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EFFECT OF COMPOST AND SOME NATURAL GROWTH PROMOTING ON CHAMOMILE

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ABSTRACT: A field experiment was carried out during the two successive growing seasons of 2019/2020 and 2020/2021 at the Nursery of Ornamental Plants, Faculty of Agriculture, Minia University to study the effect of compost (0.0, 2.5, 5.0 and 7.5 ton/fed) and foliar spray with ascorbic and salicylic acids, each at 50, 100 and 200 ppm, on growth, productivity of flowers and essential oil of chamomile (*Matricaria chamomilla*, L.) plants. Results indicated that vegetative growth traits (plant height and number of branches/plant), flowers fresh and dry weights/plant, essential oil (%) and yield/plant as well as photosynthetic pigments were significantly improved as a result of applied compost at the three levels with the highest values were obtained with 7.5 ton/fed treatment. Also, all concentrations of ascorbic and salicylic acids led to significant increases in all previous characters of vegetative growth, flowers and essential oil productivity compared to control. The combination treatment of compost (7.5 ton/fed) with salicylic acid (200 ppm) was superior than the other interaction treatments.

Key words: *Matricaria chamomilla*, compost, ascorbic acid, salicylic acid, essential oil.

INTRODUCTION

Chamomile (*Matricaria chamomilla* L.) belongs to Family Asteraceae. it is widely used as a medicinal plant. It has many active constituents, including the essential oil (Haj Sayed Hadi *et al*., 2004; Szoke *et al*., 2004 and Salamon, 2007). The principal components of the essential oil of flowers are β – farnesene, farnesol, chomazulene, a-bisabolol and a-bisabolol oxides, which are known as anti-inflammation, antiseptic spasmolytic and healing action (Jakovlev *et al*., 1983).

The positive role of compost and the direct relationship between increasing compost levels application and the increment of plant growth and productivity was reported by Hendawy and Khalid (2011).

The efficiency of ascorbic and salicylic acids as antioxidants in improving plant growth, flower and essential oil productivity was emphasized by many authors. Regarding ascorbic acid, Yousef *et al*. (2005) and Ranjbar *et al*. (2014). As for salicylic, Abdou *et al*. (2013); Mazrou (2017) and Sadaghiani *et al*. (2019).

Therefore, this experiment was aimed to study the effect of compost, ascorbic acid as well as salicylic acids on growth and productivity of chamomile plant.

MATERIALS AND METHODS

The present investigation was conducted at the Nursery of Ornamental Plants, Faculty of Agriculture, Minia University, during the two successive growing seasons of 2019/2020 and 2020/2021 and the essential oil percentages were determined at the Laboratory of Horticulture Department, Faculty of Agriculture and Natural Resources, Aswan University, to study the effect of compost rates and some natural growth regulators (ascorbic acid and salicylic acids) on chamomile (*Matricaria chamomilla*, L.) plant.

The experiment layout was a randomized complete block design in a split-plot design with three replicates. The main plots (A) included four levels of compost (0.0, 2.5, 5.0 and 7.5 ton/fed), while the sub-plots (B) involved six natural growth regulators treatments (ascorbic acid at 50, 100 and 200 ppm and salicylic acid at 50, 100 and 200 ppm, as well as control), including 28 interaction treatments. The physical and chemical analysis of the used soil are listed in Table (a). Seeds of chamomile plant were sown in the second week of September (15^{th} September), during both seasons, in the beds of the nursery. The seedlings were transplanted at 40 days after sowing (25^{th} October).

Fully decomposed compost (plant residues) was obtained from Egypt Company for Circulate Solid Residues at New El-Minia City and added during preparing the soil to cultivation in both seasons. The chemical analysis of compost is shown in Table (b).

The different concentrations of each ascorbic acid and salicylic acid (50, 100 and 200 ppm) were biweekly applied by hand sprayer 3 times each season, starting on 4^{th} November for each season.

Fresh flower heads were collected (hand picking) when 50% of the plant was in the blooming stage (last week of December lasted to the end of April) which was continued daily. Every week (each seven days), dry weight of the flowers was calculated after drying the flower heads at room temperature (Hendawy and Khalid, 2011).

Data recorded:

Vegetative growth (plant height and number of branches/plant), fresh and dry weights of flower heads per plant, essential oil (%) and essential oil yield/plant, (ml), as well as photosynthetic pigments.

