

Original Research Article

Response of Sunflower (*Helianthus annuus* L.) to spraying of ~~nanosilver~~ nanosilver, organic fertilizer (Algaster) and salicylic acid and their impact on seeds content of fatty acids and vicine

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Abstract:

This experiment was carried out on Sunflower (*Helianthus annuus* L.) Spanish class (Viki) in one of the fields for the period from 03/05/2013 until 06/18/2013, where the shoots were sprayed after period of 65 days of its cultivation with 25 and 50 ml-/l-liter of ~~nanosilver~~ nanosilver, 0.75 and 1.5 g-/l-liter of organic fertilizer (Algaster) and with use of salicylic acid in two concentrations 60 and 120 mg/l in addition to the comparison treatment (spraying with distilled water only). The field experiment was laid as a factorial experiment which included three factor in RBCD design with three replication (3×3×3) that included three factors, the averages of transaction were compared by using LSD (Least significant difference at 0.05%).

Results of the experiment referred that spray shoots with 50 ml-/l-liter of ~~nanosilver~~ nanosilver, 1.5 g-/l-liter of organic fertilizer (Algaster) and 120 mg-/l-liter of salicylic acid gave the highest positive effects of unsaturated fatty acid while the same high concentrations of factors reduced ~~seeds~~ content of the most of the saturated fatty acids and vicine in seeds_[01]. The three way interaction had affection on field experiment in some studied traits positively while it had no significant effect on seeds content of vicine and fatty acids (Palmitic_[02], Stearic, Arachidic, Myristic_[02], Linoleic and Oleic).

Keywords : ~~Nano-silver~~ Nanosilver, Salicylic acid, Vicine

1. INTRODUCTION

Sunflower plant (*Helianthus annuus* L.) is considered of annual oil crops that are grown in the spring and autumn. This plant belongs to the family Compositae (Asteraceae) [1,2].

***This research is a part of Ph.D. Dissertation of the second researcher**

36 The original inhabitant of the plant southwest of the United States America
 37 then. It^[03] is known in Asia, and it is believed that the Indian tribes; who are in the
 38 United States were the first in cultivation of the sunflower and then transplant to
 39 the southwestern United States and Europe by the Spaniards and moved it to
 40 Russia, where it began easily spread, since the year 1860 [3].

41 Sunflower crop characterized by its third sequence in importance for the
 42 production of oils after Peanut (*Arachis hypogaea* L.) and Soybean (*Glycine max*
 43 L.) and the global production of Sunflower seeds increased from 26 to 31 million
 44 tons between 2004 to 2006 [4].

45 [5] mentioned that the Sunflower leaves are used in the Caucasus for the
 46 treatment of malaria fever, and the its seeds are considered as diuretic and
 47 expectorant and used in the bronchial infections, cold and cough and the
 48 importance of this plant in the world in general, and on the level of Iraq, in
 49 particular, their low productivity in Iraq, we must use the best methods and new
 50 technologies that leads to increase the crop and encourages the increase in the
 51 cultivated area in order to raises the productivity and economic resources^[04].
 52 Among these technologies the one that provided by technical science "technologies
 53 minor" or Nanotechnology, in which nanomaterials are used in sizes ranging from
 54 (1 to 100 nm) [6].

55 The usage of Nano-silver particles is considered to be one of the most
 56 popular and widely used methods at the commercial level because of the
 57 positive effects on plants. In addition to being the only nano available in this time
 58 in Iraq [7,8].

59 Organic fertilizer (Algastar) also considered as an organic natural fertilizer
 60 that extracted from marine extracts which is rich in amino acids and natural
 61 hormones and consists of nitrogen (1%) and potassium (18%) alginate acid by
 62 more than 10% sulfur 1.3% and natural and organizations growth organic
 63 materials by 45%. There with it contributes to an increase in the proportion of
 64 germination and works to produce strong seedlings, and increase productivity and
 65 fruit quality, and it is valid for use with all types of crops.

66 The use of salicylic acid on the other hand has an important role in enhancing
 67 the plant positive growth, in addition to its being one of the growth regulators with
 68 a phenolic nature. It participates in the regulation of many physiological processes
 69 in the plant, such as the closure of stomata, photosynthesis, uptake of ions, bio-
 70 inhibition of ethylene and stress tolerance and throw off the free radicals and its
 71 negative effects [9,10]. Given the importance of Nutritionally and its use in the
 72 production of unsaturated vegetable oils with a special importance in human

health, and to increase the yield of winning the unity of space and the lack of information on the effects of silver nanoparticles on the plant became the aim of this study and finding^[05] the effect of combinations of the above factors mentioned and its interventions in the fatty acids.

2. MATERIALS AND METHODS

The experiment was carried out from period 5/3/2013 until 18/6/2013 in the College of Agriculture / University of Wasit. Piece specified the agricultural field, amounting to 364 m² (40.5 m length × 9 m width). It was divided into three sectors area of each sector amounted to 121.5 m² (40.5 m length × 3 m width) and each very sector contains 27 panels with a total of 81 panels, the area of each plate (1.5 m × 3 m) and in one panel contained 20 seeds. Sixty five day after sowing the seeds the resulted plant shoots were sprayed with 25 and 50 ml/l of nanosilver and 0.75 and 1.5 g/l of Algastar and salicylic acid 60 and 120 mg/l in addition to the control treatment.

