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The effect of cattle manure and biostimulants on growth and essential oil production of southernwood Artemisia (*Artemisia abrotanum* L.) plant

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ABSTRACT

This investigation was carried out at Fac. of Agric. Cairo Univ.,and the experimental farm of Medicinal and Aromatic Plants Research Department, Horticulture Research Institute, Agricultural Research Center, Dokki, Giza, in the two successive seasons of 2014 and 2015.The research aimed to study the effect of cattle manure (CM) rates (15, 30 and 45 m^3/fed.) alone or and some different levels of yeast, ascorbic acid and Actosol on growth, yield, essential oil productivity and chemical composition of *Artemisia abrotanum,* L. plants. The results showed that, in both seasons, the highest plant height; number of branches per plant; plant fresh and dry weights, essential oil percentage, essential oil yield in fresh herb per plant and total carbohydrates (%) were obtained by adding cattle manure at rate 30 m^3/fed compared to other cattle manure treatments. Ascorbic acid at 100 ppm had a significant effect of all characterstics compared to other biostimulants. Treating the plant with cattle manure at rate 30 m^3/fed. combined ascorbic at 100 ppm resulted in highest values of all characterstics compared to other combination treatments.

Key words: *Artemisia abrotanum*, cattle manure, yeast ascorbic, actosol growth, essential oil percentage, and carbohydrates.

Introduction

The genus *Artemisia* belongs to one of the largest and most widely distributed genera of the family *Asteraceae* (*Compositae*). It is a diverse and economically important genus and it has more than 500 species. Most plants within this genus have a great importance as medication, foodstuff, ornamentals or soil stabilizers, some are allergenic or toxic, and some are weeds growing in the fields (Hayat *et al.,* 2009; Tan *et al.,* 1998). The Artemisia genus has been used throughout history. Ancient Greek writings talking of its use for women's health suggest that the name "Artemisia" comes from Artemis, the Greek goddess of women. Artemisia plants have been used by the ancient Greeks, Chinese, Japanese and Aztecs for uses such as moxibustion and colic and stomach disorder treatment (Kay 1996). Southernwood, *Artemisia abrotanum*, is native to southern Europe, Syria and China (Stephenson 1831; Garland 2004). *Artemisia abrotanum* commonly known as "Southernwood" traditionally considered as antiseptic, astringent, emmenagogue, expectorant, febrifuge, stomachic, stimulant, tonic, antiinflammatory, vermifuge and spasmolytic. It is used for treating upper respiratory tract diseases (Asolkar *et al.,* 1965; Bjork *et al.,* 2002b).

Organic and natural fertilizers are a very important method of providing the plants with their nutritional requirements. They have been used basically as a means of alleviating the problem of chemical residues in the export market. Also they are one of the methods used to reclaim sandy desert land and to improve the chemical and physical characteristics of the soil. Organic fertilizers are obtained from animal sources such as animal manure or plant sources like green manure. Continuous usage of inorganic fertilizer affects soil structure. Hence, organic manures can serve as alternative to mineral fertilizers for improving soil structure (Dauda *et al.,* 2008).

Humic acid have been shown the direct effect on plant growth to the increase the cell chlorophyll content, the acceleration of the respiration process, hormonal growth response, increasing

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substances penetration to plant membranes, affects the dry matter production and the uptake of nutrient by plants. The indirect effects of humic acid compounds have been attributed to improvement of physical, chemical and biological conditions of the soil. It enhances water relation, improves nutrient absorption, stimulates the development of micro flora populations (Mallikarjuna *et al.,* 1987) Actosol is a commercial product of Humic acid. . Actosol containing humic acid which is valuable in correcting the widespread occurrence of certain nutrients deficiency symptoms. This is attainted through increasing the soil water holding capacity, promoting soil structure and enhance the metabolic activity of microorganisms. It is also act as a source of nitrogen, phosphorus and sulpher for plants (El-Seginy 2006; Fayza and Zakher 2010 and Fawzy *et al.,* 2012)

Ascorbic acid (vitamin C.) has been known as antioxidant and it protects plants against damage resulting from aerobic metabolism, photosynthesis and a range of pollutants. It also acts as enzyme co–factor, especially hydrolase enzyme, electron transport, oxalate and tartarate synthesis. Moreover, it has a significant resistant against many plant pathogens such as nematode, fungi, bacteria and parasitic plants (Mehdy, 1994).

Active dry yeast is a natural safe bio-fertilizer which causes various promotive effects on plants. Yeast has been reported to be an enriched source for cytokinines, vitamins, enzymes, amino acids and minerals (Khedr and Farid, 2002).

Materials and Methods

This investigation was carried out at Fac. of Agric., Cairo Univ.,and the experimental farm of Medicinal and Aromatic Plants Research Department, Horticulture Research Institute, Agricultural Research Center, Dokki, Giza, in the two successive seasons of 2014 and 2015. The aim of this study was to investigate the effect of using different levels of organic fertilizers (cattle manure) and some different levels of active dry yeast, ascorbic acid and actosol on growth, yield, essential oil productivity and chemical composition of Southernwood plant Artemisia (*Artemisia abrotanum ,* L.) plants. to improve the growth and essential oil productivity and chemical composition of the plant.

