J. Agric. Sci. Mansoura Univ., 32 (8): 6661 - 6669, 2007

GROWTH, YIELD AND QUALITY OF POTATO AS AFFECTED BY SOME ANTIOXIDANTS

Awad, E.M.M. and Safa.A.A. Mansour
Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.

ABSTRACT

This experiment was carried out during the two fall seasons of 2005/2006 and 2006/2007 on potato cv. Spunta at Abou Awad village, Aga, Dakahlia Governorate, Egypt to assess the response of potato plant to some antioxidant treatments on growth, yield and some quality characters as well as NPK contents in tubers. Aqueous solution of the antioxidants as foliar spray; *i.e*., hydrogen peroxide (5 ml/l.), vitamin E (150 ppm), salicylic acid (100 ppm), citric acid (0.5 %), tannic acid (150 ppm) and control.

The obtained results revealed that antioxidants had beneficial effects on vegetative growth characters, total tuber yield and chemical contents of potato tubers. Vegetative growth characters plant height, foliage fresh and dry weight/plant at 75 days after planting (DAP), total Total tuber yield per plant and per feddan were significantly increased in response to foliar application of citric acid and vitamin E, in both seasons. While, number of main stems/plant and number of tubers/plant were significantly affected by using hydrogen peroxide and salicylic acid in the two seasons.

Hydrogen peroxide in both seasons, increased the dry matter and starch percentage as compared with the control. Citric acid was superior for vitamin C, phosphorus and potassium contents in potato tubers. Also, the highest values of nitrogen content was recorded by using Vitamin E compared with control in both seasons.

The beneficial effect of antioxidants treatments was due to improving the vegetative growth characters, production and chemical contents of potato tubers.

Keywords: Hydrogen peroxide, vitamin E, citric acid, salicylic acid, tannic acid, potatoes.

INTRODUCTION

The majority of antioxidant capacity of fruits or vegetables may be from some components such as falvonoids, isofalvonoids, flavones, isoflavones, anthocyanins, catechins, vitamin C, E or Beta carotene (Kahkonen *et al*. 1999). Many of these phytochemicals may help to protect cell against oxidative damage caused by free radicals (Wada and Ou, 2002). Antioxidants intercept free radicals and protect cell from the oxidative damage that lead to aging and diseases (Karadeniz *et al*. 2005). Active oxygen scavengers (antioxidants) should be beneficial in the protection of structure and function of the photosystems against excess light (Rajagopal *et al*. 2005). Also, antioxidants play role in the reduction or prevention of enzymatic browing by inhibiting polyphenol oxidase (Maurice *et al*. 2000). Antioxidants (free radical scavengers) are suggested for improving the yield and quality of the seeds of legume vegetables. Moustafa (1999) found that some antioxidants improved tomato fruit weight/plant and total yield/fed. Similar results were obtained by Youssef (2000) on potato.

Lopez-Delgado *et al*. (2005) found that spraying potato plant twice weekly, from 21 to 90 days after planting, with 5 or 50 mM hydrogen peroxide

(H_2O_2) solutions significantly enhanced tuber starch accumulation by 6.7 % and 11.0 % respectively and stem diameters 27.0 % and 21 %, respectively, compared to the control. Hydrogen peroxide is therefore potentially useful to improve the tuber quality of potato.

Citric acid is an organic compound belonging to the family of carboxylic acids. It presents in practically all plants. It is one of a series of compounds involved in the physiological oxidation of fats, proteins and carbohydrates to CO_2 and water. Dark stress decreased the level of N_2ase proteins and activities of enzymes involved in carbon and nitrogen assimilation in nodules via increasing O_2 in root zone which causes large decline in leghaemoglobin and antioxidant defenses (Gogoreena *et al*. 1997), therefore, increasing O_2 in root zone in legume crops led to decreasing N_2ase proteins, citrate (>1.0 mM) and inhibiting the rate of CO_2 production and O_2 consumption (respiratory gas exchange) in carrot roots through inhibiting the phosphorylation of fructose 6 – phosphate to fructose 1,6 – diphosphate which decreased N_2ase proteins (Lopez-Kato – Noguchi, 1997). Abdel- Allah (2007) obtained results that plant height, yield and its components as well as protein content in common bean pea and faba bean were increased with application citric acid.

