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RESPONSE OF JOJOBA (*SIMMONDSIA CHINENSIS*, LINK) PLANTS TO COMPOST AND SOME STIMULATING SUBSTANCES TREATMENTS

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ABSTRACT: This work was done during the two experimental seasons of 2020 and 2021 at the farm of Faculty of Agriculture, Minia University, Egypt to study the reaction of jojoba (*Simmondsia chinensis*, Link) plants to compost (0.0, 500, 1000 and 1500 g/container) and some stimulating substances (control, vitamin E at 100 ppm, active yeast at 10 g/l and garlic extract at 10%) treatments. Data revealed that increasing the level of compost led to a significantly increased in plant height, main stem thickness, number of branches/plant and aerial parts and root weights (fresh or dry) compared with control. While sprayed plants with all stimulating substances significantly enhanced all previous characters compared with the control. It can be concluded that the high level of compost (1500 g/container) plus yeast at 10 g/l or garlic extract at 10% led to the greatest growth parameters of jojoba plant.

Keywords: *Simmondsia chinensis,* Link, compost, vitamin E, active yeast, garlic extract.

INTRODUCTION

Jojoba *Simmondsia chinensis* its own to family, Simmondsiaceae (Hoagland, 1992 and Hickman, 1993). Jojoba is considered a woody evergreen shrub innate to the semiarid areas of Southern Arizona, Southern California and North Western Mexico (Brooks, 1978 and Buchmann, 1987). It is considered to be plants are physiologically active whole the year. Seed oil can be used in many processes (Brooks, 1978 and Carlson *et al.,* 1992).

Organic substances are applied to the soil to enhance their properties such as nutrients and organic matter. Which reflected the good growth of several plants including jojoba (Bashir *et al*., 2007; Abdou *et al*., 2008; Ashour, 2010; Abdou and Ashour, 2012; Bala and Laura, 2015; Eed, 2016 and Abusaief *et al*., 2021).

Alpha tocopherols have a positive effect on all growth parameters (El-Quesni *et al*. (2009) on *Hibiscus rosa sineses* and El-Sayed *et al*. (2021) on taxodium.

Active yeast is considered a good raw material for cytokinins, natural elements, vitamins, protein, lipids, carbohydrates and nucleic acid (Ali *et al*., 2020). The increase in plant growth due to spraying active yeast was recorded by Mahmoud (2001) on magnolia; Abdel-Wahid *et al*. (2006) on Euonymus; Reda (2008) on *Eucalyptus camaldulensis*; Taha *et al*. (2016) on neem plants; and Ali *et al*. (2020) on *Taxodium disticum*.

Garlic extract has a positive role to cope with the harmful effect of plant growth. Where these extracts contain growth materials, phytohormones and vitamins (Safithri *et al*., 2011). The positive effect of garlic extract on enhancing plant growth was interrupted by Hanafy *et al*. (2012) on *Schefflera arboricola* plants; Abbasifar *et al*. (2020) on some ornamental plants such as poplar, sycamore and rose.

Therefore, this investigation was to evaluate the response of jojoba (*Simmondsia chinensis*, Link) plants to compost and some stimulating substances treatments.

MATERIALS AND METHODS

This work was conducted through the two growing seasons of 2020 and 2021 at the farm of the Faculty of Agriculture, Minia University, Egypt to study the response of jojoba seedlings planted in sandy soil to four compost levels and four stimulating substances, as well as, their interaction in terms of some vegetative and root growth parameters.

Seeds of jojoba were obtained from mother plants grown in the Faculty of Agriculture, Minia University, Egypt, and sown on the first day of February in 2020 and 2021 in black polyethylene bags (15 × 10 cm), each page filled with 1.5 kg of sandy soil in the Nursery. After two months from sown in both seasons, uniform seedlings (8.0 cm long) were transplanted in the first week of April for both experimental seasons (2020 and 2021) to containers (25 × 25 × 35 cm) each container contained about 20 kg of sandy soil. Soil analysis (according to ICARDA, 2013) in both seasons was listed in Table (a).

