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Promoting Productivity of Washington Navel Orange Trees by Using Some Crop Seed Sprout Extracts, Silicon and Glutathione

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ABSTRACT

During 2012 & 2013 seasons, Washington Navel orange trees grown under Bany Suef region conditions received four sprays (growth start, just after fruit setting and at one month intervals) of seed sprout extracts namely wheat, rocket and Fenugreek each at 0.4% and / or potassium silicate and glutathione each at 0.1% . The study focused on the effect of these treatments on solving the problems of poor yield of such citrus species.

Single and combined applications of wheat, rocket and fenugreek seed sprout extracts at 0.4% and/ or potassium silicate at 0.1% and glutathione at 0.1% was very potent in enhancing growth, total chlorophylls, N, P,& K , yield and fruit quality comparing to the check treatment. The promotion was materially associated with using seed sprout extract of wheat, fenugreek and rocket, in descending order. Using seed sprout extracts (wheat, fenugreek and rocket) and / or potassium silicate and glutathione each at 0.1% was preferable than using seed sprout extracts alone of all crops.

The best results with regard to overcoming poor yield and improving fruit quality of Washington Navel orange trees were obtained due to spraying the trees four times with wheat seed srpout extract at 0.4% plus potassium silicate and glutathione each at 0.1%.

Key words: Washington Navel orange trees seed, sprout extracts, silicon and glutathione

Introduction

Poor fruit setting as well as the decline on the yield of Washington Navel orange trees grown under Middle Egypt conditions are considered serious problems facing such citrus species.

Recent studies showed that solving the problem of yield reduction, nowadays in fruit crops depends on using crop seed sprout extracts as well as the two important antioxidants namely silicon and glutathione. Local and foreign literatures are rarely available about the effect of seed sprouts of crop species on fruit crops. Sprouting is active and complex metabolic process that may alter the content and composition of proteins and amino acids and improve the nutritional value. In fenugreek proteins digestibility after seed germination increased by 4-15 %. Sprouting was beneficial in increasing the biological availability of all vitamins. Vitamin C increased from 4 to 20 folds and A, B, B_2 reduced. Germination of rocked seeds elaborate biochemical changes and proteins break into amino acids and water soluble vitamins such as vitamins B and C (Camacho *et al.,* 1992; Patil *et al.,* 1997; Cairney, 1999 and 2005 ; Biommerson, 2007 and Anwar *et al.,* 2009).

Various studies showed that using silicon was beneficial for counteracting the adverse effects of water stress on growth and nutritional status of the plants (Epstein, 1999 and Epstein and Bloom, 2003). It is also known that silicon increases drought tolerance in plants by maintaining plant water balance, photosynthesis activity, erectness of leaves and structure of xylem vessels under higher transpiration rates. Also, its is responsible for encouraging water transport and root growth under unfavourable conditions and antioxidants defense system (Neumann and Zur- Nieden, 2011).

Glutathione as antioxidant containing three amino acids i.e. cysteine , glycine and glutamic acid is the most important non- protein thiol present in the plants. It is essential in sulfur metabolism and very important in producing tolerance to all stresses of plants. It regulates sulfur uptake and produces antioxidant defense system for avoiding the great damage and hazards that caused by reactive oxygen species. It is responsible for enhancing the biosynthesis of organic foods and cell division (Levitt, 1980; Rennenberg, 1982 and Meister and Anderson, 1983).

Using crop seed sprout extracts was very effective in enhancing growth, nutritional status, yield and fruit quality of different horticultural crops (Abdallah *et al.,* 2000 ; Bauttsta- Banos *et al.,* 2003 ; Crews and peoples , 2004; Cazoula *et al.,* 2004; Abdallah , 2008 . Mohamed, 2008; Darwish, 2009, Anderson and Cedergreen, 2010; Al- Shereif *et al.,* 2013 and El- Sayed -Faten, 2014).

Previous studies showed that using silicon in fruit orchards under drought conditions were accompanied with alleviating the adverse effects of drought on growth, plant pigments as well as nutritional status of the plants (Matichenov *et al.,* 2000; Kanto, 2002; Ma and Takahashi, 2002; Neumenn and Zur- Neiden 2011; Gad El- Kareem, 2012; Al- Wasfy, 2013; Ahmed *et al.,* 2013 and Ibrahim and Al –Wasfy, 2014) .