Oil determination:

The essential oil percentage was determined in dried flower heads samples in both seasons by subjecting to hydro distillation using Clevenger apparatus according to method described by the Egyptian Pharmacopoeia (1984), then the essential oil yield per plant and per feddan were calculated.

Chlorophyll a, b and carotenoids:

Chlorophyll a, b and carotenoids were determined in fresh samples of leaves (mg/g f.w.) according to the method cited from Fadl and Sari El–Deen (1978). The determination was conducted using acetone (85% v/v) as plank at wavelength of 660, 644 and 440.5 nm for chlorophyll a, b and carotenoids, respectively. Then calculated using the following equations:

Chl. a (mg/g f.w.) = $(9.784 \times E\ 662) - (0.99 \times E\ 644)$

Chl. B (mg/g f.w.) = $(21.426 \times E\ 644) - (4.65 \times E\ 662)$

Carotenoids (mg/g f.w.) = $(4.695 \times E\ 440.5) - 0.268\ (E\ 662 - E\ 644)$

Where: E the optical density of given wavelength.

The obtained data were tabulated and statistically analyzed according to MSTAT–C (1986), and L.S.D test at 5% was followed to compare between the means of treatments

RESULTS AND DISCUSSION

1. Vegetative growth traits:

Data presented in Table (1) indicated that both of plant height and number of branches/plant were significantly increased due to the application of compost at 2.5, 5.0 and 7.5 ton/fed compared to control. The tallest plants (80.03 and 90.14 cm in both seasons, respectively) and the greatest number of branches/plant (25.50 and 22.10 in both seasons, respectively), regardless the effect of ascorbic and salicylic acids, were obtained with a high level of compost. Similar results were recorded by Juárez-

Table a. Physical and chemical properties of the used soil during the two seasons.

Soil characters	Values 2019/2020	2020/2021	Soil characters	Values 2019/2020	2020/2021
Physical properties:			**Exchangeable nutrients:**		
Sand (%)	26.78	25.60	**Ca^{++} (mg/100 g soil)**	29.21	30.03
Silt (%)	29.87	30.64	**Mg^{++} (mg/100 g soil)**	4.45	4.65
Clay (%)	43.35	43.76	**Na^{+} (mg/100 g soil)**	2.81	2.75
Soil type	Clay loam	Clay loam	**K^{+} (mg/100 g soil)**	2.95	2.74
Chemical properties:			**DTPA-Extractable nutrients:**		
pH (1:2.5 paste)	7.87	7.81	**Fe (ppm)**	7.93	7.81
E.C. (dS/m)	1.12	1.10	**Cu (ppm)**	1.81	1.76
O.M. (%)	1.44	1.49	**Zn (ppm)**	2.47	2.48
$CaCO_3$ (%)	2.09	2.10	**Mn (ppm)**	7.71	7.85

Table b. Chemical analysis of the used compost in both seasons of 2019/2020 and 2020/2021.

Properties	Value	Properties	Value
Organic carbon (%)	24.3	**Total P (%)**	0.6
Humidity (%)	24.8	**Total K (%)**	1.1
Organic matter (%)	43.4	**Fe (ppm)**	1765
C/N ratio	17.2	**Zn (ppm)**	62
pH (1:2.5)	8.10	**Mn (ppm)**	127
E.C. (mmhos/cm)	5.2	**Cu (ppm)**	205
Total N (%)	1.6		

Table 1. Effect of compost, some natural growth regulators and their combinations on plant height and branches number/plant of chamomile during 2019/2020 and 2020/2021 seasons.