The treatments:

Factor (A); compost treatments (control, 500, 1000 and 1500 g/container). Compost (plant residues) was obtained from Egypt Company for Circulate Solid Residues at New El-Minia City and mixed with the soil before cultivation. Compost analysis was recorded in Table (b).

Factor (B); stimulating substances treatments (control, vitamin E at 100 ppm, active yeast at 10 g/l and garlic extract at 10%).

Vitamin E, active yeast and garlic extract were applied as foliar spray monthly, starting at the last week of April till the last week of August (five times). All other agricultural practices were done as usual.

Alpha-tocopherol (vitamin E) was provided by El-Tayser Company for Chemical and Scientific Instrument, Minia, Egypt.

Active yeast (*Saccharomyces cervisia*), yeast dry matter was 95% and live cells were 11.6×10^9/g. The active yeast interruption was arranged by melting sugar with dry yeast together (1:1, w/w) in moderately hot water (about 35-37 ℃) and kept at room temperature for 12 hours to activate the yeast according to Skoog and Miller (1957).

Garlic extract was prepared as follows: one kilogram of fresh cloves was merged with distilled water (one kilogram per litre), and after that, frozen (24 hours) and liquefied twice times then clarified. The clarified extract (100%) was used for performing the certain garlic extract concentration (100 ml/l = 10%) according to El-Desouky *et al*. (1998).

Table a. Physical and chemical properties of the used soil before planting of bermudagrass during 2020 and 2021 seasons.

Soil character	Values		Soil character	Values	
	2020	2021		2020	2021
Physical properties			**Nutrients**		
Sand (%)	89.0	90.0	**Total N (%)**	0.01	0.01
Silt (%)	9.30	8.40	**Available P (%)**	3.49	2.57
Clay (%)	1.70	1.60	**Na^+ (mg/100 g soil)**	0.80	0.91
Soil type	Sandy	Sandy	**K^+ (mg/100 g soil)**		
Chemical properties			**DTPA-extractable nutrients**		
pH (1:2.5)	8.10	8.32	**Fe (ppm)**	1.02	1.09
E.C. (dS/m)	1.08	1.10	**Cu (ppm)**	0.31	0.38
O.M. (%)	0.02	0.03	**Zn (ppm)**	0.31	0.27
$CaCO_3$ (%)	13.86	13.75	**Mn (ppm)**	0.50	0.61

Table b. Compost analysis applied in the present study.

Properties	Value	Properties	Value
Dry weight of 1.0 m^2	455 kg	**C/N ratio**	18.5-14.1
Fresh weight of 1.0 m^2	655-705 kg	**NaCl (%)**	1.13-1.78
Moisture (%)	27-32	**Total P (%)**	0.52-0.77
pH (1:2.5)	7.2-8.0	**Total K (%)**	0.9-1.1
E.C. (m. mhos/cm)	2.2-4.2	**Fe (ppm)**	155-205
Total N (%)	0.9-1.4	**Zn (ppm)**	153-228
Organic matter	44	**Mn (ppm)**	22-58
Organic carbon (%)	18.5-19.7	**Cu (ppm)**	76-152

Data recorded:

Vegetative traits i.e. seedling height (cm), main stem thickness (mm), number of branches/plant, aerial parts and roots (fresh and dry weights per plant (g).

The recorded findings were statistically analyzed according to MSTAT-C (1986), and LSD test at 0.05 was used to compare treatments means

RESULTS AND DISCUSSION

Vegetative traits:

Data listed in Tables (1 and 2) showed that all used levels of compost significantly increased seedling height, main stem thickness, number of branches/plant, and aerial parts weights (fresh and dry) over the control of both seasons. Such five traits were increased gradually by a gradual increase in compost amount. It is interesting to observe that increase in such five traits due to the use of 1500 g/plant over the control reached 38.23, 28.33, 42.29, 61.31 and 61.30% in the first season and 33.15, 44.00, 53.24, 58.74 and 58.80% in the second one, respectively, for seedling height, main stem thickness, branches/plant, aerial parts weights either fresh or dry. The superiority of 1500 g compost/plant may be due to the unique dose to the action of organic materials in physiological, biological and chemical soil characters, increase water–plant relationships through adjusting, bulk density, permeability, soil moisture.