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Spraying Glutathione proved to be very beneficial effect on enhancing growth and fruiting of different fruit crops (Levitt, 1980; Rennenberg, 1982; Meister and Anderson, 1983; Dekok and Stulen, 1993; Jorge *et al.,* 1993; Foyer *et al.,* 1997; Noctor and Foyer, 1998; Tausz and Grill , 2000; Kocsy *et al.,* 2001; Mullineaux and Rausch, 2005 and Abdelaal *et al.,* 2012).

The merit of this study was examining the effect of wheat, rocket and fenugreek seed sprout extracts, silicon and glutathione on improving fruiting of Washington Navel orange trees.

Materials and Methods

This study was carried out during 2012 and 2013 seasons on thirty – nine uniform in vigour 22- years old Washington Navel orange trees onto sour orange rootstock. The selected trees are grown in a private orchard located at El- Fashen district , Bany Suef Governorate. The selected trees are planted at 5x5 meters apart. The texture of the soil is clay and the water table depth not less than two meters. Soil analysis was done according to the procedures that outlined by Chapman and Pratt (1965)

Table 1: Analysis of the tested soil

Constituents	Values
Sand %	5.7
Silt %	14.3
Clay %	80
Texture	Clay
O.M. %	2.41
pH (1 : 2.5 extract)	8.00
EC (1 : 2.5 extract) (mmho/ mm/ 25ºC	0.97
CaCO3 %	1.25
Total N %	0.09
Available (ppm)	4.1
Available K (ppm)	415.5

The selected trees were subjected to the common horticultural practices that already applied in the orchard. Surface irrigation system was followed using Nile water.

This experiment included the following thirteen treatments:

1- Control.
2- Spraying extract of wheat seed sprouts at 0.4% (4 g / L)
3- Spraying extract of rocket seed sprouts at 0.4% (4 g / L)
4- Spraying extract of fenugreek seed sprouts at 0.4% (4 g / L)
5- Spraying extract of wheat seed sprouts at 0.4% + spraying potassium silicate at 0.1% .
6- Spraying extract of rocket seed sprouts at 0.4% + spraying potassium silicate at 0.1%.
7- Spraying extract of fenugreek seed sprouts at 0.4% + spraying potassium silicate at 0.1%.
8- Spraying extract of wheat seed sprouts at 0.4% + spraying glutathione at 0.1%
9- Spraying extract of rocket seed sprouts at 0.4% + spraying glutathione at 0.1%.
10- Spraying extract of fenugreek seed sprouts at 0.4% + spraying glutathione at 0.1%.
11- Spraying extract of wheat seed sprouts at 0.4% + spraying potassium silicate at 0.1% + glutathione at 0.1%.
12- Spraying extract of rocket seed sprouts at 0.4% + spraying potassium silicate at 0.1 % + spraying glutathione at 0.1%.
13- Spraying extract of fenugreek seed sprouts at 0.4% + spraying potassium silicate at 0.1 % + spraying glutathione at 0.1%.

Each treatment was replicated three times, one tree per each. Extracts the three crops species namely wheat, rocket and fenugreek applied at fixed once. (according to Abdellah, 2008). They were prepared by cleaning the seeds from all impurities and subjected for sprout production as follows: a) Rocket seeds were sown at a rate of 30 g seeds /m^2 (according to Abdallah , 2008) . Rocket sprout was harvested at fully expanded green cotyledonny leaves stage at green sprouts which was after 11 days from seed sowing in full season, b) Fenugreek seeds were sown in dark using glass jar method as described by Abdallah (2008), sprouts were harvested after three days from seed soaking and c) wheat seeds were sown in open trays and left under shade conditions till ten days then the sprouts were picked , Generally sprouts of wheat rocket and fenugreek were homegenzied with distilled water at 1 : 10 using an electric blender for five minutes , then fillterated , and kept under 4ºC in the refreigrator till use . For preparing 0.4% concentrations (4 g / L) may take 40 ml of such extract / water. Silicon was applied in the form of potassium silicate (20% Si + 10% K_2O) . All crop seed sprout extracts silicon and glutathione at fixed rate namely 0.1% (Gad El Kareem , 2012, Al- Wasfy, 2013) were sprayed four times at growth start (1st week of Mar.), just after fruit setting (mid. of Apr.) and at one month intervals. Triton B as a wetting agent at 0.1% was added to all sprayed solutions. Chemical analysis of wheat,

rocket and fenugreek seeds sprout was shown in Table (2). Randomized complete block design (RCBD) was adopted .