Artemisia seedlings used in this study (average height of 10cm) were obtained from the farm of El-ikhlas Saft al Alban Giza gavernmenate, on 20th March 2014 in the first season and 15 the March 2015in the second one. The seedlings were cultivated in clay pots (30 cm diameter) filled with a clay sand soil and the pots were kept in the field. The physical and chemical analyses of the experimental soils are represent in Table (A).

Table A: Physical and chemical analyses of the soil used for growing Artemisia (*Artemisia abrotanum*) plants.

Physical characteristics	First season 2014	Second season 2015
Clay%	39.21	38.36
Silt%	24.32	23.25
Fine sand%	27.14	29.21
Coarse sand%	2.23	2.10
Soil type	Clay sand	Clay sand
Chemical		
pH	7.31	7.20
N (ppm)	22.4	21.6
P2O5 (ppm)	104	102
K2O (ppm)	153	162
Zn (ppm)	3.20	2.33
Fe (ppm)	1.93	1.30
B (ppm)	2.21	2.10
Mn (ppm)	0.45	0.37
Cu (ppm)	0.45	0.47

The cattle manure was obtained from the Animal Production Department, Agricultural Research Center, El-Kanater El-Khaireya. The cattle manure was added during preparing the soil for cultivation. The physical and chemical characteristics of cattle manure are shown in Table (B) Active dry yeast was prepared by adding 2, 4 g to 1 litre of fresh water plus 2g sucrose and left for 6 hours, then it was used.

Ascorbic acid (Vit. C) was obtained from El–Gomhoria Company for chemicals, Egypt.
Humic acid (as Actosol®) was obtained from a private company (American Egyptian United Company) in Cairo. The chemical analysis of Actosol as follows: Carbon 53.80%, Hydrogen 6.20 % , Oxygen 32.80% , 4.30% and 1.15%.

Table B: Physical and chemical characteristics of the cattle manure.

Cattle manure	1st season (2014)	2nd season (2015)
Weight of 1 m^3 (kg)	460	472
Moisture content (%)	7.65	8.78
Organic matter (%)	65.24	63.55
Organic carbon (%)	37.80	35.63
Total N (%)	1.73	1.74
C:N ratio	21 : 84	20 : 5
NH3 - N(ppm)	60.5	58.7
NO3 – N(ppm)	184.31	195.23
Total P (%)	0.47	0.51
Total K (%)	1.36	1.24
Fe(ppm)	1775.6	1680.4
Mn (ppm)	235.8	210.3
Zn (ppm)	142.5	121.8
Cu (ppm)	42.73	41.74

Each of ascorbic acid (Vit. C) and active dry yeast were sprayed, while the actosol as soil drench. were added at 4 times, the 1st addition of was one month after transplanting, and the 2nd one was 21 days later, while the 3rd one was after the first cut and repeated after 21 days plants were sprayed in the morning till the solution run off.

The plants were harvested two times during every season at full blooming, so, the first cut was done on June 29th, and June 27th in the first and second seasons, respectively. The second cut was done on October 19th and October 17th in the first and second seasons, respectively. At each cut ,the following measurements were recorded ,plant height (cm),number of branches /plant, herb fresh and dry weight (g /plant),essential oil , essential oil yield(ml /plant, essential oil yield (litres /fed.) and total carbohydrates %in the dry herb.

The experiment included the following treatments:-

The layout of the experiment was split plot design, including twenty one treatments, which were the combinations between three rates cattle manure 15 (CM1) m^3/fed=ie127 g/plant, 30 (CM 2) m^3/fed=ie254 g/plant and 45 (CM3) m^3/fed. =ie381 g/plant and seven treatments (Active dry yeast 2 g /L, Active dry yeast 4g /L, Ascorbic 100ppm, Ascorbic 200ppm, Actoso 1 ml/pot , Actoso2 ml/pot addition Control .
The oil percentage of fresh herb samples at each cut was extracted by water distillation according to British Pharmacopoeia (1963).

Oil yield /fed: was calculated as 25000 plant /fed. Hassan (2016).
Herb samples were oven-dried at 70º C until a constant weight was obtained, then the concentration of total carbohydrates in the dry herb were determined according to Herbert *et al.* (1971).

Statistical analysis

Statistical analysis for split-plot design was made for each Gomez and Gomez (1984) whereas the cattle manure treatments were located at the main plots and the treatments were located at the sub plot. L.S.D was computed to compare differences among means at 5% and 1%of levels of probability.

Results and Discussion

Plant height (cm)

Data presented in Table (1) show that cattle manure had a significant effect on plant height in the first season. Cattle manure at rate of 30 m^3/fed was the most effective treatment, in both seasons giving the tallest plants (51.00 and 34.62 cm in the first and second cuts of first season, respectively) and (60.43 and 36.10 cm in the first and second cuts of second season, respectively). Similar results were obtained by Gendy *et al* (2012) on *Hibiscus sabdariffa*., as the cattle manure at (15 and 30 m^3/fed.) enhanced the vegetative growth namely; plant height, number of branches and leaves dry weight/plant compared to the untreated plants.

Table 1: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the plant height (cm) of Artemisia (*Artemisia abrotanum* L.) plants at 2014 and 2015 seasons.

Biostimulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed.(A)				Cattle manure m^3/fed.(A)			
	15	30	45	Mean	15	30	45	Mean
Control	33.33	47.67	44.00	41.67	29.67	31.67	29.00	30.11
Active dry yeast 2g/L	34.33	48.67	45.00	42.67	30.67	35.67	29.67	32.00
Active dry yeast 4g /L	37.00	52.67	46.33	45.33	31.33	33.00	30.00	31.44
Ascorbic acid 100ppm	43.00	52.00	49.67	48.22	30.67	37.00	30.33	32.67
Ascorbic acid 200ppm	38.67	52.00	44.33	45.00	30.67	34.00	30.33	31.67
Actosol 1ml/L	36.00	50.33	44.33	43.55	30.33	34.33	29.67	31.44
Actosol 2 ml/L	36.00	53.67	46.33	45.33	30.33	36.67	30.33	32.44
Mean	36.90	51.00	45.71		30.52	34.62	29.90	
LSD for:	5%	1%			5%	1%		
Cattle(A)	3.22	5.35			0.84	1.39		
Biostimulants (B)	1.64	2.20			1.02	1.37		
A*B	2.37	3.42			1.47	2.13		
	Second Season 2015							
Control	52.00	54.33	53.33	53.22	31.00	31.67	31.67	31.45
Active dry yeast 2g /L	52.00	60.33	57.33	56.55	33.33	35.67	33.67	34.22
Active dry yeast 4g /L	52.33	64.33	60.67	59.11	36.67	36.00	33.33	35.33
Ascorbic acid 100 ppm	58.00	63.00	62.00	61.00	35.67	38.00	37.00	36.89
Ascorbic acid 200 ppm	53.33	60.00	63.33	58.89	33.33	37.00	35.67	35.33
Actosol 1ml/L	55.00	56.33	59.67	57.00	32.67	37.33	33.33	34.44
Actosol 2 ml/L	61.00	64.67	60.33	62.00	33.33	37.00	35.33	35.22
Mean	55.28	60.43	59.52		33.71	36.10	34.29	
LSD for:	5%	1%			5%	1%		
Cattle (A)	1.39	2.31			0.99	1.65		
Biostimulants (B)	2.20	2.95			0.93	1.25		
A*B	3.17	4.57			1.34	1.94		

Regarding the effect of dry yeast, ascorbic acid and Actosol these treatments significantly increased plant height in the two cuts of both seasons. In the first cut of first season the highest value (48.22 cm) was obtained from plants received100 ppm ascorbic acid. Whereas, the tallest plants of the first cut of second season (62.00 cm) was obtained with plants received Actosol at 2ml /L. In the second cut of both first and second seasons, the highest values (32.56 and 36.89 cm, respectively) were produced plants fertilized with received ascorbic acid at rate of 100 ppm.

The interaction between cattle manures and biostimulants was significant as it increased the plant height of in both seasons. The tallest plants (53.67and 64.67cm) were obtained with cattle manure at rate of 30 m^3/fed plus Actosol at 2ml /L in the first cut of the first and second seasons, respectively. The corresponding values in the second cut were (37.00 and 38.00 cm) results from cattle manure at 30 m3/fed and ascorbic acid at 100ppm. Similar results were obtained by El-Sayed *et al.* (2015) on *Ocimum sp* who showed that using chicken manure at 10 m^3 /feddan and humic acid at 125 ppm increased plant height.

Number of branches/plant

Data in Table (2) indicated that in the first season cattle manure treatments increased number of branches/ plant and the highest values were obtained with cattle manures at rate of 30 m^3/fed (12.52 and 14.86 branches/plant in the first and second cuts, respectively).A similar trend was recorded in the two cuts of the second season giving 12.62 and 18.24 branches/plant. Priya and Elakkiya (2012) on *Eclipta alba*, indicated that the application of a poultry manure as an organic fertilization gave the number of branches per plant.

Table 2: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on number of branches of Artemisia (*Artemisia abrotanum* L.) plants at 2014 and 2015 seasons.

Biostimulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed(A)				Cattle manure m^3/fed(A)			
	15	30	45	Mean	15	30	45	Mean
Control	7.67	10.33	9.67	9.22	10.00	13.00	11.00	11.33
Active dry yeast 2g /L	9.67	12.67	12.33	11.56	11.00	15.67	12.67	13.11
Active dry yeast 4 g L	9.00	12.33	12.00	11.11	11.00	15.67	13.00	13.22
Ascorbic acid 100 ppm	9.67	14.33	12.67	12.22	12.00	17.67	15.33	15.00
Ascorbic acid 200 ppm	8.67	12.33	12.00	11.00	10.67	14.33	14.33	13.11
Actosol 1ml/L	9.00	13.00	12.67	11.56	11.00	13.67	12.67	12.45
Actosol 2 ml/L	9.67	12.67	12.33	11.56	12.00	14.00	12.67	12.89
Mean	9.05	12.52	11.95		11.10	14.86	13.10	
LSD for:	5%	1%			5%	1%		
Cattle (A)	1.33	2.54			1.71	2.19		
Biostimulants (B)	0.5	1.67			1.97	2.30		
A*B	1.72	2.04			2.39	3.01		
	Second Season 2015							
Control	9.00	9.00	10.67	9.56	13.00	14.67	14.00	13.89
Active dry yeast 2g/L	9.67	12.67	12.00	11.45	15.33	19.67	14.33	16.44
Active dry yeast 4g/L	9.00	14.00	13.00	12.00	14.67	19.67	15.67	16.67
Ascorbic acid 100ppm	10.67	14.67	13.67	13.00	18.33	18.67	15.00	17.33
Ascorbic acid 200ppm	10.67	13.33	13.00	12.33	15.67	18.33	14.67	16.22
Actosol 1ml L	9.71	12.67	12.33	11.57	16.00	21.67	13.67	17.11
Actosol 2ml L	10.00	12.00	12.00	11.33	16.33	15.00	14.00	15.11
Mean	9.82	12.62	12.38		15.62	18.24	14.48	
LSD for:	5%	1%			5%	1%		
Cattle (A)	1.50	1.83			1.95	2.57		
Biostmulants (B)	1.58	1.77			1.84	2.13		
A*B	1.83	2.20			2.22	2.75		