Salicylic acid is a natural growth regulator and accumulation of SA in cells may affect some physiological functions and cause cytotoxicity (Kapulnik *et al*. 1992). The external application of salicylate could enhance tuber industrial quality by increasing dry matter and starch content (Nickell 1991). Exogenous applications of salicylic acid have been use to stimulate tuberization of potato plants (Koda *et al*. 1992). Abd – Allah (2001) found that the highest values of seed yield and dry pod resulted from plants sprayed with SA at 200 ppm. SA as antioxidant substance retarded the growth and green pod yield and its components as well as weight of 100 dry seed when used at 50 ppm (Amer, 2004). Youssef and Abd-llah (2007) indicated that starch content in potato tubers was increased at low levels of SA (0.1 mM or 0.5 mM).

Tocopheral synthesis was regulated in plant response to environmental stress, and "stress hormones" such as jasmonic acid, salicylic acid and abscisic appear to play a role. Potato plants that are deficient in tocopherals are also characterized by callose occlusion of plasmodesmata in source leaves, and show excess sugar accumulation (Tsukaya *et al*. 1991; Hofius *et al*. 2004). Alpha– tocopheral appears to play a major role in chloroplastic antioxidant network of plants, its levels being finely regulated depending on the severity of the stress and plant stress sensitivity. Therefore α – tocopheral contributes to preservation of an adequate redox statein chloroplasts,and to maintaining thylokoid membrane structure and function during plant development, and in plant responses to stress (Munne- Bosch and Alegre, 2002, Munne- Bosch,2005). Arisha (2000) found that dry matter %, starch content, N % and ascorbic acid in tubers were significantly increased with foliar application of vitamin C.

The main objective of this work was to study the effect of some antioxidants on growth, yield and quality of potato plant.

MATERIALS AND METHODS

This research was conducted during the two fall seasons of 2005/2006 and 2006/2007 on potatoes (*Solanum tuberosum* L.) cv. Spunta at Abou Awad village, Aga, Dakahlia Governorate, Egypt. Potato tuber seeds were planted in rows 0.75 m width at 25 cm spacing between plants. Each plot area was 18 m^2, which included four rows of 6 m length. Planting dates were 10^{th} and of 14^{th} October in 2004 and 2005 respectively the harvest time was after 105 days from planting dates (DAP) in both seasons.

Soil samples were collected from experimental site prior to planting from 0 – 30 cm depth and their properties shown in Table (1).

Table 1: Some physical and chemical properties of the experimental soil

Sand	Silt	Clay	Texture	O.M.	CaC O_3	pH	Available nutrients (ppm)					
							N	P	K	Fe	Zn	Mn
27.0	30.1	41.6	**Clayey**	1.3	3.0	8.1	46. 4	23.0	140	4.12	2.6	2.3

Hydrogen peroxide 33 % (H_2O_2), vitamin E 20 % + selenium 80 mg, citric acid anhydrous 95 %, salicylic acid 99 % and tannic acid 48 % were obtained from El-Gomhouria Co. for chemicals, Egypt.

The experimental design

The following treatments were arranged in a randomized complete block design with three replicates, follows:

1- Hydrogen peroxide (HP 5 ml/l), according to Lopez' Delgado *et al.*(2005).
2- Vitamin E (150 ppm), according to Arisha (2000).
3- Salicylic acid (SA100 ppm), according to Amer (2004), Alcohol was used solvent for salicylic acid and
4- Citric acid(CA 0.5 %), according to Abd- Allah (2001).
5- Tannic acid (TA150 ppm), according to Wada and Ou (2002).
6- Control.

The antioxidant treatments were applied to plants three times as foliar spray at, i.e.,42, 54 and 66 days after planting date.