Table 2. Chemical constituents of different crop seed sprouts at the start of study (mg/ 100 g F.W.)

Wheat seed sprout (mg/ 100 g F.W.)		Rocket seeds sprout (mg/ 100 g F.W.)		Fenugreek seed sprout (mg/ 100 g F.W.)	
Constituent	Values	Constituent	Values	Constituent	Values
Asparatic acid	3.3	Cystine	4.1	Aspartic acid	2.2
Arginine	4.0	Cysteine	3.9	Arginine (mg / 100 g F.W.)	2.1
Alanine	3.1	Methionene	3.8	Alanine	2.9
	4.1	Glutamic acid	3.5	Isolecuine	2.1
Glutamic acid	5.2	K	496	Cysteine	1.9
Thiamine (B1)	3.1	P	1410	Cystine	1.8
Riboflavine (B2)	3.0	Mg	460	Glutamic acid	2.0
Pyrodoxine (N6)	2.1	Thiamine	0.16	Methioneen lysine	6.0
Vitamin E	0.59	Rabflavine	0.15	Vitamin A	50.0
K	644	Vitamin E	0.94	Vitamin B1 thiamine	0.32
P	600	Vitamin A	4.4	Viamin B2 riboflavin	0.30
Mg	319	Vitamin C	101	Viamin B6 pyrotaxin	1.0
Ca	292	Fe	267	Vitamin C	20
Fe	211	Mn	16	Ca	220
Zn	218	Zn	255	P	341
				K	469
				Mg	371
				Fe	242
				Phytic acid	0.9
				Total phenols	5.36
				Niacin	1.4

At the end of each season, the following parameters were measured:

1. Leaf area in cm^2 (Ahmed and Morsy, 1999) .
2. Total chlorophylls in the fresh leaves of spring growth cycle (1st week of Sept) as mg/ 100 g F.W. (Moran , 1949) by summation of chlorophyll a & b .
3. In the first week of Sept. leaves of spring growth cycle in non fruiting shoots (Summer, 1985) were dried for determination of N, P and K (Chapman and Pratt, 1965).
4. Percentage of fruit retention.
5. Yield expressed in weight (kg.) and number of fruits / tree.
6. Fruit quality characteristics namely fruit weight (g.) , fruit peel weight % , fruit peel thickness (cm), percentages of juice, T.S.S., total acidity % (as g citric acid/ 100 ml juice), total reducing and non-reducing sugars % (A.O.A.C. 2000), vitamin C (mg/ 100 ml juice) , T.S.S./ acid and total proteins in the juice (Chapman and Pratt, 1965).

Statistical analysis was done and the new L.S.D. test at 5% was used to differentiate among the various treatment means (Mead *et al.,* 1993).

Results

Leaf area and its content of total chlorophylls N, P and K:

It is clear from the data in Table (3) that varying crop seed sprout, silicon and glutathione treatments had significant effect on the leaf area and its content of total chlorophylls N, P and K. Single and combined application of the seed sprout extracts of wheat, rocket and fenugreek, silicon and glutathione had significant stimulation on the leaf area as well as, total chlorophylls, N, P and K in the leaves over the check treatment. The best seed sprout extract was wheat, followed by fenugreek and rocket occupied the last position in this respect. Using extracts of seed sprout of any one of the three crop species in combined with spraying silicon and / or glutathione was superior than using seed sprouts alone. Using glutathione plus seeds sprouts of the three crops was significantly superior to using silicon with seed sprouts. Application of silicon and glutathione together with any one of seed sprouts significantly surpassed the application of any one alone in this respect. The maximum values were recorded on the trees that sprayed with extract of seeds sprouts of wheat + silicon and glutathione. The untreated trees produced the minimum values. These results were true during 2012 & 2013 seasons.

Table 3. Effect of some crop seed sprout extracts, silicon and glutathione treatments on the leaf area, total chlorophylls and percentages of N, P and K in the leaves of Washington Navel orange trees during 2012 & 2013.