Natural growth regulators treatments	Compost levels (ton/feddan) (A)									
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
	1st season (2018/2019)					2nd season (2019/2020)				
	Plant height (cm)									
Control	51.75	53.58	55.50	57.58	54.60	62.08	64.16	64.53	87.24	69.51
Ascorbic acid (50 ppm)	53.16	54.41	57.75	63.99	57.43	63.75	70.41	75.41	87.49	74.26
Ascorbic acid (100 ppm)	61.08	68.83	68.91	76.74	68.89	66.66	72.83	82.91	89.16	77.89
Ascorbic acid (200 ppm)	72.49	80.58	82.16	85.49	80.18	62.08	84.58	86.00	86.25	84.73
Salicylic acid (50 ppm)	74.83	76.16	80.41	87.08	79.37	79.83	84.37	85.33	87.91	84.36
Salicylic acid (100 ppm)	84.99	87.91	93.41	93.75	90.01	74.16	74.99	92.66	95.83	84.41
Salicylic acid (200 ppm)	88.08	92.74	94.99	95.58	92.85	88.58	89.33	94.74	97.08	92.61
Mean (A)	69.54	73.31	76.23	80.03		64.78	67.18	83.10	90.14	
L.S.D at 5%	A: 2.5	B: 2.0	AB: 4.0			A: 2.9	B: 2.2	AB: 4.4		
	Branches number/plant									
Control	12.26	12.78	13.35	14.49	13.19	11.75	12.28	12.75	13.99	12.69
Ascorbic acid (50 ppm)	14.25	14.91	17.49	18.99	16.41	13.75	14.41	16.99	18.49	15.91
Ascorbic acid (100 ppm)	17.99	21.99	22.49	22.75	21.30	17.49	21.49	21.99	22.25	20.80
Ascorbic acid (200 ppm)	18.75	19.99	22.58	25.08	21.60	18.25	19.49	22.08	24.58	21.10
Salicylic acid (50 ppm)	14.33	17.08	20.58	24.91	19.22	13.83	16.58	20.08	24.41	18.72
Salicylic acid (100 ppm)	15.33	20.08	22.41	23.83	20.41	14.83	19.58	21.91	23.32	19.91
Salicylic acid (200 ppm)	16.66	20.66	23.66	27.49	22.11	16.23	20.23	23.23	27.06	21.92
Mean (A)	15.65	18.21	20.35	22.50		15.16	17.81	19.95	22.10	
L.S.D at 5%	A: 1.51	B: 0.62	AB: 1.24			A: 1.48	B: 0.54	AB: 1.58		

Rosete *et al*. (2012); Haj Seyed Hadi *et al*. (2015); Rabie *et al*. (2017) and Gandomi *et al*. (2021) on chamomile plants.

Also, data in Table (1) mentioned that all used concentrations of ascorbic and salicylic acids significantly increased plant height and number of branches/plant, and salicylic acid at 200 ppm recorded the tallest plants (92.85 and 92.61 cm) and highest values number of branches/plant (22.11 and 21.92), in both seasons, respectively). In agreement with our results concerning the promotion effect of salicylic acid Mazrou (2017) and Sadaghiani *et al*. (2019), also, Yousef *et al*. (2005) and Ranjbar *et al*. (2014) on chamomile, Ali (2004) and Abdul-Basit *et al*. (2018) on *Tagetes* sp. Al-Shareif (2006) and Elgohary *et al*. (2020) on caraway and Elbohy *et al*. (2018) on *Zinnia elegans*. Regarding the effect of ascorbic acid, Attia and Moftah (2003) on borage, Ahmed (2005) on *Majorana hortensis*, Abdou *et al*. (2009) on fennel plants, Eid *et al*. (2011) on *Tagetes erecta*, L., Ewais *et al*. (2012) on sunflower and Mostafa (2018) on dragonhead plant.

The interaction between the two factors was significant for plant height and number of braches/plant. The combined treatment of 7.5 ton/fed compost and salicylic acid (200 ppm) was superior to the other interaction treatments.

2. Fresh and dry weights of flower heads:

Data in Table (2) indicated that all compost levels (2.5, 5.0 and 7.5 ton/fed) significantly increased flower fresh and dry weights/plant in both seasons as compared to control. Application of compost at 7.5 ton/fed recorded the heaviest fresh weights (142.06 and 139.13 g/plant) and dry weights (26.40 and 25.95 g/plant), in both seasons, respectively. The positive effects of compost on enhancing flowering weights were obtained by Hendawy and Khalid (2011); Chand *et al*. (2012); Haj Seyed Hadi *et al*. (2015); Aleman *et al*. (2016); Ahmadian *et al*. (2018); Monjezi *et al*. (2018); Salehi *et al*. (2018) and Gandomi *et al*. (2021) on chamomile plants and Nazari *et al*. (2008); Hassan *et al*. (2014); Idan *et al*. (2014); Singh *et al*. (2015) and Sharma *et al*. (2017) on marigold plants.