A manual sprinklers were used (1 litre capacity) for each concentration of previously prepared solution already mentioned, the comparison treatment has been sprayed by distilled water only.

Been harvesting The plants were harvested^[06] in the 18/6/2013 and was measured following characteristics:

— Extraction, isolate and diagnose of vicine in seeds according to [11], e. Estimation of some fatty acid (saturated and unsaturated) in the seeds determined according to [12].

2.1 STATISTICAL ANALYSIS

Statistical analysis was carried out by three-way ANOVA using SPSS. The data sets were analysed by using randomized completely block design (RCBD) with three replicates of each treatment (3×3×3). Least significant difference ($p < 0.05$) values were calculated for comparisons of treatment means [13].

3. RESULTS AND DISCUSSION

1-Estimation of vicine (mg/gmg/g) in seeds

The obtained results in (Table 1) showed that using of nanosilver leads to reduces the content of vicine in seeds. With increasing the concentrations of particles nanosilver from 25 ml/l to 50 ml/l the

vicine content were decreased from 0.4885 to 0.5681 mg/g compared with the treatment comparison 0.6959 mg/g . Organic fertilizer (Algaster) is the other hand showed a clear reduction content of vicine in the seeds with increasing concentrations used as given level of 1.5 g/l (0.5348 mg/g) compared with the least concentration and treatment comparison that gave 0.5785 and 0.6393 mg/g , respectively. Also the use of salicylic acid at different levels resulted in clear reduction content of vicine in seeds, the used concentration of caused reduction in vicine reached to 0.5485 mg/g (for 120 mg/l) compared with concentration of 60 mg/l and the treatment of comparison which gave 0.5856 and 0.6185 mg/g , respectively.

Table (1.) The effect of ~~nanosilver~~ organic fertilizer (Algaster) and salicylic acid and interaction with each other on the seed content of vicine (in mg/g) in the seeds

Particles <u>nanosilver</u> (ml/l)	Organic fertilizer(Algastar) (<u>gm/g</u> /l)	Salicylic acid (mg/l)			Two way interaction between <u>nanosilver</u> and organic fertilizer
		0	60	120	
0	0	0.7733	0.7500	0.6967	0.7400
	0.75	0.7267	0.7000	0.6700	0.6989
	1.5	0.6933	0.6467	0.6067	0.6933
25	0	0.6467	0.6100	0.6000	0.6467
	0.75	0.5900	0.5567	0.5300	0.5589
	1.5	0.5667	0.5167	0.4967	0.5267
50	0	0.5933	0.5667	0.5167	0.5589
	0.75	0.5100	0.4900	0.4333	0.4778
	1.5	0.4667	0.4333	0.3867	0.4289
Average <u>vicine content for</u> salicylic acid (<u>mg/g</u>)		0.6185	0.5856	0.5485	0.0209
LSD 5%		0.0120			
Three way interaction		N.S			
<u>Nanosilver</u> (ml/l)		Salicylic acid (mg/l)			Average <u>vicine content</u> <u>for nanosilver</u> (<u>mg/g</u>)
		0	60	120	
0		0.7311	0.6989	0.6578	
25		0.6011	0.5611	0.5422	0.5681
50		0.5233	0.4967	0.4456	0.4885
Two way interaction		N.S			0.0120
Organic fertilizer(<u>gm/g</u>)		Salicylic acid (mg/l)			Average <u>vicine content</u> <u>for organic fertilizer</u> (<u>gm/g</u>)
		0	60	120	
0		0.6711	0.6422	0.6044	0.6393
0.75		0.6089	0.5822	0.5444	0.5785
1.5		0.5756	0.5322	0.4967	0.5348
Two way interaction		N.S			0.0120

The two way interaction between nano-silvernanosilver particles and organic fertilizer (Algaster) in its high concentrations is established vicine content reached_[012] 0.4289 mg / gmg/g, which differs significantly from the combination that consists of 50 ml / literml/l nano-silvernanosilver and 0.75 g/l organic fertilizer which gave 0.4778 mg / gmg/g and the comparison treatment that gave 0.7400 mg / gmg/g and from treatment comparison. Regarding the two way interaction between nano-silvernanosilver particles and salicylic acid from aside_→, and between the organic fertilizer and salicylic acid on the other side and the three way interaction among the parameters previously mentioned didn't achieve_→, any effect in the vicine seeds content_[013]_→.