Treatment	Leaf area (cm2)		Total chlorophylls (mg/ 100 g F.W.)		Leaf N %		Leaf P %		Leaf K %	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Control	24.1	23.0	9.1	8.7	1.80	1.87	0.11	0.12	1.11	1.13
Wheat seed sprout extarct at 0.4%	28.3	27.2	9.8	9.4	2.02	2.10	0.19	0.21	1.30	1.33
Rocket seed sprout extract at 0.4%	25.3	24.2	9.3	8.9	1.87	1.95	0.14	0.16	1.17	1.20
Fenugreek seed sprout extarct at 0.4%	27.0	25.9	9.5	9.1	1.95	2.02	0.16	0.18	1.24	1.27
Wheat seed sprout + silicon	31.7	30.5	10.5	10.1	2.24	2.31	0.25	0.26	1.53	1.56
Rocket seed sprout + silicon	29.4	28.3	10.0	9.6	2.10	2.17	0.21	0.23	1.37	1.40
Fenugreek seed sprout + silicon	30.5	29.3	10.2	9.8	2.17	2.25	0.23	0.24	1.44	1.47
Wheat seed sprout + glutathione	32.8	31.6	11.2	10.8	2.47	2.55	0.31	0.31	1.75	1.78
Rocket seed sprout + glutathione	30.5	29.4	10.8	10.4	2.33	2.40	0.28	0.30	1.61	1.63
Fenugreek seed sprout + glutathione	31.7	30.6	11.0	10.7	2.40	2.47	0.30	0.29	1.67	1.70
Wheat seed sprout + silicon + glutathione	36.2	35.0	12.1	11.7	2.71	2.80	0.38	0.40	1.95	1.96
Rocket seed sprout + silicon + glutathione	33.9	32.7	11.4	11.0	2.56	2.63	0.34	0.36	1.82	1.81
Fenugreek seed sprout + silicon + glutathione	35.0	33.9	11.7	11.4	2.64	2.71	0.36	0.37	1.89	1.90
New L.S.D. at 5%	1.1	1.2	0.2	0.2	0.06	0.05	0.02	0.02	0.05	0.04

Fruit retention % and yield per tree:

It is evident from the data in Table (4) that the percentage of fruit retention as well as yield expressed in weight and number of fruits / tree were significantly improved in response to foliar application of seed sprout extracts of wheat, rocket and fenugreek either alone or with silicon and/ or glutathione comparing to the control treatment. Spraying extracts of seed sprouts of wheat, fenugreek and rocket, in descending order significantly was followed by improving fruit retention, yield and number of fruits/ tree. Using silicon and/ or glutathione with different seed sprouts significantly was preferable than spraying these seed sprouts alone in this connection. Using glutathione with various seed sprouts significantly surpassed the application of silicon with these seed sprouts and using both together was significantly preferable than using each alone in this respect. The maximum yield (75.8 & 76.1 kg) was presented in the trees that received four sprays of a mixture of bio stimulant containing wheat seed sprouts extract, silicon and glutathione during both seasons, respectively. The lowest yield (47.1 & 46.2 kg) was observed on the untreated trees during both seasons, respectively. The percentage of increase on the yield due to using the promised treatment (wheat seed sprouts + silicon + glutathione) over the check treatment reached 60.93 & 64.72 % during 2012 & 2013 seasons, respectively.

Table 4. Effect of some crop seed sprout extracts, silicon and glutathione treatments on the percentage of fruit retention, number of fruits per tree, yield, fruit weight and fruit peels % of Washington Navel orange trees during 2012 & 2013.