Regarding the effect of antioxidants (ascorbic and salicylic acids), from that all levels used (50-200 ppm) significantly enhanced fresh and dry flowers weights/plant as compared to the control (Table, 2). The highest values of fresh and dry weights were obtained by salicylic acid followed by ascorbic acid each at 200 ppm as recorded 147.21 and 143.65 g/plant followed by 141.14 and 136.29 g/plant in the first and second seasons, respectively. While, the best dry flowers weight/plant was resulted for salicylic acid (200 ppm) as gave 29.67 and 29.01 g/plant, in both seasons, respectively. Many investigators found similar effects of salicylic acid as Abdou *et al*. (2013) and Mazrou (2017) on chamomile, Ali (2004) on *Tagetes minuta*, Khandaker *et al*. (2011) on *Amaranthus tricolor*, Farjadi-Shakib *et al*. (2012) on *Cyclamem persicum*, Ghorbani *et al*., (2013) on violet flower, Choudhary *et al*. (2017); Kumar *et al*. (2019) and Sadique *et al*. (2021) on *Tagetes erecta*, L. plants and Niri *et al*. (2016); Kumar (2017) and Abdul-Basit *et al*. (2018) on marigold. concerning the effect of ascorbic acid, Yousef *et al*. (2005) and Ranjbar *et al*. (2014) on chamomile plants, Attia and Moftah (2002) and Abd El-Latif (2007) on borage plants, Ewais *et al*. (2012) on *Helianthus* sp., Elbohy *et al*. (2018) on *Zinnia*, and Azizi *et al*. (2021) on *Calendula officienalis*, obtained similar results.

The interaction was significant and the heaviest weights were obtained with the application of compost at 7.5 ton/fed, combined with spraying plants with salicylic acid at 200 ppm.

3. Oil productivity:

Essential oil (%) and oil yield per plant were augmented due to compost fertilization (2.5, 5.0 and 7.5 ton/fed). The best results of essential oil % (1.36 and 1.42) and essential oil yield/plant (36.81 and 37.93 ml) in both seasons, respectively, were obtained with

Table 2. Effect of compost, some natural growth regulators and their combinations on flower heads fresh and dry weights (g/plant) of chamomile during 2019/2020 and 2020/2021 seasons.

Natural growth regulators treatments	Compost levels (ton/feddan) (A)									
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
	1st season (2018/2019)					2nd season (2019/2020)				
	Flower heads fresh weight (g/plant)									
Control	45.11	57.12	57.61	57.62	54.36	46.28	53.04	53.37	63.03	53.68
Ascorbic acid (50 ppm)	64.12	95.12	115.7	121.9	98.85	58.61	94.27	112.95	119.40	96.31
Ascorbic acid (100 ppm)	121.53	123.53	137.86	141.44	131.09	116.44	116.96	133.45	138.45	126.32
Ascorbic acid (200 ppm)	124.88	132.53	141.51	165.45	141.14	128.52	120.53	134.24	161.86	136.29
Salicylic acid (50 ppm)	63.90	106.05	130.17	164.29	116.10	60.61	102.45	125.36	156.97	111.35
Salicylic acid (100 ppm)	99.31	125.67	137.59	168.20	132.69	94.78	122.67	132.43	158.86	126.93
Salicylic acid (200 ppm)	114.57	136.65	161.32	176.32	147.21	108.70	133.36	157.16	175.36	143.65
Mean (A)	90.49	105.85	106.11	142.06		87.56	106.04	121.16	139.13	
L.S.D at 5%	A: 9.12		B: 8.52		AB: 16.04	A: 10.01		B: 8.99		AB: 17.98
	Flower heads dry weight (g/plant)									
Control	11.68	12.92	13.43	16.01	13.49	11.18	12.01	13.09	15.59	12.97
Ascorbic acid (50 ppm)	21.26	21.34	23.76	23.84	22.55	20.43	20.76	22.93	23.34	21.86
Ascorbic acid (100 ppm)	21.68	23.34	26.01	27.09	24.53	20.76	22.76	25.42	26.59	23.88
Ascorbic acid (200 ppm)	23.35	26.43	27.09	28.51	26.34	22.85	25.93	26.59	28.18	25.89
Salicylic acid (50 ppm)	16.43	19.18	21.09	28.18	21.22	15.93	18.85	20.18	27.75	20.68
Salicylic acid (100 ppm)	17.26	21.84	25.67	28.34	23.28	16.85	21.51	25.26	28.26	22.97
Salicylic acid (200 ppm)	26.93	28.09	30.84	32.83	29.67	26.34	27.51	30.26	31.93	29.01
Mean (A)	19.80	21.88	23.97	26.40		19.19	21.33	23.39	25.95	
L.S.D at 5%	A: 2.11		B: 1.85		AB: 3.76	A: 2.00		B: 1.73		AB: 3.46

compost at 7.5 ton/fed as shown in Table (3). Similar results were recorded by Mazrou (2017); Sadaghiani *et al*. (2018) and (2019) on chamomile plants.