Ammonium nitrate (33.5 % N) as a source of nitrogen was applied at three equal portions after 3, 5 and 7 weeks from planting date, while potassium sulphate (48.0 % K_2O) was added once with third portion of nitrogen. Normal superphosphate (15.5 % P_2O_5) was added once during the soil preparation. Chemical fertilizers at 180 kg N + 75 kg P_2O_5 + 96 kg K_2O/fed were used also added.

Studied characters

1. Vegetative growth characters

At 75 days after planting (DAP), a random sample of six plants from each plot was taken measure plant height, number of main stems/plant, foliage fresh and dry weight .

2.Yield and its components

Total tuber yield (ton per feddan), tuber number/plant, and tuber weight/plant, were determined at harvesting time (105 days after planting).

3. Tuber quality

At harvest time**,** tuber quality characters were determined as follows:

Random samples of tubers were dried at 70 ºC until constant weight for dry matter determination. Starch content in tubers was determined in dry matter according to A.O.A.C. (1990). Total soluble solids were determined by hand Refractometer. Vitamin C (ascorbic acid) content of tubers was estimated by titration with 2,6 – dichlorophenol indophenol blue dye.

4.NP and K contents in tubers

Total N, P and K in tubers were determined at harvest time according to the methods described by bremner and mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively.

Statistical analysis

The data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the randomized complete block design according to Gomez and Gomez (1984). The treatment means were compared using the Newly Least Significant Differences (N.L.S.D.) according to Waller and Duncan (1969) at 5 % level of probability.

RESULTS AND DISCUSSION

1. Vegetative growth characters

Data in Table (2) revealed that vegetative growth characters, i.e. plant height, number of main stems/plant and foliage fresh and dry weight/plant at 75 days after planting (DAP) were significantly affected in the two seasons. It is clear that foliar application of citric acid and vitamin E gave the highest values of plant height, number of main stems/plant and foliage fresh and dry weight/plant in both seasons. On the other hand, the lowest values of number of main stems/plant and foliage fresh and dry weight/plant were observed with control, while the lowest values of plant height were noticed with salicylic acid in both seasons. The effectiveness of any given antioxidant in the plant depends on which free radical is involved, and where the target of damage is. Thus, while in one particular system an antioxidant may protect against free radicals, in other systems it could have no effect at all, or in certain circumstances, an antioxidant even act a " Pro- oxidant" that generates toxic oxygen species (Munne – Bosch, 2002).These results agree with those reported by Kato-Naguchi,(1997) and Abd El-Allah *et al*.(2007).

Table 2: Effect of antioxidants on vegetative growth characters in the fall seasons of 2005/2006 and 2006/2007

Antioxidants	Plant height (cm)		No. of main stems/plant		Foliage fresh weight g/plant)		Foliage dry weight(g/plant)	
	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Hydrogen peroxide	52.53	50.99	2.72	2.66	294.56	287.20	11.27	11.09
Vitamin E	53.50	53.19	2.61	2.54	315.60	311.60	12.15	12.09
Citric Acid	56.22	55.84	2.82	2.79	347.60	338.10	13.45	13.23
Salicylic acid	42.65	39.16	2.47	2.32	259.06	257.80	11.26	11.21
Tannic acid	47.12	44.08	2.41	2.23	274.20	278.53	11.41	11.38
Control	45.20	42.85	2.32	2.23	269.80	268.16	11.08	11.00
N.L.S.D. 5 %	2.31	2.91	0.08	0.09	14.72	13.10	0.39	0.37