Treatment	Fruit retention %		No. of fruits / tree		Yield / tree (kg.)		Fruit weight (g.)		Fruit peel weight %	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Control	0.90	0.88	242.0	241.0	47.1	46.8	194.0	191.7	25.0	24.9
Wheat seed sprout extarct at 0.4%	1.10	1.12	261.0	262.0	53.4	53.7	204.6	204.9	23.1	22.9
Rocket seed sprout extract at 0.4%	0.97	0.99	248.0	249.0	48.8	49.1	196.6	197.0	24.0	23.8
Fenugreek seed sprout extarct at 0.4%	1.04	1.05	255.0	256.0	51.5	51.7	201.8	201.8	23.5	23.3
Wheat seed sprout + silicon	1.30	1.31	281.0	281.0	60.1	60.4	214.0	215.0	21.0	20.8
Rocket seed sprout + silicon	1.16	1.16	268.0	268.0	55.6	55.7	207.6	208.0	22.2	22.1
Fenugreek seed sprout + silicon	1.22	1.24	274.0	275.0	58.2	58.6	212.3	213.0	21.5	21.3
Wheat seed sprout + glutathione	1.49	1.50	299.0	300.0	68.0	68.4	227.5	228.0	18.6	18.4
Rocket seed sprout + glutathione	1.36	1.35	288.0	290.0	63.5	64.2	220.5	221.5	20.1	20.1
Fenugreek seed sprout + glutathione	1.43	1.41	294.0	294.0	66.2	66.4	225.0	226.0	19.3	19.1
Wheat seed sprout + silicon + glutathione	1.70	1.76	320.0	321.0	75.8	76.1	237.0	238.0	16.9	16.7
Rocket seed sprout + silicon + glutathione	1.55	1.60	306.0	307.0	70.4	70.9	230.0	231.0	18.0	17.8
Fenugreek seed sprout + silicon + glutathione	1.61	1.66	312.0	314.0	72.4	73.2	232.0	233.0	17.5	17.3
New L.S.D. at 5%	0.06	0.05	5.0	5.8	1.3	1.4	4.5	4.7	0.5	0.6

Fruit quality:

Data in Tables (5 to 6) obviously reveal that spraying extracts of seed sprouts of wheat, rocket and fenugreek with or without silicon and glutathione caused a significant promotion on fruit quality in terms of increasing fruit weight, juice %, T.S.S., T.S.S. / acid, total reducing and non- reducing sugars, vitamin C and total proteins in the juice and reducing fruit peel weight and thickness and total acidity % comparing with the check treatment. The promotion was significantly associated with using wheat seed sprouts extract followed by using fenugreek seed sprouts. Extracts of rocket seed sprouts occupied the last position in this respect. Using silicon and/ or glutathione with extracts of seed sprouts of the three crops significantly were preferable than using seed extracts alone. The best results with regard to fruit quality were observed due to supplying the trees four times with extracts of wheat seed sprouts + silicon + glutathione. Unfavourable effects on fruit quality were observed on the untreated trees. Similar results were declared during 2012 & 2013 seasons.

Table 5. Effect of some crop seed sprout extracts, silicon and glutathione treatments on some physical and chemical characteristics of the fruits of Washington Navel orange trees during 2012 & 2013.

Treatment	Fruit peel thickness (cm.)		Juice %		TS.S. %		Total acidity %		T.S.S. / acid	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Control	0.51	0.53	40.5	40.0	13.9	13.7	1.737	1.713	8.0	8.0
Wheat seed sprout at 0.4%	0.44	0.43	42.3	43.0	14.6	14.6	1.640	1.627	8.9	9.0
Rocket seed sprout at 0.4%	0.48	0.47	41.1	41.8	14.1	14.1	1.700	1.687	8.3	8.4
Fenugreek seed sprout at 0.4%	0.46	0.45	41.7	42.4	14.4	14.5	1.671	1.660	8.6	8.7
Wheat seed sprout , silicon (s)	0.38	0.37	44.1	44.8	15.2	15.2	1.530	1.513	9.9	10.0
Rocket seed sprout + silicon(s)	041	0.40	43.0	43.6	14.8	14.8	1.600	1.587	9.3	9.3
Fenugreel seed sprout + silicon(s)	0.39	0.38	43.5	44.1	15.0	15.0	1.560	1.540	9.6	9.7
Wheat seed sprout + glutahione	0.37	0.36	46.3	47.0	15.7	15.8	1.430	1.416	11.0	11.2
Rocket seed sprout + glutahione	0.40	0.39	45.0	45.7	15.4	15.5	1.500	1.487	10.3	10.4
Fenugreek seed sprout + glutahione	0.38	0.37	45.6	46.3	15.6	15.7	1.461	1.441	10.7	10.9
Wheat seed sprout + silicon + glutahione	0.36	0.35	48.3	49.0	16.1	16.3	1.341	1.323	12.0	12.3
Rocket seed sprout + silicon + glutahione	0.40	0.39	47.0	47.6	15.8	15.9	1.400	1.387	11.3	11.5
Fenugreek seed sprout + silicon + glutahione	0.38	0.38	47.7	48.5	15.9	16.1	1.371	1.357	11.6	11.9
New L.S.D. at 5%	0.02	0.02	0.5	0.5	0.2	0.2	0.025	0.026	0.5	0.6

Table 6. Effect of some crop seed sprout extracts, silicon and glutathione treatments on some chemical characteristics of the fruits of Washington Navel orange trees during 2012 & 2013.