Similar findings were reported by Bashir *et al*. (2007), Abdou *et al.* (2008), Ashour (2010), Abdou and Ashour (2012), Bala and Laura (2015), Eed (2016) and Abusaief *et al*. (2021) on *Simmondsia chinensis*.

As can be seen from data existing in Tables (1 and 2), that the all used treatments of vitamin E, active yeast and garlic extract led to a significant increase in the five previous traits facing the check treatment in the two experimental seasons. The greatest values were obtained by active yeast at 10 g/l, come behind garlic extract at 10%, and vitamin E at 100 ppm.

Active yeast is considered a good source of cytokinins, and macro elements, which are reflected in vegetative growth. Our findings are in line with those recorded by Mahmoud (2001) on magnolia; Reda (2008) on *Eucalyptus spp.*; Taha *et al*. (2016) on neem plants and Ali *et al*. (2020) on *Taxodium disticum*.

Garlic extract was found to exert a positive influence on vegetative growth because it contains enzymes, co-vitamins and proteins as well as minerals. The enhancement impact of garlic on plant growth was proved by Hanafy *et al*. (2012) on *Schefflera arboricola* plants and Abbasifar *et al*. (2020) on some ornamental plants (poplar, rose and sycamore).

The effect of interaction between the two factors (main and sub) was significant for seedling height, main stem thickness, No. of branches/plant, aerial parts weights either fresh or dry in the first and second seasons. The beast interaction was obtained by compost at 1500 g/container plus active yeast at 10 g/l or garlic extract at 10% (Tables, 1 and 2).

Table 1. Influence of compost and some stimulating substances on seedling height, main stem thickness and branches/plant of jojoba seedlings during the two growing seasons (2020 and 2021).

Some stimulators treatments (B)	Compost levels (g/seedling) (A)									
	0.0	500	1000	1500	Mean (B)	0.0	500	1000	1500	Mean (B)
	The 1st season (2020)					The 2nd season (2021)				
	Seedling height (cm)									
Control	36.20	42.56	46.54	51.44	44.19	39.49	44.34	48.48	53.79	46.53
Vitamin E (100 ppm)	39.44	45.51	49.40	54.78	47.28	42.53	47.59	51.52	56.39	49.51
Yeast (10 g/l)	41.66	47.60	51.55	56.49	49.33	44.62	49.62	53.41	58.56	51.55
Garlic Extract (10%)	40.58	46.54	50.64	55.53	48.32	43.46	48.20	52.49	57.79	50.49
Mean (A)	39.47	45.55	49.53	54.56		42.53	47.44	51.48	56.63	
L.S.D. at 0.05	A: 3.55		B: 1.81	AB: 3.62		A: 3.88		B: 1.10	AB: 2.20	
	Main stem thickness (mm)									
Control	5.4	5.7	6.2	7.0	6.08	6.7	7.5	8.6	9.4	8.1
Vitamin E (100 ppm)	5.8	6.2	6.8	7.5	6.58	7.2	8.3	9.1	10.5	8.8
Yeast (10 g/l)	6.5	6.9	7.4	8.3	7.28	8.1	9.0	10.3	11.8	9.8
Garlic Extract (10%)	6.3	6.7	7.1	8.0	7.03	7.8	8.8	9.9	11.3	9.5
Mean (A)	6.0	6.4	6.9	7.7		7.5	8.4	9.5	10.8	
L.S.D. at 0.05	A: 0.04		B: 0.03	AB: 0.06		A: 0.05		B: 0.04	AB: 0.8	
	Number of branches/plant									
Control	5.17	6.33	7.83	8.58	6.98	5.67	7.75	8.83	9.33	7.90
Vitamin E (100 ppm)	6.25	7.75	8.33	9.75	8.02	6.33	8.50	9.42	10.17	8.61
Yeast (10 g/l)	8.92	9.42	10.25	11.00	9.90	9.17	10.58	11.17	13.00	10.98
Garlic Extract (10%)	7.67	8.08	9.58	10.50	8.96	7.83	9.83	10.83	11.92	10.10
Mean (A)	7.00	7.90	9.00	9.96		7.25	9.17	10.06	11.11	
L.S.D. at 0.05	A: 0.15		B: 0.04	AB: 0.08		A: 0.25		B: 0.14	AB: 0.28	