2. Yield and its components

The obtained data in Table (3) illustrated that potato total yield per feddan, number of tubers and tuber weight/plant were significantly increased with foliar spray of citric acid, vitamin E and hydrogen peroxide antioxidants in both seasons. The highest values of total yield and tuber weight/plant were obtained with foliar addition of citric acid followed by vitamin E, while the highest value of tuber number/plant was obtained with treatment received salicylic acid. These results were true in both seasons. These results may be attributed to the role of citric acid; it is one of a series of compounds involved in the physiological oxidation of fats, proteins and carbohydrates to CO_2 and water as well as chelation of transition metals, e.g., citric acid. This kind of mode of action depend on the availability of metals in catalyzing amounts. Interference with this process of catalysis by chelation would be expected to have a strong effect on the progress of the radical reaction transition metal ions may either be activated by the chelator increasing the catalyzing potential or may be rendered inactive. The change brought depends on the metal and chelator (Smith *et al*. 1990), (Gogoreena *et al*. 1997; Abd – Allah, 2007), while, the increased in total yield and tuber weight/plant path vitamin E due to the role of this tocopherol radical oxidation in plant metabolism became clear in Arabidopsis mutants, in which the cyclase was either deleted or overexpressed (Kanwischer *et al*. 2005)and some specific functions of α – tochopherolquinone have been also, suggested, for example antioxidant action in the reduced form and protection of photosystem against photoinhibition and transfer energy from the primarily excited molecule to the "quencher" (Burda *et al*. 2003) which as a tocopheral synthesis is regulated in plant responses to environmental stress, and "stress hormones" such as jasmonic acid, salicylic acid and ascorbic acid appear to play a role . It has been shown that the expression of tocopheral biosynthetic genes, particularly those encoding for tyrosine aminotransferase and p – hydroxyphenyphenylpyruvate dioxygenase, which catalyze the transamination from tyrosine to p – hydroxyphenyphenylpyruvate and its conversion to homogentisate, respectively,(Falk *et al*. 2002;Sandorf and Hollonder –Czytko,2002) further, strong positive α – tocopheral delay chlorophyll degradation (Munne-Bosch and Alegre, 2002), as well as excess sugar accumulation in potato plants (Hofius *et al.* 2004), while, number of tubers/plant via salicylic acid act as inhibitor plant hormone (Li-Zhaoliang *et al*. 1998), however SA plays as essential role in the regulation of plant growth and development (Harborne, 1980) also, koda *et al*. (1992) found that the ability of salicylic acid to stimulate tuberization in potato.

3. Quality characters (dry matter ,starch %, vitamin C and TSS in tubers)

The data presented in Table (4) indicated that the all antioxidants had significant stimulating effect on dry matter %, starch %, vitamin C and TSS contents in tubers of both seasons. The best treatments for increasing dry matter and starch were observed with foliar application of hydrogen peroxide but citric acid for vitamin C and TSS comparing to all studied treatments. Estimated increases in dry matter and starch accumulation in tubers ranged from 14.23 to 16.11 % and 20.18 to 20.14 in the first and second seasons, respectively. It may be that hydrogen peroxide (H_2O_2) treatment affects starch biosynthesis indirectly via effects on cellular signaling mechanisms .The treatment might generate of triggering signaling cascades activating various adaptive responses (Neill *et al.,* 2002 ; Pastori and foyer, 2002; Dietz and Scheibe, 2004). It is therefore, possible that included changes in gene expression cause the increased starch content we found in potato plants. An alternative possibility is post – translational redox regulation of starch metabolism enzymes, as found in ADP – glucose pyrophosphorylase (Ballicora *et al*., 2000).Hydrogen peroxide is therefore potentially useful to improve the tuber quality of potato crop. Tuber starch is an important quality character for potato crop. Dry matter is generally used as an index of starch content

Table 3: Effect of antioxidants on total tuber yield and its components in the fall seasons of 2005/2006 and 2006/2007

Antioxidants	Total tuber yield (t/fed)		No. of tubers/plant		Tuber weight plant	
	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Hydrogen peroxide	12.65	12.04	5.08	4.95	617.45	609.34
Vitamin E	12.78	12.36	5.33	5.22	638.25	619.81
Citric Acid	13.30	12.81	5.53	5.43	688.50	678.06
Salicylic acid	12.08	11.94	6.06	5.65	602.98	587.89
Tannic acid	12.07	11.83	4.89	4.87	582.94	591.58
Control	12.12	11.65	4.83	4.79	570.56	570.16
N.L.S.D. 5 %	0.36	0.32	0.23	0.17	18.81	16.60

Table 4: Effect of antioxidants on tuber quality in the fall seasons of 2005/2006 and 2006/2007