2-Saturated fatty acid (PalmaticPalmitic)

Results in table (2) showed that the treated plant with nano-silvernanosilver particles led to significant reduction in saturated fatty acid (PalmaticPalmitic) as the rate reached 18.93

Table (2) effect of nano-silvernanosilver_→ organic fertilizer (algaster) and salicylic acid and interaction with each other on content of saturated fatty acid (SFA_[014]) Palmatic in the seeds

Particles ~~nano~~ ~~silver~~ <u>nano</u> <u>silver</u> (ml/l)	Organic fertilizer(Algastar) (~~gm~~ g/l)	Salicylic acid (mg/l)			Two way interaction between ~~nano~~ ~~silver~~ <u>nano</u> <u>silver</u> and organic fertilizer
		0	60	120	
0	0	44.53	40.73	34.96	40.07
	0.75	38.47	32.84	29.75	33.68
	1.5	35.09	26.45	20.99	35.09
25	0	31.75	27.45	22.38	31.75
	0.75	20.37	19.31	16.59	18.76
	1.5	19.05	17.73	15.09	17.29
50	0	26.48	24.30	21.57	24.12
	0.75	19.37	17.46	16.89	17.91
	1.5	17.35	15.05	11.90	14.76
Average SFA Palmitic for salicylic acid (μ g/g)		28.05	24.59	21.12	2.165
LSD 5%		1.250			
Three way interaction		N.S			
~~Nano silver~~ <u>Nanosilver</u> (ml/l)		Salicylic acid (mg/l)			Average SFA Palmitic for ~~nano~~ ~~silver~~ <u>nano</u> <u>silver</u> (μ g/g)
		0	60	120	
0		39.36	33.34	28.56	33.76

25	23.72	21.50	18.02	21.08
50	21.07	18.93	16.79	18.93
Two way interaction	2.165			1.250
Organic fertilizer(gmg/l)	Salicylic acid (mg/l)			Average SFA Palmitic for organic fertilizer (µg/g)
	0	60	120	
0	34.25	30.83	26.30	30.46
25	26.07	23.20	21.08	23.45
50	23.83	19.75	15.99	19.86
Two way interaction	N.S			1.250

18.93 µg/ml when using the concentration of 50 ml/l, which differed significantly from the use of 25 ml/l concentration, which gave 21.08 µg/ml from stearic acid compared with control which amount of 33.76 µg/ml. Organic fertilizer was also achieved a significant decrease in saturated fatty acid (Palmitic) when using different concentrations the concentration of 1.5 g/l 19.86 µg/ml, which was significantly different from the use of 0.75 g/l concentration of, which gave 23.45 µg/ml compared to control treatment 30.46 µg/ml. Spraying with salicylic acid showed reduction in fatty acid (Palmitic), when using the concentration 120 mg/l that gave 21.12 µg/ml compared to the treatment control 28.05 µg/ml also differed significantly when spraying with 60 mg/l, which gave 24.59 µg/ml saturated fatty acid (Palmitic).

Two way interaction between nano-silver particles and organic fertilizer concentrations showed that the combination of 25 and 50 ml/l of nano-silver particles with 1.5 g / liter of organic fertilizer (Algaster) gave the lowest level of saturated fatty acid Palmitic in seeds reached 17.29, 14.76 µg/ml which was the lowest compared with all other treatment combinations of overlap, including control treatment amounting to 40.07 µg/ml.

Two way interaction between the nano-silver particles and salicylic acid showed superiority of the combination consisting of 50 ml/l of nano-silver particles and 120 mg/l of salicylic acid, which gave the lowest level reached to 16.79 µg/ml, which was not significantly different from the combination of 25 ml/l of nano-silver with 120 mg/l of salicylic acid 18.02 µg/ml or the combination consisting of 50 ml/l of particles nano-silver with 60 mg/l of salicylic acid amounting 18.93 µg/ml, but were less than all other interaction factors other including control treatment amounting to 39.36 µg/ml.

The three way interaction had no significant effect among the studied factors in the saturated fatty acid ~~Palmitic~~ Palmitic of the Sunflower seeds, as well as the two way interaction between organic fertilizer and salicylic acid.

3-Saturated fatty acid (Stearic)

The obtained results in table (3) shows the effects of factors and its interventions in Stearic-. Results in the table showed that using the concentration of 25 and 50 ~~ml-/liter~~ ml/l of ~~nano-silver~~ nanosilver particles cause significant decrease in fatty acid about 1.259 $\mu\text{g/ml}$, 1.095 $\mu\text{g/ml}$ respectively, compared to the treatment control amounting to 2.875 $\mu\text{g/ml}$ with no significant difference from each other. The organic fertilizer led to decrease in the saturated fatty acid stearic with its concentrations 0.75, 1.5 ~~g-/l~~ g/l, which were 1.599 $\mu\text{g/ml}$ and 1.407 $\mu\text{g/ml}$ respectively. With no significant difference from each other-, but they showed significant difference from the control treatment which was 2.223 $\mu\text{g/ml}$.

The use of salicylic acid has led to significant effect in saturated fatty acid by its concentrations 60 and 120 ~~mg-/l~~ mg/l as it reached 1.669 $\mu\text{g/ml}$ and 1.500 $\mu\text{g/ml}$ respectively, both of which did not differ significantly from each other, but they disagree with control treatment which was 2.060 $\mu\text{g/ml}$.