Table 2. Influence of compost and some stimulating substances on aerial parts weights (fresh and dry) of jojoba seedlings during the two growing seasons (2020 and 2021).

Some stimulators treatments (B)	Compost levels (g/seedling) (A)									
	0.0	500	1000	1500	Mean (B)	0.0	500	1000	1500	Mean (B)
	The 1st season (2020)					The 2nd season (2021)				
	Aerial parts fresh weight/plant (g)									
Control	40.95	47.30	56.77	68.08	53.28	45.14	51.70	61.67	73.00	57.88
Vitamin E (100 ppm)	46.00	51.69	60.89	73.96	58.14	49.75	57.06	66.14	79.51	63.12
Yeast (10 g/l)	49.65	57.18	65.80	79.27	62.98	53.93	61.14	71.19	84.67	67.73
Garlic Extract (10%)	47.92	54.65	62.88	76.33	60.45	52.40	58.88	68.98	82.26	65.63
Mean (A)	46.13	52.71	61.59	74.41		50.31	57.20	67.00	79.86	
L.S.D. at 0.05	A: 6.11		B: 3.15	AB: 6.30		A: 6.33		B: 3.45	AB: 6.90	
	Aerial parts dry weight/plant (g)									
Control	16.38	18.92	22.70	27.23	21.31	18.05	20.68	24.67	29.20	23.15
Vitamin E (100 ppm)	18.40	20.68	24.36	29.58	23.26	19.90	22.82	26.46	31.80	25.25
Yeast (10 g/l)	19.86	22.87	26.32	31.71	25.19	21.57	24.45	28.48	33.87	27.09
Garlic Extract (10%)	19.16	21.86	25.15	30.53	24.18	20.96	23.56	27.59	32.91	26.26
Mean (A)	18.45	21.08	24.63	29.76		20.12	22.88	26.80	31.95	
L.S.D. at 0.05	A: 1.92		B: 1.07	AB: 2.14		A: 2.11		B: 1.04	AB: 2.08	

Roots fresh and dry weights/plant:

Data presented in Table (3) proved that all compost treatments led to significant improvement in root weights either fresh or dry facing the control in the first season and second one. High compost level (1500 g/container) was more effective than other treatments including the control. The heaviest weights of roots resulted from compost treatments may be due to nutrient, sugars, vitamins and cytokinins resulted from the decomposition of compost having enhancing effect on plant growth, therefore, reflected of the weight of roots system.

Similar results were recorded by Ashour (2010) and Abdou and Ashour (2012) on jojoba, Saleh (2000) and Abdou *et al.* (2007) on *Ficus sp*., Daldoum and Hammad (2015) on *Acacia Senegal*, Kannan and Rajendran (2015) on *Jatropha curcas* and Youssef *et al*. (2020) on *Cupressus macrocarpa*.

Regarding the impact of stimulating substances, data in Table (3), showed that all used levels pronounced augmented roots weight either fresh or dry comparing the control in the first and second seasons. The weightiest significant roots weight either fresh or dry were obtained by active yeast treatment as reached 37.87 and 33.24% fresh weight of root and 36.30 and 32.50% dry weight of root over control in both seasons, respectively.