Antioxidants	Dry matter(%)		Starch (%)		Vitamin C (mg/100 g F.W.)		TSS(%)	
	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007	2005/ 2006	2006/ 2007
Hydrogen peroxide	16.54	16.94	13.40	13.42	16.10	16.09	4.30	4.37
Vitamin E	15.16	15.27	11.50	11.48	15.30	15.24	4.22	4.32
Citric Acid	16.33	16.43	11.87	11.82	18.88	18.76	4.42	4.50
Salicylic acid	16.22	16.32	11.88	11.90	15.41	15.20	4.12	4.17
Tannic acid	15.23	15.27	11.22	11.20	14.16	14.08	4.07	4.14
Control	14.48	14.59	11.15	11.17	13.15	13.06	4.02	4.04
N.L.S.D. 5 %	0.38	0.39	0.35	0.37	0.84	0.84	0.06	0.08

4. N, P and K contents in tubers

Results in Table (5) demonstrated clearly that N, P and K contents in tubers were significantly increased by the application of antioxidants in both seasons, except P content in the second season. However, the highest percentage of nitrogen was obtained with addition vitamin E, while phosphorus and potassium were found in tuber with citric acid application. These results are in accordance with those reported by El-Ghamriny *et al*. (1999), who came to similar conclusions regarding N, P and K contents in tomato fruits with foliar spray by vitamin C.

Table 5: Effect of antioxidants on N, P and K contents in tubers at harvesting in the fall seasons of 2005/2006 and 2006/2007

Antioxidants	N %		P %		K %	
	2005/2006	2006/2007	2005/2006	2006/2007	2005/2006	2006/2007
Hydrogen peroxide	1.71	1.66	0.35	0.33	1.83	1.78
Vitamin E	1.95	1.94	0.34	0.33	1.82	1.78
Citric Acid	1.74	1.73	0.36	0.34	2.28	2.17
Salicylic acid	1.62	1.59	0.31	0.31	1.78	1.71
Tannic acid	1.59	1.57	0.31	0.31	1.75	1.70
Control	1.50	1.50	0.30	0.31	1.66	1.63
N.L.S.D. 5 %	0.07	0.07	0.02	N.S.	0.09	0.07

REFERENCES

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

Abd-Allah, E.M., M.A. ISSA, S.M. Abd El-Kader; H.S. Abd El-Salam, and W.M.Abd El-Hakim (2007). Effect of some antioxidants treatments on yield, some chemical constituents and antinutritional factors of some vegetable legumes. 1st Intr. Conf. Desert Cultivation Problems & Solutions, Minia Univ., 27-29 March.

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

A.O.A.C. (1990). Official Methods of Analysis Association of Official Analytical Chemists. 15th ed. Inc. Wash. D.C. Nutrient Cycling in Agroecosystems, 56 (3): 263-275.

Arisha, H.M.E. (2000). Effect of Vitamin C on growth, yield and tuber quality of some potato cultivars under sandy soil conditions. Zagazig J. Agric. Res. 27(1): 91-104.

Ballicora, M. A., B.F.Jeremiah, F.Yingbin, P. Schurmann, and Preiss.(2000). Activation of the potato tuber AdP glucose pyrophosphorylase by thioredoxin .J.Biol. Chem. 275:1315-1320.

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., pp. 595-624.

Burda K., J.Kruk , R. Borgstadt , J. Stanek , K. Strzalka, G.H. Schmid and O.Kruse (2003). Mossbauer studies of the non- heme iron and cytochrome in a *Chlamydomonas reinharditi* PSI- mutant and their interactions with α – tocopherol quinine. FERBS Lett 535-159-165.

Dietz, K.J. and R. Scheibe (2004). Redox regulation: an introduction. Physiol. Plant, 120: 1-3.

El-Ghamriny, E.A., M.H.Arisha and K.A.Nour (1999). Studies on tomato flowering, fruit set, yield and quality in summer. 1. Spraying with thiamine, ascorbic acid and yeast. Zagazig J. Agric. Res. 26 (5): 1345-1364.