Table (-3-) effect of ~~nano-silver~~ nanosilver-, organic fertilizer(- (Algaster) and salicylic acid and interaction with each other in the seed content of saturated fatty acid stearic

Particles ~~nano-silver~~ <u>nanosilver</u> (ml/l)	Organic fertilizer(Algastar) (~~g~~ <u>mg</u> /l)	Salicylic acid (mg/l)			Two way interaction between ~~nano-silver~~ <u>nanosilver</u> and organic fertilizer
		0	60	120	
0	0	4.307	3.907	3.173	3.796
	0.75	3.357	2.493	2.187	2.679
	1.5	2.660	1.947	1.843	2.660
25	0	2.223	1.313	1.183	2.223
	0.75	1.150	1.107	1.047	1.101
	1.5	1.100	1.110	1.096	1.102
50	0	1.657	1.167	1.077	1.300
	0.75	1.057	1.020	0.973	1.017
	1.5	1.033	0.953	0.917	0.968
Average salicylic acid		2.060	1.669	1.500	0.3413
LSD 5%		0.1971			
Three way interaction		N.S			
~~Nano-silver~~ <u>Nanosilver</u> (ml/l)		Salicylic acid (mg/l)			Average ~~nano-silver~~ <u>nanosilver</u> ((ml/l)
		0	60	120	

0	3.441	2.782	2.401	2.875
25	1.491	1.177	1.109	1.259
50	1.249	1.047	0.989	1.095
Two way interaction	0.3413			0.1971
Organic fertilizer(gmg/l)	Salicylic acid (mg/l)			Average organic fertilizer(gmg/l)
	0	60	120	
0	2.729	2.129	1.811	2.223
25	1.854	1.540	1.402	1.599
50	1.598	1.337	1.285	1.407
Two way interaction	N.S			0.1971

The two way interaction between the [nano-silvernanosilver](#) particles and organic fertilizer (Algaster) showed that all combinations containing [nano-silvernanosilver](#) concentrations 25 and 50 [ml / literml/l](#) with organic fertilizer (Algaster) with its all concentrations were significantly lower than the treatmentorganic fertilizer (Algaster) without the use of nanosilver.

The two way interaction between the [nano-silvernanosilver](#) particles and salicylic acid had significant effect on seeds content of saturated fatty acid Stearic, such combinations containing [nano-silvernanosilver](#) with 60 and 120 [mg / Lmg/l](#) salicylic acid caused significant decrease in the Stearic compared with other treatments that did not include [nano-silvernanosilver](#) particles. While the two way interaction between organic fertilizer and salicylic acid showed no significant impact. Also the threeway interaction between the factors didn't achieved, any significant effect on the saturated fatty acid Stearic in plant seeds.

4-Saturated fatty acid (Myristic)

The obtained result in table (4) showed that the addition of [nano-silvernanosilver](#) with concentrations of 25 and 50 ml /L caused a significant decrease in saturated

Table (4) effect of [nano-silvernanosilver](#), organic fertilizer (Algaster) and salicylic acid and interaction with each other in the seed content of saturated fatty acid myristic

Particles nano-silvernanosilver (ml/l)	Organic fertilizer(Algaster) (gmg/l)	Salicylic acid (mg/l)			Two way interaction between nano-silvernanosilver and organic fertilizer
		0	60	120	
0	0	11.50	9.75	10.28	10.51
	0.75	6.59	6.15	5.91	6.22
	1.5	6.06	7.56	3.91	6.06

25	0	6.74	5.14	4.91	6.74
	0.75	5.56	4.48	6.94	5.66
	1.5	5.19	3.63	3.36	4.06
50	0	6.74	5.23	4.94	5.64
	0.75	4.89	5.05	4.22	4.72
	1.5	5.98	4.38	3.08	4.48
Average salicylic acid		6.58	5.71	5.28	2.25
LSD 5%		N.S			
Three way interaction		N.S			
~~Nano silver~~ <u>Nanosilver</u> (ml/l)		Salicylic acid (mg/l)			Average ~~nano silver~~ <u>nanosilver</u> $\pm$ (ml/l)
		0	60	120	
0		8.05	7.82	6.70	7.52
25		5.83	4.42	5.07	5.11
50		5.87	4.88	4.08	4.95
Two way interaction		N.S			1.29
~~Organic fertilizer~~ (<u>gm</u> g/l)		Salicylic acid (mg/l)			Average organic fertilizer(<u>gm</u> mg/l)
		0	60	120	
0		8.33	6.71	6.71	7.25
25		5.68	5.23	5.69	5.53
50		5.74	5.19	3.45	4.79
Two way interaction		N.S			1.29

fatty acid of Myristic (5.11 μ g/ml, 4.95 μ g/ml respectively) with no significant difference from each other, but they disagreed with control treatment which was 7.52 μ g/ml. The use of organic fertilizer with concentrations of 0.75 and 1.5 g/ L led to a significant decrease in saturated fatty acid Myristic reached to 5.53 μ g/ml and 4.79 μ g/ml respectively (with no significant difference from each other), but they disagreed with control treatment which was 7.25 μ g/ml. Also Salicylic acid did not achieve any significant effect.