Concerning the effects of ascorbic and salicylic acids treatments (Table, 3), these treatments significantly stimulated the essential oil (%) and yield/plant, compared to the control in both seasons. Sparing chamomile plants with salicylic acid at 200 ppm significantly increased the production of oil, giving the highest essential oil % (1.48 and 1.55) and essential oil yield/plant (44.33 and 45.58 ml), in both seasons, respectively.

The capability of antioxidants especially salicylic acid on essential oil (%) and yield/plant were detected by Abdou *et al*. (2013) and Mazrou (2017) on chamomile plants. In regard to the effect of ascorbic acid, Yousef *et al*. (2005) and Ranjbar *et al*. (2014) on chamomile, Yousef and Talaat (2003) on rosemary, Reda *et al*. (2005) on *Thymus*, Ayat (2007) and Said *et al*. (2014) on coriander plants, Ibrahim (2010) and El-Leithy *et al*. (2011) on geranium, Mostafa (2018) on dragonhead mentioned that ascorbic acid treatments increased essential oil percentage.

The interaction effect between the two studied factors on essential oil (%) and yield/plant was significant in both seasons (Table, 3). The highest values were observed by using 7.5 ton/fed compost in combination with salicylic acid (200 ppm) as a foliar spray.

4. Photosynthetic pigments:

Data in Table (4) clarified that the treatments of 2.5, 5.0 and 7.5 ton/fed compost significantly increased the photosynthetic pigments contents (chlorophyll a, b and carotenoids). The highest values for the previous three photosynthetic contents were obtained with the high level of compost (7.5 ton/fed). These results are in harmony with those recorded by Sakr (2001) and Abdou *et al*.

Table 3. Effect of compost, some natural growth regulators and their combinations on essential oil (%) and yield/plant (ml) of chamomile during 2019/2020 and 2020/2021 seasons.

Natural growth regulators treatments	Compost levels (ton/feddan) (A)									
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
	1st season (2018/2019)					2nd season (2019/2020)				
	Essential oil (%)									
Control	0.80	0.85	0.85	1.05	0.89	0.75	0.85	0.90	1.10	0.90
Ascorbic acid (50 ppm)	0.85	0.90	1.00	1.15	0.98	0.80	0.90	0.95	1.20	0.96
Ascorbic acid (100 ppm)	0.90	0.95	1.10	1.25	1.05	0.85	0.95	1.00	1.30	1.03
Ascorbic acid (200 ppm)	1.00	1.10	1.30	1.50	1.23	0.95	1.10	1.20	1.55	1.20
Salicylic acid (50 ppm)	0.95	1.00	1.15	1.30	1.10	0.85	1.00	1.10	1.35	1.08
Salicylic acid (100 ppm)	1.05	1.10	1.25	1.45	1.21	0.95	1.10	1.20	1.50	1.19
Salicylic acid (200 ppm)	1.15	1.35	1.60	1.80	1.48	1.20	1.40	1.65	1.95	1.55
Mean (A)	0.96	1.04	1.18	1.36		0.91	1.04	1.14	1.42	
L.S.D at 5%	A: 0.014		B: 0.025		AB: 0.050	A: 0.023		B: 0.035		AB: 0.070
	Essential yield/plant (ml)									
Control	9.34	10.98	11.42	16.81	12.14	8.39	10.21	11.78	17.15	11.88
Ascorbic acid (50 ppm)	18.07	19.21	23.76	27.42	22.11	16.34	18.68	21.78	28.01	21.20
Ascorbic acid (100 ppm)	19.51	22.17	28.61	33.86	26.04	17.65	21.62	25.42	34.57	24.81
Ascorbic acid (200 ppm)	23.35	29.07	35.22	42.77	32.60	21.71	28.52	31.91	43.68	31.45
Salicylic acid (50 ppm)	15.61	19.18	24.25	36.63	23.92	13.54	18.85	22.20	37.46	23.01
Salicylic acid (100 ppm)	18.12	24.02	32.09	41.09	28.83	16.01	23.66	30.31	42.39	28.09
Salicylic acid (200 ppm)	30.97	37.92	49.34	59.09	44.33	31.61	38.51	49.93	62.26	45.58
Mean (A)	19.28	23.22	29.24	36.81		17.89	22.87	27.62	37.93	
L.S.D at 5%	A: 0.77		B: 0.99		AB: 0.98	A: 0.66		B: 1.06		AB: 2.11