Regarding using biostimulants treating plants with ascorbic acid at 100 ppm significant in increased the number of branches per plant (12.22 and 15.00 branches per plant) in first and second cuts in the first season. A similar trend was recorded in the second season, (13.00 and 17.33 branches/plant) in the first, and second cut, respectively.

Regarding the interaction between cattle manure and biostimulants, the data indicated that cattle manures 30m^3/fed combined with ascorbic acid at 100 ppm gave the highest (14.33 and 17.67) number of branches/plant in the first and second cuts of first season, respectively. on borage plant , Attia and Moftah (2002) found that foliar application of ascorbic at 300 ppm enhanced growth of plants in comparison with check plants. Also, the results in Table (2) show that in the second season, the data followed the same manner as in the in first cut. Whereas, the treatment of CM at 30 m^3/fed plus Actosol 1ml. (with value of 21.67 branches/plant). Was the most effective in the second cut. El-Sayed *et al.* (2015) on *Ocimum sp* showed that using chicken manure at 10 m^3 /feddan and humic acid at 125 ppm increased number of branches.

Herb Fresh weight /plant (g)

Data in Table (3) shows that in the two seasons, different rates of cattle manure increased significantly the herb fresh weight of artemisia plant especially the medium rate (30m^3/fed) recording 34.04 and 92.14 g/plant fresh weigh in the first and second cuts of first season, respectively.

Table 3: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the herb fresh weight/plant (g) of Artemisia (*Artemisia abrotanum* L.) plants at 2014 and 2015 seasons.

Biostmulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed.(A)				Cattle manure m^3/fed.(A)			
	15	30	45	Mean	15	30	45	Mean
Control	22.40	29.40	26.00	25.93	53.83	69.17	66.70	63.23
Active dry yeast 2g/L	24.17	32.17	27.17	27.84	71.83	76.17	81.83	76.61
Active dry yeast 4g/L	22.33	35.33	26.83	28.16	71.17	87.17	89.47	82.60
Ascorbic acid 100ppm	26.50	39.70	31.87	32.69	63.67	114.83	109.67	96.06
Ascorbic acid 200ppm	27.17	36.67	27.53	30.46	69.33	97.50	97.33	88.05
Actosol 1ml/L	26.83	32.20	25.77	28.27	72.83	94.33	89.67	85.61
Actosol 2 ml/L	29.00	32.83	28.00	29.94	72.83	105.83	101.50	93.39
Mean	25.49	34.04	27.60		67.93	92.14	90.88	
LSD for:	5%	1%			5%	1%		
Cattle (A)	2.07	3.44			4.50	7.40		
Biostmulants (B)	1.53	2.05			4.24	5.69		
A*B	2.20	3.17			6.12	8.82		
	Second Season 2015							
Control	25.67	35.67	30.50	30.61	59.33	78.67	63.00	67.00
Active dry yeast 2g/ L	28.67	30.00	32.00	30.22	71.83	95.00	91.33	86.05
Active dry yeast 4g /L	28.67	33.67	33.83	32.06	69.67	92.83	89.47	83.99
Ascorbic acid 100ppm	30.00	44.50	34.83	36.44	74.83	119.00	103.67	99.17
Ascorbic acid 200ppm	29.33	35.50	34.83	33.22	66.50	98.17	91.17	85.28
Actosol 1ml/L	27.33	32.40	31.00	30.24	69.00	112.50	89.67	90.39
Actosol 2 ml/L	32.83	35.00	32.67	33.50	74.33	112.17	99.50	95.33
Mean	28.93	35.25	32.81		69.36	101.19	89.69	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	1.52	2.52			3.12	5.18		
Biostmulants (B)	1.53	2.05			2.26	3.03		
A*B	2.20	3.17			3.26	4.70		

A similar trend was obtained in the second one. The heaviest fresh weight of plant was produced as a result of 30 m^3/fed. cattle manure treatment with mean values of 35.25 and 101.19 g/plant fresh weight /plant, in the first and second cuts in the second season ,respectively. The generally superior effect of organic manures on vegetative growth may be attributed to their effects on the soil, such as improving some of its chemical and physiochemical properties, improving water use

efficiency (Wallace, 1994 a).These results were in agreement with those obtained by Yeboah *et al.* (2012) on *Artemisia annua L.*, they found that 4 t/ha poultry manure treatment was effective and gave the highest fresh and dry leaf yield.

Regarding using biostimulants of ascorbic acid at 100 ppm had a significant effect on the fresh weight / plant (32.69 and 96.06 g /plant) in the first and second cuts in the first season, respectively. The best results in the second season, was obtained with ascorbic acid at 100 ppm (36.44 and 99.17 g /plant) in the first and second cuts, respectively). Shaddad *et al.* (1990) assumed that the effect of asc. on plant growth may be due to the substantial role of asc. in many metabolic and physiological processes. Youssef *et al.* (2005) found that ascorbic acid had a significant effect on increasing *Matricaria chamomilla* plant growth parameters.