The two way interaction between the ~~nano silver~~ nanosilver particles and organic fertilizer (Algaster) showed that all combinations of concentrations ~~nano silver~~ nanosilver particles (25 to 50 ml / L) with (0.75 and 1.5 g / L) of organic fertilizer did not differ from each other significantly, but it was less compared with the treatment that did not include ~~nano silver~~ nanosilver particles or organic fertilizer which was 10.51 μ g/ml-. The two way interactions between ~~nano silver~~ nanosilver particles and salicylic acid concentration and organic fertilizer with salicylic acid on the other hand which did not achieve any significant effect in the saturated fatty acid Myristic. Also the three way interaction of studied factors did not have significant influence in the saturated fatty acid Myristic.

5-Saturated fatty acid (Arachidic)

Results intable (5) show the saturated fatty acid Archadic in seeds which decreased significantly with increasing the used concentrations of used ~~nano-silver~~nanosilver particles as it l 0.125 µg/ml reached when used the concentration of 50 ml /, which was significantly different from the concentration of 25 ~~ml-/liter~~ml/l, which reached 0.282µg/ml and the treatment of control amounting to 0.535µg/ml. The use of organic fertilizer (Algaster) showed effect on saturated fatty acid Archadic reached 0.209 µg/ml when using 1.5 g / l, which did not differ from the least concentration 0.75 g / liter, which gave 0.261µg/ml but differ significantly for the control treatment which was 0.473µg/ml. Salicylic acid with the concentration of 120 ~~mg-/L~~mg/l achieved a reduction in seed content of saturated fatty acid Archadic reached to 0.252µg/ml, which was significantly different from the use of 60 ~~mg-/L~~mg/l as it gave 0.300µg/ml and differs from the control treatment 0.390µg/ml. The two way interaction between concentrations ~~nano-silver~~nanosilver particles and organic fertilizer (Algaster) showed that the combinations of concentrations ~~nano-silver~~nanosilver particles (25 to 50 ml /L) with (0.75 and 1.5 g / L) of organic fertilizer gave a lower level of saturated fatty acid Archadic in seeds, compared to the treatment control amounting to 0.801µg/ml, or compared with the use of 0.75 and 1.5 g / liter of organic fertilizer without the use of ~~nano-silver~~nanosilver which was 0.444% and 0.360%, respectively.

The two way interaction between ~~nano-silver~~nanosilver and salicylic acid explained that combinations of ~~nano-silver~~nanosilver with concentrations of 25 or 50 ~~ml-/liter~~ml/l with 60 and 120 ~~mg-/L~~mg/l of salicylic acid caused reduction in saturated fatty acid significantly when compared with the control treatment which included salicylic acid (from without ~~nano-silver~~nanosilver).

Two way interaction between the concentrations of organic fertilizers and salicylic acid also showed all combinations of organic fertilizer (0.75 and 1.5 g / L) with concentrations of salicylic acid (60 and 120 ~~mg-/L~~mg/l) caused result in saturated fatty acid Archadic less than the control treatment amounting to 0.620 µg/ml or

Table (5) effect of ~~nano-silver~~nanosilver, organic fertilizer (algaster) and salicylic acid and interaction with each other in the seed content of saturated fatty acid Archidic

Particles ~~nano-silver~~ <u>nanosilver</u> (ml/l)	Organic fertilizer(algaster) (gmg/l)	Salicylic acid (mg/l)			Two way interaction between ~~nano-silver~~ <u>nanosilver</u> and organic fertilizer
		0	60	120	

0	0	1.047	0.817	0.540	0.801
	0.75	0.487	0.393	0.453	0.444
	1.5	0.407	0.310	0.363	0.407
25	0	0.663	0.457	0.310	0.663
	0.75	0.327	0.210	0.143	0.227
	1.5	0.167	0.133	0.127	0.142
50	0	0.167	0.137	0.117	0.140
	0.75	0.110	0.110	0.113	0.111
	1.5	0.137	0.133	0.100	0.123
Average salicylic acid		0.390	0.300	0.252	0.096
LSD 5%		0.055			
Three way interaction		N.S			
Nano silverNanosilver (ml/l)		Salicylic acid (mg/l)			Average nano silvernanosilver (ml/l)
		0	60	120	
0		0.647	0.507	0.452	0.535
25		0.386	0.267	0.193	0.282
50		0.138	0.127	0.110	0.125
Two way interaction		0.096			0.055
Organic fertilizer(gmg/l)		Salicylic acid (mg/l)			Average organic fertilizer(gmg /l)
		0	60	120	
0		0.620	0.470	0.322	0.473
25		0.308	0.238	0.237	0.261
50		0.237	0.192	0.197	0.209
Two way interaction		0.096			0.055

with the use of 60 or 120 mg/liter of salicylic acid without organic fertilizer 0.470µg/ml and 0.322µg/ml respectively. The three way interaction between the affecting factors didn't show any significant effect in the saturated fatty acid Archadic. 5.53µg/ml and 4.79µg/ml respectively (with no significant difference from each other), but they disagreed with control treatment which was 7.25µg/ml. Also Salicylic acid did not achieve any significant effect.