(2012) on mint plant, Khalil *et al*. (2002); El-Maadawy (2007) and Dikr and Belete (2017) on *Tagetes erecta*, L., Kandeel and Abou-Taleb (2002); Mohsen (2002); Kandeel (2004); El-Sanafawy (2007) and Abdou *et al*. (2011 and 2014) on *Ocimum spp.*, and El-Sherbeny *et al*. (2005) on *Sideritis montana*.

Photosynthetic pigments contents were significantly increased as a result of spraying chamomile plants with all used antioxidant concentrations compared to the control in both seasons. The highest contents of pigments were recorded with the high level of salicylic acid (200 ppm), followed by ascorbic acid at 200 ppm, with significant differences were detected in most cases.

Our results are in agreement with those obtained by, Mazrou (2017), on chamomile plants, Attia and Moftah (2003) on borage plants, Khalil *et al*., (2010); Abd El-Salam (2014) and Marzok *et al*. (2017) on sweet basil plants, Choudhary *et al*. (2016) on African marigold plants, Niri *et al*. (2016) on marigold plants, Abdul-Basit *et al*. (2018); Abbas *et al*. (2019) and Kumar *et al*. (2019) on *Tagetes* sp. regarding salicylic acid treatments. At the same time, Attia and Moftah (2002) on borage plants, Ahmed (2005) on marjoram, Reda *et al*. (2005) on *Thymus*, Farahat *et al*. (2007), on *Cupressus sempavirens*, Ayat (2007) on coriander plants, Ewais *et al*. (2012) on sunflower plants, Elbohy *et al*. (2018) on *Zinnia* plants, and Mostafa (2018) on dragonhead, regarding the effect of ascorbic acid.

The interaction between compost fertilization and the natural growth regulators treatments (ascorbic and salicylic acid acids) was significant for the three photosynthetic pigments as compared to control in both seasons. The combined treatment compost (7.5 ton/fed) and salicylic

Table 4. Effect of compost, some natural growth regulators and their combinations on chlorophyll a, b and carotenoids (mg/g f.w.) of chamomile during 2019/2020 and 2020/2021 seasons.