Falk, J.,N.Krauss , D.Dahnhard andK . Krupinska (2002).The senescence associated gene of barley encoding 4-hydroxyphenylpyruvate dioxygenase is expressed during oxidative stress. J. Plant Physiol 159: 1245-1253.

Gogoreena, Y., A.J.Gordon, P.R. Escured, J.F. Witty, and J.F Moran (1997). N_2 fixation, carbon metabolism and oxidative damage in nodules of dark stressed common bean plants. Plant Physiol. 113: 1193-1201.

Gomez, K.N. and A.A. Gomez (1984). Statistical procedures for agricultural research. John Wiley and Sons, New York, 2nd ed., 68 P.

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

Hofius, D., M. Hajirezaei, M. Gelger, H. Tschierschh, M.Melzer and U.Sonnewold (2004). RNAL – mediated tocopheral deficiency impairs photoassimilates export in transgenic potato plants. Plant Physiol. 135: 1256-1268.

Jackson, M.L. (1970). Soil Chemical Analysis. Prentic Hall, Englewood Ceiffs, N.J. ahkonen, M.M., A.L. Hopia, H.J. Vuorela, J.P. Rauha, K. Pihlaiak, T.S. Kujala and M. Heinonen (1999). Antioxidant activity of plant extracts containing phenolic compounds. J. Agric. Food Chem. 47: 3954-3662.

Kanwischer, M. S. Porfirova, E. Bergmuller and P. Dormann (2005). Alterations in tocophpherol cyclase activity in transgenic and mutant plants of arapidopsis affect tocopherol content, tocopherol composition, and oxidative stress. Plant Physiol. 137: 713-723.

Kapulnik, Y., N. Yalpani and I. Raskin (1992). Salicylic acid induces cyanide-resistance respiration in tobacco cell suspension cultures. Plant Physiol. 100: 1921-1926.

Karadeniz, F., H.S Burdurlu and Y. Soyer (2005). Antioxidant activity of selected fruits and vegetables grown in Turkey. Turk. J. Agric. 29: 297-303.

Kato-Naguchi, H. (1997). Effect of citrate on respiratory gas exchange and metabolism in carrot-root tissues. Phytochemistry, 45: 225-227.

Koda, Y., K.Takahashi and Y. Kikuta (1992). "Potato tuber uncluding activities of salicylic and related compound". J. Plant Growth Regulation 11: 215-219.

Li-Zhaoliang, M., Y.B. Yuan, C.L. Liu, Z.Z. Cao, Z.L. Li, Y.B. Yuan, C.L. Liu, and Z.X. Cao (1998). Regulation of antioxidant enzymes by salicylic acid in cucumber leaves. Acta Botanica Sinica, 40: 356-361.

Lopez-Delgado, L.H., H.A.Zaualeta-Mancera, M.E.Mora-Herrera, M.V Rivera, F.X.Flores-Gutierrez and I.M. Scott (2005). Hydrogen peroxide increases potato-tuber and stem starch content, stem diameter and stem lignin content. Amer. J. Potato Res. 82: 279-285.

Moustafa, Y.M.M. (1999). Improving the Productivity of Tomato by Producing F_1 Hybrids and Using Some Antioxidant Treatments. M. Sc. Thesis, in Vegetable crops, Dept. Hort. Fac. Agric. El-Minia Univ. pp. 125.

Munne- Bosch, S. (2005). The role of α – tocopherol in plant stress tolerance. J . plant physiol. 162 :743748 .

Munne-Bosch, S. and L. Alegre (2002). The function of tocopherols and tocotrienols in plants. Crit Rev plant Sci 21:31-57 .

Neill , S.J.,R.Desikan , A.Clarke, R.D.Hurst and J.T. Hancock (2002). Hydrogen peroxide and nitric oxide as signaling molecules in plants. JExp. Bot. 53:1237-1247.

Nickell, G.L. (1991). Proceedings 18th Annual Meeting. Plant Growth Regulation Soc. of America, LaGrange, GA. PP 115-120.

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., pp. 403-430.