6-Unsaturated fatty acid (Linoleic)

Table (6) shows the significance of the study factors effect of factors and its interventions in the unsaturated fatty acid Linoleic-. Results in the table showed that the use of nano-silvernanosilver with 50 mL / L led to a significant increase in the proportion of unsaturated fatty acid Linoleic amounted to 26.59µg/ml compared to the control

Table (6) effect of nanosilver, organic fertilizer (algaster) and salicylic acid and interaction which each other in unsaturated fatty acid linoleic

Particles ~~nanosilver~~ Nanosilver (ml/l)	Organic fertilizer (algastar) (mg/l)	Salicylic acid (mg/l)			Two way interaction between ~~nanosilver~~ Nanosilver and organic fertilizer
		0	60	120	
0	0	9.14	12.77	16.99	12.96
	0.75	15.88	17.50	18.16	17.18
	1.5	17.67	19.76	20.97	17.67
25	0	18.96	21.06	22.90	18.96
	0.75	22.30	23.91	25.05	23.75
	1.5	23.68	23.50	26.06	24.42
50	0	21.95	24.11	25.58	23.88
	0.75	25.42	26.35	27.24	26.34
	1.5	26.55	29.43	32.69	29.56
Average salicylic acid		20.17	22.04	23.96	1.313
LSD 5%		0.758			
Three way interaction		N.S			
~~Nano-silver~~ Nanosilver (ml/l)		Salicylic acid (mg/l)			Average ~~nanosilver~~ Nanosilver (ml/l)
		0	60	120	
0		14.23	16.68	18.71	16.54
25		21.65	22.82	24.67	23.05
50		24.64	26.63	28.50	26.59
Two way interaction		N.S			0.758
Organic fertilizer(mg/l)		Salicylic acid (mg/l)			Average organic fertilizer(~~mg~~ mg /l)
		0	60	120	
0		16.68	19.31	21.82	19.27
25		21.20	22.59	23.48	22.42
50		22.63	24.23	26.58	24.48
Two way interaction		1.313			0.758

of treatment₂ while the concentration of 25 ml/l of silver led to a significant increase in the acid above by 16.54µg/ml compared to the control treatment. Its worth to mention, that the previously mentioned treatments differs from each other significantly.

The use of salicylic acid also led to a significant increase in the unsaturated Linoleic acid where it reached 22.04µg/ml and 23.96µg/ml for treatment of salicylic acid 60 and 120 mg/l respectively, both of which differed from each other and were higher than the treatment of control, which differed from them, amounting to 20.17µg/ml.

Two way interaction between ~~nano-silver~~nanosilver particles and organic fertilizer showed significant positive impact in increasing the unsaturated fatty acid Linoleic when the combinations of the used concentrations of ~~nano-silver~~nanosilver with organic fertilizer (Algaster) 25 and 50 ~~ml-/liter~~ml/l of ~~nano-silver~~nanosilver and 0.75 and 1.5 g / liter of organic fertilizer compared with the use of concentrations of organic fertilizer without ~~nano-silver~~nanosilver treatments that gave the highest level percentage of acid when use the combination consisting of 50 ~~ml-/liter~~ml/l of ~~nano-silver~~nanosilver with 1.5 g / liter of organic fertilizer, which reached 29.56 μ g/ml and differed significantly from the rest of the other combinations including the comparison treatment amounting to 12.96 μ g/ml.

The two way interaction between fertilizer and salicylic acid combination consisting of high concentrations achieved a 1.5 g / liter of compost and 120 ~~mg-/L~~mg/l of salicylic acid distinctive in the unsaturated fatty acid Linoleic 26.58 μ g/ml, and the combination constituent of 0.75, 1.5 ~~mgm-/liter~~mgm-/liter organic fertilizer and 120.60 mg-/~~liter~~liter of salicylic acid have achieved a high amount reached 23.48 μ g/ml and 16.68 μ g/ml—24.23 μ g/ml—, respectively, and the two of them disagreed with each other and differed from the rest of the other combinations including control treatment of

The two way interaction between the ~~nano-silver~~nanosilver and salicylic acid did not have any significant effect in the unsaturated fatty acid Linoleic. The two way interaction between organic fertilizer and salicylic acid combination consisting of 1.5 g-/~~liter~~liter of organic fertilizer and 120 mg-/~~liter~~liter of salicylic acid gave the highest amount reached 26.58 μ g/ml as the combination consisting of 1.5 g / liter of organic fertilizer and achieved 60 mg-/~~l~~l salicylic acid fatty acid that reached 24.23 μ g/ml and differed with interactions between them and the rest of the other interactions including control treatment of 16.68 μ g/ml. The two way interaction between the ~~nano-silver~~nanosilver and salicylic acid on the other side and three way interaction between the studied factors did not achieve any significant effect on unsaturated fatty acid Linoleic.

7-Unsaturated fatty acid (α - Linolenic)

From the data presented in table (7) that the use of ~~nano-silver~~nanosilver concentrations 25 and 50 ml / L which led to a significant increase in the amount of unsaturated fatty. There was no significant effect for the two way interaction between ~~nano-silver~~nanosilver and organic fertilizer (Algaster) on the unsaturated fatty acid (α -Linolenic). The two way interaction between ~~nano-silver~~nanosilver

and salicylic acid showed that the combination constituent of 50 ~~ml / liter~~ml/l of ~~nano silver~~nanosilver with the use of 60 and 120 ~~mg / l~~mg/liter of salicylic acid gave the highest amount of unsaturated acid fatty (α -Linolenic) amounted to 0.646 μ g/ml and 0.629 μ g/ml respectively.