Natural growth regulators treatments	Compost levels (ton/feddan) (A)									
	0.0	2.5	5.0	7.5	Mean (B)	0.0	2.5	5.0	7.5	Mean (B)
	1st season (2018/2019)					2nd season (2019/2020)				
	Chlorophyll a (mg/g f.w.)									
Control	1.995	2.108	2.216	2.338	2.164	2.012	2.092	2.172	2.253	2.133
Ascorbic acid (50 ppm)	2.045	2.150	2.265	2.392	2.213	2.102	2.182	2.264	2.345	2.223
Ascorbic acid (100 ppm)	2.085	2.180	2.298	2.412	2.243	2.192	2.272	2.353	2.434	2.312
Ascorbic acid (200 ppm)	2.225	2.220	2.436	2.461	2.335	2.283	2.374	2.454	2.534	2.403
Salicylic acid (50 ppm)	2.075	2.180	2.296	2.433	2.246	2.132	2.212	2.294	2.375	2.253
Salicylic acid (100 ppm)	2.105	2.201	2.319	2.426	2.262	2.232	2.312	2.393	2.474	2.352
Salicylic acid (200 ppm)	2.275	2.271	2.488	2.502	2.384	2.433	2.414	2.504	2.586	2.484
Mean (A)	2.115	2.187	2.331	2.423		2.195	2.264	2.348	2.429	
L.S.D at 5%	A: 0.025		B: 0.017		AB: 0.034	A: 0.035		B: 0.025		AB: 0.050
	Chlorophyll b (mg/g f.w.)									
Control	0.668	0.700	0.728	0.769	0.716	0.661	0.687	0.715	0.742	0.701
Ascorbic acid (50 ppm)	0.672	0.740	0.873	0.887	0.793	0.691	0.717	0.745	0.772	0.731
Ascorbic acid (100 ppm)	0.681	0.751	0.882	0.896	0.802	0.720	0.748	0.774	0.801	0.760
Ascorbic acid (200 ppm)	0.693	0.768	0.899	0.976	0.822	0.751	0.778	0.808	0.835	0.793
Salicylic acid (50 ppm)	0.682	0.757	0.880	0.896	0.804	0.701	0.728	0.755	0.786	0.742
Salicylic acid (100 ppm)	0.690	0.765	0.891	0.901	0.811	0.734	0.761	0.787	0.815	0.774
Salicylic acid (200 ppm)	0.705	0.779	0.905	0.941	0.832	0.800	0.806	0.824	0.852	0.813
Mean (A)	0.674	0.751	0.865	0.880		0.722	0.746	0.772	0.793	
L.S.D at 5%	A: 0.017		B: 0.015		AB: 0.030	A: 0.015		B: 0.010		AB: 0.020
	Carotenoids (mg/g f.w.)									
Control	0.685		0.722		0.759	0.799		0.741		0.691
Ascorbic acid (50 ppm)	0.702		0.770		0.804	0.817		0.773		0.721
Ascorbic acid (100 ppm)	0.722		0.785		0.821	0.833		0.790		0.752
Ascorbic acid (200 ppm)	0.735		0.797		0.834	0.846		0.803		0.782
Salicylic acid (50 ppm)	0.712		0.781		0.812	0.838		0.785		0.731
Salicylic acid (100 ppm)	0.735		0.802		0.934	0.946		0.854		0.764
Salicylic acid (200 ppm)	0.756		0.817		0.956	0.995		0.881		0.831
Mean (A)	0.721		0.782		0.845	0.867				0.753
L.S.D at 5%	A: 0.022		B: 0.019		AB: 0.038	A: 0.019		B: 0.008		AB: 0.016

acid (200 ppm) produced the highest contents of chlorophyll a and carotenoids, whereas, the highest content of chlorophyll b was obtained with compost 7.5 ton/fed combined with salicylic acid or ascorbic acid each at 200 ppm in the first season and in the second one.

From the obtained results, it could be discussed as follows: the promoting effect of compost in chamomile plants may be attributed to the role of compost in physiological and biological process (Bohan *et al*., 1985).

The enhancement of growth, flowers yield and essential oil production due to spraying plants with ascorbic and salicylic acids might be attributed to the positive, biological and physiological roles of those substances as antioxidant that protect the plant against damage and as promoting where they induce flowering retard senescence and augmented the rate of cell metabolic and salicylic acid may be a prerequisite for auxin and/or plays an important role as coenzyme (Popova *et al*., 1997).

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تأثير الكمبوست وبعض منشطات النمو الطبيعية علي الكاموميل

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أُجريت تجارب حقلية أثناء موسمي نمو متعاقبين ٢٠٢٠/٢٠١٩ و ٢٠٢١/٢٠٢٠، لدراسة تأثير الكمبوست (صفر ، ٢,٥ ، ٥,٠ ، ٧,٥ طن/فدان) والرش بحمض الاسكوربيك والسالسليك بمعدل ٥٠ ، ١٠٠ ، ٢٠٠ جزء/مليون علي النمو الخضري وإنتاجية الأزهار والزيت لنبات البابونج. أشارت النتائج إلي أن صفات النمو الخضري مثل: إرتفاع النبات، عدد الفروع للنبات، والوزن الطازج والجاف للنورة الزهرية للنبات وكذلك النسبة المئوية للزيت الطيار للأزهار ومحصول الزيت للنبات وأيضاً صبغات البناء الضوئي تحسنت معنوياً نتيجة المعاملة بالكمبوست بمستوياته الثلاثة مع الحصول علي أعلي القيم من المعاملة ٧,٥ طن/فدان كمبوست. ووُجد أن كل التركيزات المستخدمة من حمض الاسكوربيك والسالساليك أدت إلي زيادة معنوية في كل الصفات السابقة (النمو الخضري وإنتاجية الأزهار والزيت) مقارنة بمعاملة الكنترول. بالإضافة إلي معاملة التفاعل بين الكمبوست ٧,٥ طن/فدان وحمض السالساليك اسد ٢٠٠ جزء/مليون تفوقت علي معاملات التفاعل الأخري.