Pastori,G.M. and C.H. Foyer (2002). Common components, networks, and pathways of cross –tolerance to stress. The central role of "redox" and abscisic acid mediated controls. Plant Physiol .129:460-468.

Rajagopal, S., D. Joly, A. Gauthier, M. Beauregared and R.Carpentier (2005). Productive effect of active oxygen scavengers on protein degradation and photochemical function in photosystem submembrane fractions during light stress. FEBS. J. 272: 892-902.

Sandorf, I.and H. Hollander – Czytko (2002). Jasmonate is involved in the induction of tyrosine aminotransferase and tocopherol biosynthesis in Arabidopsis thaliana. Planta 206:173-179.

Smith, J.B. , J.C. Cumano and C.F. Balbs (1990). Quantitive effects of iron chelators on hydroxyl radical production by the superoxide- driven fenton reaction. Free Radical Res. Comm.. 8: 101-106.

Tsukaya, H. , T. Oshima ,S. Naito, M. Chino and Y. Komeda (19991).Sugar dependent expression of the CHS-A gene fore chalcone synthase from petunia in transgenic Arabidopsis. Plant Physiol. 97:1414-1421.

Wada, L. and B.Ou (2002). Antioxidant activity and phenolic content of Oregon cranberries. J. Agric. Food Chem. 50: 3495-3500.

Waller, R.A. and D.B. Duncan (1969). A bays rule for the symmetric multiple comparison problem. J. Amer. Assoc., 64: 1484-1503.

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.

Youssef, N.S. and E.M. Abd-Allah (2007). Role of antioxidant treatments improving potato yield and quality. Bull. Fac. Agric. Cairo Univ., 58: 144-158.

تأثير بعض مضادات الأكسدة على نمو ومحصول وجودة البطاطس

السيد محمد محمد عوض ، صفاء على أحمد منصور

معهد بحوث البساتين ، مركز البحوث الزراعية ، الجيزة ، مصر.

أجرى هذا البحث خلال الموسمين النيليين ٢٠٠٦/٢٠٠٥ ، ٢٠٠٧/٢٠٠٦ على محصول البطاطس صنف سبونتا بقرية أبو عوض – أجا – محافظة الدقهلية – مصر. لتقييم استجابة نبات البطاطس لبعض معاملات مضادات الأكسدة على النمو والمحصول ومكوناته بالإضافة إلى بعض صفات الجودة. تم استخدام خمسة مضادات أكسدة هي فوق أكسيد الهيدروجين (٥ مل/لتر) ، فيتامين E (١٥٠ ppm) ، حمض الستريك (٠,٥ %) ، حمض السالسيلك (١٠٠ ppm) ، حمض التنيك (١٥٠ ppm) بالإضافة إلى معاملة الكنترول. وقد أوضحت النتائج المتحصل عليها أن صفات المجموع الخضري لنبات البطاطس (ارتفاع النبات ، الوزن الطازج والجاف/نبات) عند عمر ٧٥ يوم من الزراعة وأيضاً المحصول الكلى للدرنات ووزن الدرنات/نبات قد زادت معنوياً مع الإضافة الورقية بحمض الستريك وفيتامين E في كل من موسمي الزراعة. بينما عدد السيقان الرئيسية وعدد الدرنات/نبات تأثر معنوياً باستخدام فوق أكسيد الهيدروجين وحمض السالسيلك في موسمي الزراعة على الترتيب.

فوق أكسيد الهيدروجين في كلا موسمي الزراعة أدى إلى زيادة في تحسين نسبة المادة الجافة والنشا في الدرنات مقارنةً بالكنترول. حمض الستريك أعطى أعلى محتوى من فيتامين C ، الفوسفور والبوتاسيوم في الدرنات. أيضاً محتوى النيتروجين سجل أعلى قيم باستخدام فيتامين E مقارنةً بالكنترول في كلا موسمي الزراعة.

التأثير المفيد لمضادات الأكسدة أدى إلى تحسين الصفات الخضرية والإنتاجية والمحتوى الكيميائى لدرنات البطاطس.