Table (7) effect of ~~nano silver~~nanosilver, organic fertilizer(~~algaster~~) and salicylic acid and interaction which each other in unsaturated fatty acid α -linolenic

Particles ~~nano silver~~ <u>nanosilver</u> (ml/l)	Organic fertilizer(algastar) (~~gm~~ g/l)	Salicylic acid (mg/l)			Two way interaction between ~~nano silver~~ <u>nanosilver</u> and organic fertilizer
		0	60	120	
0	0	0.135	0.126	0.119	0.126
	0.75	0.139	0.128	0.116	0.128
	1.5	0.160	0.150	0.140	0.160
25	0	0.124	0.120	0.405	0.124
	0.75	0.130	0.114	0.667	0.304
	1.5	0.110	0.361	0.737	0.402
50	0	0.663	0.407	0.383	0.484
	0.75	0.118	0.661	0.903	0.561
	1.5	0.647	0.870	0.600	0.706
Average salicylic acid		0.247	0.326	0.452	N.S
LSD 5%		0.113			
Three way interaction		0.339			
~~Nano silver~~ <u>Nanosilver</u> (ml/l)		Salicylic acid (mg/l)			Average ~~nano silver~~ <u>nanosilver</u> ((ml/l)
		0	60	120	
0		0.121	0.135	0.125	0.127
25		0.145	0.199	0.603	0.315
50		0.476	0.646	0.629	0.584
Two way interaction		0.196			0.113
Organic fertilizer(~~gm~~ g/l)		Salicylic acid (mg/l)			Average organic fertilizer(~~gm~~ g/l)
		0	60	120	
0		0.129	0.218	0.302	0.216
25		0.307	0.301	0.562	0.390
50		0.306	0.460	0.492	0.419
Two way interaction		0.196			0.113

Also the combination of 25 ~~ml / liter~~ml/l of ~~nano silver~~nanosilver with 120 ~~mg / l~~mg/liter of salicylic acid achieved a high amount of 0.603 μ g/ml and despite the lack of difference in the last three combinations from each other, but they differed significantly from most other combinations and treatment control which was 0.121

µg/ml. The two way interaction between organic fertilizer and salicylic acid effects in saturated fatty acid (α -Linolenic) showed that the combination consisting of 0.75 g / liter of organic fertilizer with 120 mg / L mg/l of salicylic acid gave the highest of unsaturated fatty acid(α -Linolenic) 0.562 µg/ml, which was significantly different from all other combinations.

8-Unsaturated fatty acid (Oleic)

Results table (8) showed that the concentration of nanosilver had significantly impact on unsaturated fatty acid Oleic, as the concentration of 50 ml / liter ml/l recording the highest amount 49.90 µg/ml, which differed significantly compared

Table (8) effect of nanosilver, organic fertilizer (algaster) and salicylic acid and interaction which each other in unsaturated fatty acid Oleic

Particles <u>nano silver</u> <u>nano silver</u> (ml/l)	Organic fertilizer(algastar) (<u>gm</u> g/l)	Salicylic acid (mg/l)			Two way interaction between <u>nano silver</u> <u>nanosilver</u> and organic fertilizer
		0	60	120	
0	0	13.12	16.77	22.06	17.32
	0.75	21.47	29.33	34.86	28.55
	1.5	26.93	32.75	38.50	26.93
25	0	32.21	37.67	44.58	32.21
	0.75	45.17	49.75	50.00	48.31
	1.5	49.65	50.92	57.24	52.60
50	0	40.68	43.66	47.78	44.04
	0.75	42.84	45.50	49.99	46.11
	1.5	55.98	57.53	65.11	59.54
Average salicylic acid		36.45	40.43	45.57	2.256
LSD 5%		1.303			
Three way interaction		N.S			
<u>Nano silver</u> <u>Nanosilver</u> (ml/l)		Salicylic acid (mg/l)			Average <u>nano silver</u> <u>nanosilver</u> (<u>gm</u> ml/l)
		0	60	120	
0		20.50	26.29	31.81	26.20
25		42.34	46.11	50.61	46.35
50		42.34	46.11	50.61	49.90
Two way interaction		N.S			1.303
Organic fertilizer(<u>gm</u> g/l)		Salicylic acid (mg/l)			Average organic fertilizer(<u>gm</u> mg /l)
		0	60	120	
0		42.34	46.11	50.61	33.17
25		36.49	41.53	44.95	40.99

50	44.19	47.07	53.62	48.29
Two way interaction	N.S			1.303

to the concentration of 25 ~~ml / liter~~ml/l, which gave 46.35µg/ml while the treatment control was 26.20µg/ml. The use of organic fertilizer also has significant effect on organic fertilizer respectively. The impact of spraying salicylic acid treatment with 120 ~~mg / L~~mg/l achieved the highest rate of unsaturated fatty acid Oleic which was 45.57 µg/ml, that differed significantly from the use of concentration of 60 ~~mg / L~~mg/liter from which achieved 40.43µg/ml and 36.45µg/ml treatment control.