Treatments	Total sugars %		Reducng sugars %		Non reducing sugars %		Vitamin C (mg/ 100 ml juice)		Fruit total proteins %	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Control	9.1	9.0	3.5	3.4	5.6	5.6	41.1	41.1	0.60	0.53
Wheat seed sprout at 0.4%	9.8	10.0	4.0	3.9	5.8	6.1	43.6	44.5	0.75	0.71
Rocket seed sprout at 0.4%	9.3	9.4	3.7	3.5	5.6	5.9	41.7	42.5	0.65	0.62
Fenugreek seed sprout at 0.4%	9.5	9.7	3.8	3.6	5.5	6.1	42.7	43.4	0.70	0.66
Wheat seed sprout , silicon (s)	10.5	10.6	4.5	4.3	6.0	6.3	46.8	47.5	0.90	0.90
Rocket seed sprout + silicon(s)	10.0	10.1	4.2	4.1	5.8	6.0	44.7	45.1	0.80	0.79
Fenugreel seed sprout + silicon(s)	10.2	10.3	4.3	4.1	5.9	6.2	45.9	46.6	0.86	0.84
Wheat seed sprout + glutahione	11.2	11.4	4.9	4.7	6.3	6.7	48.5	49.0	0.96	0.95
Rocket seed sprout + glutahione	10.7	10.9	4.6	4.4	6.1	6.5	47.1	47.8	0.94	0.93
Fenugreek seed sprout + glutahione	11.0	11.2	4.7	4.6	6.3	6.6	47.7	48.5	0.95	0.94
Wheat seed sprout + silicon + glutahione	11.8	12.0	5.2	5.0	6.6	7.0	50.7	51.5	1.00	1.06
Rocket seed sprout + silicon + glutahione	11.4	11.5	5.0	4.8	6.4	6.7	49.1	49.7	0.95	0.97
Fenugreek seed sprout + silicon + glutahione	11.6	11.7	5.1	4.9	6.5	6.8	49.7	50.5	0.96	1.01
New L.S.D. at 5%	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.5	0.04	0.04

Discussion

The positive action of extract of seed sprouts on growth and fruiting of Washington Navel orange trees might be attributed to their higher own content from amino acids, minerals and vitamins such as V.B. and V. C (Camecho *et al.,* 1992 ; Patil *et al.,* 1997 ; Cariney, 1997 and 2005 and Anwar *et al.,* 2009).

The beneficial effects of silicon on counteracting the adverse effects of all stresses around the trees on growth and fruiting could explain the present results. The great merits of silicon in enhancing the plant resistant to different disorders uptake of water, photosynthesis, water transport and root developed could give another explanation for the present results (Neumann and Zur- Nieden , 2011).

The essential role of glutathione as the three peptides compound containing glycine, cysteine and glutamic acid in enhancing sulfur metabolism as well as facilitating reduction and oxidation reactions as well as enhancing the tolerance of trees to all stresses and the antioxidant defense system for avoiding hazards that caused by reactive oxygen species. Also, glutathione had a definite role in the biosynthesis of organic foods and cell division (Levitt & 1980, Rennenberg, 1982 and Meister and Anderson, 1983).

The promoting effect of seed sprouts (Darwish 2009 ; Andersen and Cedergreen , 2010; Al- Shereif *et al.,* 2013 and El- Sayed- Faten, 2012). Silicon (Gad El- Kareem, 2012 and Al- Wasfy, 2013; Ahmed *et al.,* 2013 and Ibrahim and Al- Wasfy, 2014) and glutathione (Mullineaux and Rausch, 2005 and Abdelaal *et al.,* 2012) on growth and fruiting of horticultural crop were emphasized.

Conclusion:

For overcoming poor yield of Washington navel orange trees and at the same improving fruit quality , it is necessary for spraying wheat seeds sprouts extract at 0.4% + silicon + glutathione each at 0.1% four times at growth start, just after fruit setting and at one month intervals.

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