. L. El-S. and Z.M.A. Khedr (2005). Program and new treatments for reducing the infection severity and inducing tolerability of tomato yellow leaf curl virus (TYLCV) in fall season. The 6th Arabian Conference for Horticulture, Ismailia, Egypt, 221-245.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research 2nd ed. John Wiely and Sonic, 139 - 153.

Hess, J.L. (1993). Vitamin E, alpha-vitamin E. In: R.G. Alscher and J.L. Hess (eds.) Antioxidants in higher plants. CRC press, Inc. Boca Rarton, Florida, 111-134.

Jackson, N. L. (1967). Soil chemical analysis. Prentic-Hall Inc. Englewood Cliffs. N.S.

Jasiswal, P.K. and S. Bhambie (1989). Effect of growth regulators substances on poodding yield of *Vigna radiata* (L.). Acta Botanical Indica. 17(1): 54 – 58.

Kalarani, M.K.; M.K. Thangaraj, M. Sivakumar and V. Mallika (2002). Effect of salicylic acid on tomato. Crop Research. 23(3):486 – 492.

Li , Z. I., Y. B. Yuan, C. L. Liu, Z. X. Cao and T. H. Tsao (1998). Studies of signal transduction of salicylic acid in cucumber cells. Acta iotanica-Sinica ,40:430-436.

Liu Xini, Li Yun and Zhang ShuQiu (2000). Effect of salicylic acid on growth and content of IAA and IPA of broad bean seedlings. Plant physiology communications. 36 (6): 512 -514.

McCue, P.; Z. ZuoXing, J. L. Pinkham and K. Shetty (2000). A model for enhanced pea seedling vigour following low pH and salicylic acid treatments. Brocess Biochemistry. 35(6): 603 – 613.

Mencarelli, F.; R.Massantini, M.Casella, (1993). The influence of chemicals, stem length and plastic films on the quality of artichoke buds Journal of Horticultural Science, 68 (4): 597-603.

Murkowski, A. (2001). Heat stress and spermidine effect on chlorophyll fluorescence in tomato. Biologia Plantarum, 44 (1): 53 – 57.

Murquard, R. D. and J. L. Timpton (1987). Relationship between extractable chlorophyll and an insitu method to estimate leaf green. Hort. Sci., 22 (6):1327.

Nabila, A. A. A. (1999). Effect of chemical and heat treatment of seed on squash infection by cucumber mosaic virus (CMV). Assiut J. Agric. Sci., 30:193-206.

Olsen, S. R. and L. E. Sommers (1982). Phosphorus. *In*: Page, A. L.; R. H. Miller and D. R. Keeney (Eds). Methods of Soil Analysis. Part 2 Amer. Soc. Agron. Madison, W. I. USA, 403-430.

Price, A. H. and G. A. F. Henry. (1987). *In*: C. Rice-Evens (eds.) Free radicals, oxygen stress and drug action. Richlieu Press, London, 443-450

Ren, H. X.; X. Chen, X. J. Zhao and Y. F. Wang (1999). Effect of N nutrition and salicylic acid on floral bud initiation in cucumber cotyledon culture. ActaHort. Sinica, 26:105-109.

Sanaa, A. M. Z.; S. I. Ibrahim and H. A. M. S. Eldeen (2001). The effect of naphthalene acetic acid (NAA), salicylic acid on growth, fruit setting, yield and some correlated components in dry bean. Annals of Agriculture Science, Cairo, 46(2): 451– 463.

Sitaramaiah, K. and K.N. Pathak (1981). Effect of growth regulators, phenolic and aromatic acid on root knot severity on tomato. Zeitschrift fur pflanzenkrankhten und pflanzenschutz. 88(11): 651– 654.

تـأثير الـرش الـورقي بـبعض مضـادات الأكسـدة علـي نمـو و محصـول البسـلة تحـت ظروف الزراعة المبكرة.

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أجريت تجربتان حقليتان خلال الموسمين المتعاقبين ٢٠٠٦ و ٢٠٠٧ في منطقةِ شربين, محافظة الدقهلية، مصر لدراسة وتقييم كفاءة استخدام بعض المواد المضادة للأكسدة الآمنة في تحسين النمو و محصول البسلة صنف ماستر بي تحت ظروف الزراعة المبكرة بداية شهر سبتمبر و قد استخدمت عدة معاملات تضمنت الرش الورقي بحامض الأسكوربيك (فيتامين ج) و فيتامين هـ و حامض السلسليك بتركيزات ٠ و ١٠٠ و ١٥٠ و٢٠٠ جزء بالمليون منفردة أو مخلوطة معا و قد أشارت النتائج إلي أن استخدام المخلوط الثاني و الذي يتضمن حامض الأسكوربيك و فيتامين هـ و حامض السلسليك بتركيز ١٥٠ جزء بالمليون لكلا منهم قد أعطي أفضل نمو خضري متمثلا في زيادة الوزن الغض و الجاف للنبات و قد أدي الرش بالمخلوط الثاني أو المخلوط الثالث الذي يتضمن حامض الأسكوربيك و فيتامين هـ و حامض السلسليك بتركيز ٢٠٠ جزء بالمليون لكلا منهم إلي الحصول علي أفضل تركيب كيماوي للنباتات و كذلك صفات المحصول و المتمثلة في نسبه العقد و متوسط وزن القرن و عدد البذور في القرن و كذلك المحصول الكلي و المبكر للفدان.

و علي ذلك توصى الدراسة برش نباتات البسلة المنزرعة بداية شهر سبتمبر بالرش الورقي بحامض الأسكوربيك (فيتامين ج) و فيتامين هـ و حامض السلسليك بتركيز ١٥٠ جزء بالمليون لكلا منهم و ذلك للحصول علي أفضل نتائج فيما يخص التركيب الكيماوي و الإزهار والعقد و المحصول .