The two way interaction between ~~nano-silver~~nanosilver and organic fertilizer (Algaster) showed that all combinations of ~~nano-silver~~nanosilver concentrations 25 and 50 ml / l with 0.75 and 1.5 g / liter of organic fertilizer cause a significant increase in the amount of unsaturated fatty acid Oleic compared to the treatment control. The higher amount of the Oleic acid was when the combination consisting of 50 ~~ml / liter~~ml/l of ~~nano-silver~~nanosilver with 1.5 g / liter of organic fertilizer which reached 59.54µg/ml was the highest among all interaction factors or in comparison with the control 17.32µg/ml.

The two way interaction between ~~nano-silver~~nanosilver and salicylic acid and two way interaction between organic fertilizer and salicylic acid in the other hand and three way interaction between the three factors for the experience did not have any significant effect in the amount of unsaturated fatty acid Oleic.

The impact of the factors under this study which resulting in reduced the seed content of in (Table 1) may possibly be due to the use of materials and components available compounds in the plant to improve the vegetative and the content of the plant which was not enough for vicine manufacturing and increase the quantity of the seeds this can be explained by the impact of ~~nano-silver~~nanosilver or organic fertilizer or salicylic acid as single or combined to disrupt the main ingredient in vicine Orotic acid compound which is responsible for the formation of pyrimidine ring and, which responsible for giving the toxicity of a compound vicine formation [14,15].

The influence on the qualitative oil or oil quality by the use of the factors under this study confirms the importance of such factors as reducing fatty acids and saturated ~~Palmitic~~Palmitic, Stearic-, Myristic and Arachidic tables (2, 3, 4, 5) and increase the unsaturated fatty acids Linoleic Linolenic and Oleic tables (6, 7, 8).

Moradkhani et al. [16] Also reached that treatment salicylic acid on leaf lipid metabolism probably in relation with chlorophyll synthesis, photosynthetic activity and carbon supply of sunflower plants. Salicylic acid also working increase in percentage of unsaturated fatty acids accompanied by the decrease in saturated fatty acids proved the quality of oil. Polyunsaturated fatty acids from soybean oil are essential for human diet because of lowering the risk of heart diseases related to cholesterol oxidation. In addition, consumption of Oleic, Linoleic and Linolenic

acids lowers the level of low density lipoprotein (LDL) in human blood [17]. Abd El-Razek et al.[18] concluded that the foliar spray with salicylic acid on olive trees working on control of biosynthetic pathways leading to the production of specific metabolites as essential oils are controlled by enzymes, which in turn are mainly effected by growth regulators.

also affected the two way interaction affected on ~~nano-silver~~nanosilver and organic fertilizer, especially high combinations each 50 ~~ml / liter~~ml/l of ~~nano silver~~nanosilver with 1.5 g / liter of organic fertilizer to the positive effects of the increase in unsaturated fatty acids Linoleic Oleic, 128.08 reached % and 243.76%, respectively, compared to the treatment comparison for each of them, while a combination of interference showed 50 ~~ml / liter~~ml/l of ~~nano-silver~~nanosilver with 0.75 g / liter of organic fertilizer and 120 ~~mg / L~~mg/l of salicylic acid increase in the proportion of fatty acid α -Linolenic reached 568.88%, or more than five times from the comparison treatment, which did not differ from the combination consisting of 50 ~~ml / liter~~ml/l of ~~nano-silver~~nanosilver with 1.5 g / liter of organic fertilizer and 60 ~~mg / L~~mg/l of salicylic acid, which are the other recorded an increase in saturated fatty acid α -Linolenic reached 544.44% thus it possible to be an alternative combination.

4.CONCLUSION

All the factors worked with its single effect and two way interaction consisting of ~~nano-silver~~nanosilver and organic fertilizer and with its high concentrations in reduction of the amount of vicine in the Sunflower seeds.

The use of ~~nano-silver~~nanosilver led to a reduction in the amount of saturated fatty acids ~~Palmitic~~Palmitic, Stearic, Myristic, Arachidic concentration when using 50 ml / L that reached 60.76%, 61.90%, 38.16% and 76.60% respectively, compared to the treatment comparison for each one of them, while ~~nano silver~~nanosilver worked alone to increase the amount of unsaturated fatty acid Linoleic, α -Linolenic and Oleic, when using the concentration of 50 ~~ml / liter~~ml/l which reached to 60.76%, 35.80% and 90.45%, respectively, compared to the treatment comparison for each of them.

The impact of two way interaction between ~~nano-silver~~nanosilver and organic fertilizer, especially the high combinations of 50 ~~ml / liter~~ml/l of ~~nano silver~~nanosilver with 1.5 g / liter of organic fertilizer led to a positive effects in the increase the unsaturated fatty acids Linoleic Oleic, amounted to 128.08% and 243.76% respectively, compared to the treatment comparison for each one of them.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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