Active yeast is capable to produce some growth stimulating substances (cytokinins). Our results are similar to those obtained by Abdel-Wahid *et al*. (2006) on *Euonymus japonicas*, Stino *et al*. (2009) on apricot, Taha *et al*. (2016) on neem plant and Ali *et al*. (2020) on *Taxodium disticum*.

The effect of interaction was significant for roots weights (fresh or dry) in both experimental seasons. Heaviest significant weights were obtained by adding compost at 1500 g/container in combination with active yeast or garlic extract.

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Table 3. Influence of compost and some stimulating substances on roots fresh and dry weights of jojoba seedlings during the two growing seasons (2020 and 2021).

Some stimulators treatments (B)	Compost levels (g/seedling) (A)									
	0.0	500	1000	1500	Mean (B)	0.0	500	1000	1500	Mean (B)
	The 1st season (2020)					The 2nd season (2021)				
	Root fresh weight/plant (g)									
Control	6.18	8.15	10.21	12.21	9.19	7.98	9.93	12.06	14.07	11.01
Vitamin E (100 ppm)	7.71	9.86	11.91	14.08	10.89	9.82	11.75	13.80	15.77	12.79
Yeast (10 g/l)	9.54	11.49	13.78	15.88	12.67	11.45	13.56	15.58	18.08	14.67
Garlic Extract (10%)	8.42	10.90	12.66	15.03	11.75	10.62	12.66	14.88	16.75	13.73
Mean (A)	7.96	10.10	12.14	14.30		9.97	11.98	14.08	16.17	
L.S.D. at 0.05	A: 0.95		B: 0.43	AB: 0.86		A: 1.08		B: 0.67	AB: 1.34	
	Root dry weight/plant (g)									
Control	3.72	4.80	5.75	6.89	5.29	4.59	5.69	6.84	7.87	6.25
Vitamin E (100 ppm)	4.61	5.91	6.82	7.89	6.31	5.15	6.78	7.86	8.74	7.13
Yeast (10 g/l)	5.66	6.74	7.66	8.79	7.21	6.56	7.84	8.81	9.90	8.28
Garlic Extract (10%)	5.47	6.50	7.51	8.57	7.01	6.32	7.69	8.53	9.63	8.04
Mean (A)	4.87	5.99	6.94	8.04		5.66	7.00	8.01	9.04	
L.S.D. at 0.05	A: 0.86		B: 0.12	AB: 0.24		A: 0.81		B: 0.22	AB: 0.44	

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استجابة نبات الجوجوبا للمعاملة بالكمبوست وبعض المواد المنشطة

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و محمد طه سالم أحمد
قسم البساتين، كلية الزراعة، جامعة المنيا، مصر

تم إجراء هذه التجربة خلال موسمي النمو ٢٠٢٠ و٢٠٢١ بمشتل نباتات الزينة، قسم البساتين، كلية الزراعة، جامعة المنيا، مصر لدراسة استجابة نبات الجوجوبا للتسميد بالكمبوست (صفر، ٥٠٠ ، ١٠٠٠ ، ١٥٠٠ جم/حاوية) وبعض المواد المنشطة (فيتامين هـ بتركيز ١٠٠ جزء في المليون، الخميرة النشطة بتركيز ١٠ جم/لتر، مستخلص الثوم بتركيز ١٠٪، بالإضافة للكنترول). أوضحت النتائج أن زيادة مستوي الكمبوست أدت إلي زيادة معنوية في ارتفاع النبات وسمك الساق الرئيسي و عدد الفروع و الوزن الطازج والجاف للأجزاء الهوائية مقارنة بالكنترول. بينما أدى رش المواد المنشطة إلي زيادة معنوية في كل الصفات السابقة مقارنة بالكنترول. ويمكن تلخيص أن الكمبوست بتركيز ١٥٠٠ جم/للنبات مع رش النباتات بالخميرة النشطة بتركيز ١٠ جم/لتر أو مع مستخلص الثوم بتركيز ١٠٪ أدي إلي أفضل نمو لنباتات الجوجوبا.