The interaction between cattle manures and biostimulants, significantly increased herb fresh weight in both seasons. the best results were obtained with Cattle manures at 30 m^3/fed. and spraying plants with either Ascorbic acid 100 ppm (39.70, 114.83, 44.50 and 119.00g. in the first and second cuts in the first and second season respectively) These results were in agreement with those obtained by Abd El-Naeem (2008) on caraway, concluded that the interaction treatment FYM (45 m^3/fed.) with ascorbic acid plus salicylic acid (each at 150 ppm) significantly increased number of umbels fruit yield and the weight of 1000 fruits compared to control treatment.

Dry weight (g) per plant

The data in Table (4) show the effect of cattle manures on plant dry weight of herb, in both seasons. Cattle manures at 30 m^3/fed gave the heaviest dry weight of herb per plant (12.15 and 12.08 g /plant in first cuts, in both seasons, respectively).

Also, in the second cut of both seasons plants treated with CM at 30 m^3/fed. gave the highest dry weight of herb, giving 42.16 and 46.24 g /plant dry weight /plant in the first and second seasons, respectively. Similar results were reported by Shirkhodaei *et al.* (2014) on coriander (*Coriandrum sativum* L.) ,they showed that the highest fresh weight of plant, dry weight of plant and biomass yield were obtained after applying 9 ton/ha vermicompost. Biostimulant also showed significant effects on biomass yield.

Using biostimulants ascorbic acid at 100 ppm significantly increased the herb dry weight giving 11.35, 44.12, 12.59 and 44.37 g/plant, in the first and second cuts of the first and second seasons, respectively). Similar results were obtained by El-Hifny and El-Sayed (2011) on sweet pepper, they obtained that maximum fresh and dry weights of plant with ascorbic acid at 400 ppm .

Interaction between cattle manures and biostimulants significantly increased herb dry weight per plant in the first and second cuts of the first season, respectively), the best results were obtained with cattle manures at 30 m3/fed. Plus fertilization with Ascorbic acid at 100 ppm (13.90, 54.55, 15.57 and 56.53 g/ plant in the first and second cut of the first and second seasons, respectively).

Essential oil percentage in fresh herb

The data in Table (5) show the effect of cattle manures on the essential oil percentage in fresh herb, in both seasons. The best results were obtained from cattle manures at 30 m^3/ fed. gave the highest oil percentage in fresh herb with mean values (0.41 and 0.42 %, in the first and second cuts, respectively). In the second season, there was no significant difference between CM at 30 m^3/fed. and CM at 45 m^3/fed. with value (0.38%) compared to with mean values (0.26% for the first cut) from plants fertilized with cattle manures at 15 m^3/fed in the first cut while the second cut the highest mean values (0.38%) was obtained from cattle manures at 30 m^3/ fed. Applying organic manure not only relieved material inhibition an autotoxic substance in the root exudates by cinnamic acid but also promoted growth, increased the content and composition of plant secondary metabolites (essential oils or alkaloids), improved root dehydrogenase, ATP ase and microorganism activities and nutrients uptake (Lu *et al.* 2002 ; Reuveni *et al.* 2002 and Zheljazkov, 2005).

Concerning the biostimulants, data showed that ascorbic acid 100ppm significantly increased essential oil%. Recording amean of (0.41 and 0.44 % in the first and second cuts of the first season, respectively). A similar trend was detected in the second season, as plants treated with ascorbic acid at 100 ppm give the highest mean values of (0.39 and 0.41% in the first and second cuts , respectively)

These result was in agreement with those obtained Eid *et al.* (2011) on Marigold (*Tagetes erecta*) plants which proved that ascorbic acid at 200 ppm increased oil % and oil components compared with control treatment **.**

Interaction between cattle manures and biostimulants revealed that cattle manures at 30 m^3/fed. plus ascorbic acid at 100 had significant effect on the oil percentage in first season. Were obtained form (0.46 and 0.48% in the first and second cuts of the first seasons respectively) similar trend was detected in the second season, the best results was obtained in the two cuts with cattle manures at 30 m^3/fed. plus ascorbic acid at 100 Recording of (0.46 and 0.45% in the first and second cuts of the second ,season respectively)

Table 4: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the herb dry weight/plant (g) of Artemisia (*Artemisia abrotanum* L.) plants at 2014 and 2015 seasons.

Biostmulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed.(A)				Cattle manure m^3/fed.(A)			
	15	30	45	Mean	15	30	45	Mean
Control	6.72	10.29	7.80	8.27	24.23	31.13	26.68	27.35
Active dry yeast 2g /L	7.25	12.87	8.15	9.42	25.43	34.28	32.73	30.81
Active dry yeast4 g /L	7.82	12.37	9.12	9.77	28.73	41.41	38.03	36.06
Ascorbic acid 100ppm	10.60	13.90	9.56	11.35	28.47	54.55	49.35	44.12
Ascorbic acid 200ppm	10.87	12.83	8.26	10.65	25.47	46.32	38.93	36.91
Actosol 1ml/L	8.05	11.27	7.73	9.02	31.20	42.45	38.11	37.25
Actosol 2 ml/L	13.05	11.49	8.40	10.98	34.60	44.98	41.40	40.33
Mean	9.19	12.15	8.43		28.30	42.16	37.89	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	0.938	1.557			3.04	5.046		
Biostimulants (B)	0.875	1.175			2.54	3.410		
A*B	1.262	1.820			3.657	5.275		
	Second Season 2015							
Control	7.70	10.5	9.60	9.93	26.70	35.40	25.20	29.10
Active dry yeast 2g L	8.60	12.25	9.15	9.92	30.53	42.75	36.53	36.60
Active dry yeast 4g /L	10.50	11.78	11.50	11.26	27.87	44.10	38.03	36.67
Ascorbic acid 100ppm	11.73	15.57	10.45	12.59	29.93	56.53	46.65	44.37
Ascorbic acid 200ppm	10.93	12.42	10.45	11.27	26.60	46.63	36.47	36.57
Actosol 1ml/L	9.75	11.34	9.30	10.13	31.05	50.63	38.11	39.93
Actosol 2 ml/L	14.78	12.48	9.80	11.17	35.31	47.67	40.66	41.21
Mean	10.57	12.08	10.04		29.71	46.24	37.38	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	0.40	0.66			0.98	1.62		
Biostimulants (B)	1.16	1.56			2.11	2.83		
A*B	1.68	2.42			3.04	4.38		

Table 5: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the essential oil percentage (%) in fresh herb of Artemisia (*Artemisia abrotanum* L.) plants in the 2014 and 2015 seasons.

Biostimulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed.(A)				Cattle manure (m^3/fed. (A)			
	15	30	45	Mean	15	30	45	Mean
Control	0.22	0.36	0.23	0.27	0.24	0.38	0.36	0.33
Active dry yeast 2g /L	0.24	0.40	0.36	0.33	0.24	0.35	0.38	0.32
Active dry yeast 4g /L	0.22	0.40	0.37	0.33	0.28	0.37	0.44	0.36
Ascorbic acid 100ppm	0.36	0.46	0.42	0.41	0.40	0.48	0.44	0.44
Ascorbic acid 200ppm	0.32	0.42	0.40	0.38	0.40	0.46	0.40	0.42
Actosol 1ml/L	0.36	0.42	0.40	0.39	0.42	0.47	0.38	0.42
Actosol 2ml/L	0.24	0.40	0.40	0.35	0.40	0.44	0.38	0.41
Mean	0.28	0.41	0.37		0.34	0.42	0.40	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	0.03	0.04			0.01	0.01		
Biostimulants (B)	0.03	0.04			0.02	0.03		
A*B	0.04	0.05			0.03	0.05		
	Second Season 2015							
Control	0.23	0.26	0.27	0.25	0.31	0.36	0.29	0.32
Active dry yeast 2g /L	0.27	0.30	0.38	0.32	0.33	0.37	0.32	0.34
Active dry yeast 4g /L	0.28	0.38	0.43	0.36	0.33	0.33	0.32	0.33
Ascorbic acid 100ppm	0.30	0.46	0.42	0.39	0.39	0.45	0.40	0.41
Ascorbic acid 200ppm	0.24	0.42	0.40	0.35	0.37	0.45	0.32	0.38
Actosol 1ml/L	0.25	0.42	0.38	0.35	0.34	0.37	0.31	0.34
Actosol 2 ml/L	0.25	0.40	0.38	0.34	0.37	0.35	0.30	0.34
Mean	0.26	0.38	0.38		0.35	0.38	0.32	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	0.02	0.04			0.01	0.02		
Biostimulants (B)	0.02	0.03			0.01	0.02		
A*B	0.03	0.04			0.02	0.03		

Essential oil yield/plant (ml)

Data in Table (6) indicated that, in both seasons cattle manures treatments increased oil yield/ plant, in both seasons .using the medum rates of cattle manures at 30 m^3/fed. Significantly increased oil yield/ plant, (0.14 and 0.39 in the first and second cuts, respectively) whears in the second season in the first cut there was no significant difference between CM at 30 m^3/fed. and CM at 45 m^3/fed. with value (0.13%).On the other hand, the second cut gave the highest mean values (0.39%) with cattle manures at 30 m^3/ fed.

Concerning biostimulants treatment, Ascorbic acid at 100 ppm, the data showed that it significantly increased oil yield/ plant in both two cuts of the two seasons. (0.14, 0.44, 0.15 and 0.39 ml/plant in first and second cuts of the first and second seasons, respectively). Ibrahim (2010) on *Pelargonium graveolens* plants concluded that essential oil % and yield / plant / cut, as well as, essential oil yield / plant / season and / fed. were considerably increased due to all rates of ascorbic acid (100, 200 and 300 ppm). The treatment of ascorbic acid at 300 ppm resulted in the highest yield of essential oil / plant or fed.

The Interaction between cattle manures and biostimulants indicated that cattle manures at 30 m^3/fed. plus ascorbic acid at 100 ppm significantly oil yield/ plant in both seasons were obtained form (0.18% and 0.55 ml/plant in the first and second cuts, respectively) A similar trend was

detected in the second season, the data followed in first and second cuts of oil yield/ plant the highest (0.20 and 0.54 ml/plant) in first and second cuts respectively)were of Cattle manures at 30 m^3/fed. plus ascorbic acid at 100 ppm.

Table 6: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the essential oil yield/plant (ml) of Artemisia (*Artemisia abrotanum* L.) plants at 2014 and 2015 seasons.

Biostimulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed.(A)				Cattle manure m^3/fed.(A)			
	15	30	45	Mean	15	30	45	Mean
Control	0.05	0.11	0.06	0.07	0.13	0.26	0.24	0.21
Active dry yeast 2g /L	0.06	0.13	0.10	0.10	0.14	0.26	0.31	0.24
Active dry yeast 4g /L	0.05	0.14	0.10	0.10	0.20	0.32	0.39	0.31
Ascorbic acid 100ppm	0.10	0.18	0.14	0.14	0.29	0.55	0.48	0.44
Ascorbic acid 200ppm	0.09	0.16	0.11	0.12	0.25	0.45	0.39	0.36
Actosol 1ml/L	0.10	0.14	0.10	0.11	0.29	0.44	0.34	0.36
Actosol 2 ml/L	0.07	0.13	0.08	0.09	0.29	0.47	0.38	0.38
Mean	0.07	0.14	0.10		0.23	0.39	0.36	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	0.01	0.02			0.02	0.04		
Biostimulants (B)	0.01	0.02			0.02	0.03		
A*B	0.02	0.03			0.03	0.05		
	Second Season 2015							
Control	0.06	0.08	0.09	0.07	0.19	0.28	0.18	0.22
Active dry yeast 2 g/L	0.08	0.11	0.12	0.10	0.23	0.35	0.29	0.29
Active dry yeast 4 g /L	0.09	0.13	0.15	0.12	0.23	0.31	0.29	0.27
Ascorbic acid 100 ppm	0.09	0.20	0.15	0.15	0.29	0.54	0.35	0.39
Ascorbic acid 200 ppm	0.07	0.15	0.14	0.12	0.24	0.44	0.29	0.33
Actosol 1ml/L	0.08	0.14	0.12	0.11	0.24	0.42	0.28	0.31
Actosol 2 ml/L	0.08	0.14	0.12	0.12	0.28	0.39	0.30	0.32
Mean	0.08	0.13	0.13		0.24	0.39	0.28	
LSD for:	5 %	1%			5 %	1%		
Cattle (A)	0.01	0.02			0.03	0.05		
Biostimulants (B)	0.01	0.02			0.02	0.03		
A*B	0.01	0.02			0.03	0.04		

Essential oil yield/feddan (liter)

The oil yield of fresh herb/ fed. is shown in Table (7), the best results were obtained with cattle manure at 30 m^3/fed. (3.50 and 9.87 liter/ fed in the first and second cuts of the first season, respectively) In the second season, the data followed the same trend giving the highest mean values (3.36 and 9.74 liter/ fed. in the first and second cuts respectively, with 30 m^3/fed. CM.

Concerning biostimulants treatments, ascorbic acid at ppm significantly increased oil yield/ plant in both two cuts of the two seasons, (3.43 and 11.02 liter/ fed.) in first and second cuts, respectively. A similar trend was detected in the second season the best results were obtained with ascorbic acid at 100 ppm recording 3.66 and 10.35 liter/ fed in first and second cuts, respectively. Similar results were obtained by Youssef *et al.* (2005) proved that spraying plants with ascorbic acid at 100 and 200 mg l. increased significantly oil %, while decreased chamazulene of *Matricaria chamomilla* plants. Eid *et al.* (2011) on Marigold (*Tagetes erecta*) plants proved that ascorbic acid at 200 ppm increased oil % and oil components compared with control treatment.

Interaction between cattle manures and biostimulants significantly increased the oil yield/ fed. in both seasons the best results were obtained with cattle manures at 30 m^3/fed. plus ascorbic acid at 100 ppm recording (4.57 and 13.87 liter/ fed. in the first and second cuts, respectively) similar trend was detected in the second season, the best results was obtained in the two cuts with Cattle manures at 30 m^3/fed. plus ascorbic acid at 100 Recording (5.12 and 13.39 liter/ fed) in the first and second cuts, respectively.

Table 7: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the essential oil yield/feddan (litres) of Artemisia (*Artemisia abrotanum* L.) plants at 2014 and 2015 seasons.

Biostimulants (B)	Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed. (A)				Cattle manure m^3/fed. (A)			
	15	30	45	Mean	15	30	45	Mean
Control	1.24	2.65	1.50	1.79	3.23	6.57	6.01	5.27
Active dry yeast 2g L	1.45	3.22	2.45	2.37	3.59	6.66	7.78	6.01
Active dry yeast 4g /L	1.23	3.53	2.48	2.42	5.03	8.06	9.84	7.64
Ascorbic acid 100 ppm	2.39	4.57	3.35	3.43	7.12	13.87	12.06	11.02
Ascorbic acid 200 ppm	2.17	3.85	2.75	2.93	6.37	11.22	9.73	9.11
Actosol 1ml/L	2.42	3.38	2.58	2.79	7.28	11.08	8.52	8.96
Actosol 2 ml/L	1.74	3.28	2.10	2.37	7.28	11.64	9.64	9.52
Mean	1.80	3.50	2.46		5.70	9.87	9.08	
LSD for:	5 %	1%			5 %	1%		
Cattle(A)	0.25	0.41			0.58	0.97		
Biostimulants (B)	0.21	0.29			0.56	0.75		
A*B	0.35	0.50			0.80	1.16		
	Season 2015							
Control	1.48	1.95	2.16	1.86	4.60	7.08	4.57	5.42
Active dry yeast 2g /L	1.93	2.62	2.90	2.49	5.93	8.79	7.31	7.34
Active dry yeast 4g /L	2.10	3.20	3.64	2.98	5.75	7.66	7.16	6.85
Ascorbic acid 100ppm	2.20	5.12	3.66	3.66	7.30	13.39	10.37	10.35
Ascorbic acid 200ppm	1.64	3.73	3.48	2.95	6.15	11.05	7.29	8.16
Actosol 1ml/L	2.03	3.40	2.95	2.79	5.87	10.41	6.95	7.74
Actosol 2 ml/L	2.05	3.50	3.11	2.89	6.88	9.81	7.47	8.05
Mean	1.92	3.36	3.13		6.07	9.74	7.30	
LSD for:	5 %	1%			5 %	1%		
Cattle(A)	0.28	0.47			0.48	0.79		
Biostimulants (B)	0.22	0.30			0.35	0.47		
A*B	0.32	0.46			0.51	0.73		

Total carbohydrates content% in the dry herb:-

Data in Table (8) indicated that cattle manures doses increased the total carbohydrates content in herb. The highest contents were obtained with cattle manures at 30 m^3/fed. (22.06, 24.56, 23.75 and 25.17 % in the first and second cuts of the first and second seasons, respectively).

The application of biostimulants treatments had a significant effect on the total carbohydrates (%) in dry herb in both seasons. The best results were obtained with ascorbic acid at 100 ppm recording (23.48 and 24.82% in the first cut of the first and second seasons, respectively). Whereas the second cut the best results were obtained with Actosol 2 ml recording (24.87% in the second cut of the first season) on the other hand in the second season the best results was obtaind with ascorbic acid at 100 ppm recording(25.57). Similar results were obtained by Smironoff (1996) stated that

ascorbate has a central role in photosynthesis ,as the high concentration in chloroplasts would imply. Mazher *et al.* (2011) who studied the effect of ascorbic acid at 100 and 200 ppm on growth and chemical constituents of *Codiaeum variegatum* L.and they showed that increasing the concentration of these foliar applications gradually increased the total carbohydrates percentages.

Interaction between cattle manures and biostimulants had significant effect on the total carbohydrates contents the maximum value of (23.66 %, in the first cut) was obtained by using cattle manures at 30 m^3/fed. plus ascorbic acid at 100ppm. whears the second cut gave the heights value25.92 %was obtained by using cattle manures at 30 m^3/fed. plus actosol at 2 ml/L).In the second season cattle manures at 15 m^3/fed plus active dry yeast 4g gave the highest total carbohydrates content%25.27 % in the first cut, whereas the second cut gave value26.30% was obtained by using cattle manures at 30 m^3/fed. plus ascorbic acid 100ppm.

Table 8: Effect of cattle manure (CM), active dry yeast, ascorbic acid and Actosol on the total carbohydrates content (% of dry matter) in the herb of Artemisia (*Artemisia abrotanum* L) plants in the 2014 and 2015 seasons**.**

Biostimulants (B)	First Season 2014							
	First cut				Second cut			
	Cattle manure m^3/fed.(A)				Cattle manure m^3/fed.(A)			
	15	30	45	Mean	15	30	45	Mean
Control	19.21	20.47	19.33	19.84	21.76	22.92	21.66	22.11
Active dry yeast 2g /L	23.22	21.56	20.85	21.88	22.59	24.87	24.41	23.96
Active dry yeast 4g /L	19.87	22.82	21.58	21.42	23.11	24.31	22.84	23.42
Ascorbic acid 100ppm	23.65	23.66	23.12	23.48	23.34	25.79	23.39	24.17
Ascorbic acid 200ppm	21.48	20.80	21.46	21.25	23.11	24.29	22.59	23.33
Actosol 1ml/ L	22.29	21.98	20.85	21.71	24.41	23.82	23.06	23.76
Actosol 2 ml/L	20.62	23.12	22.92	22.22	23.37	25.92	25.32	24.87
Mean	21.48	22.06	21.44		23.10	24.56	23.32	
LSD for:	5 %	1%			5 %	1%		
Cattle(A)	0.57	ns			0.65	1.08		
Biostimulants (B)	0.71	0.96			0.68	0.91		
A*B	1.03	1.48			0.98	1.42		
	Second Season 2015							
Control	18.89	22.11	21.81	20.94	22.54	24.16	23.84	23.51
Active dry yeast 2g /L	23.27	24.69	22.56	23.51	24.60	24.89	24.76	24.75
Active dry yeast 4g /L	25.27	24.03	22.36	23.89	24.04	24.94	24.51	24.50
Ascorbic acid 100ppm	25.07	25.17	24.21	24.82	25.06	26.30	25.34	25.57
Ascorbic acid 200ppm	24.41	23.07	22.34	23.27	25.42	26.22	24.36	25.33
Actosol 1ml/ L	21.53	24.72	24.06	23.44	25.09	25.59	24.81	25.16
Actosol 2 ml/L	23.68	22.44	22.62	22.91	23.11	24.07	25.42	24.20
Mean	23.16	23.75	22.85		24.27	25.17	24.72	
LSD for:	5 %	1%			5 %	1%		
Cattle(A)	0.56	0.93			0.97	1.61		
Biostimulants (B)	0.86	1.16			0.51	0.67		
A*B	1.29	1.87			0.74	1.06		

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