RESPONSE OF *ADHATODA VASICA* L.GROWN IN DIFFERENT SOILS TO SOME FERTILIZATION TREATMENTS

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ABSTRACT

Pots experiment was carried out at Farm of Fac. Agric. Kafrelsheikh Univ. during 2013 and 2014 seasons to study the effect of soil type (clayey and clay+ sand (2:1v/v), some fertilization treatments (T1- control (NPK full dose), T2- 75%NPK dose +5%FYM(from soil dry weight in pot), T3- 50%NPK dose +10%FYM, T4- 25%NPK dose + 5%FYM+2g/l active dry yeast (ADY) +200ppm ascorbic acid (AA), T5- 5%FYM+ 2g/l ADY+300ppm salicylic acid (SA),T6- 5%FYM+ 2g/l ADY+300ppm AA, T7- 2g/l ADY+300ppm of each SA or AA, T8- 10%FYM+2g/l ADY, T9- 10%FYM+200ppm of each SA or AA and T10- 10%FYM+1g/l ADY+200ppm of each SA or AA) and their interaction on the vegetative growth and chemical composition of *Adhatoda vasica..*The obtained data can be summarized as follows: Effect of soil type 1- The planting in clayey soil resulted in higher values of plant height, number of shoots/plant, main stem diameter, plant leaf area and fresh and dry weights of aerial parts and roots/ plant in the two seasons, except for the pant height in the first season, and the differences between clayey and clay +sand (2:1)did not reach the significant level in case of shoot number, main steam diameter and plant leaf area in the first season also , in case of plant height in the second season. 2- The planting in clay +sand (2:1) gave higher significant values of leaf green color degree in the first season and total carbohydrates in the both seasons .While the plants cultured in clayey soil had higher values of N,P, and K% in the two seasons and the difference between the two used soils did not reach the significant level in case of N and P% in the second season only. For the effect of fertilization treatments: 1-Higher significant values of plant height resulted from T8 in the first season and T9 in the second one, shoots number/plant were recorded for T2 in the first season and T1,T2,T3and T9in the second season, main stem diameter resulted from T4 in the first season and T3in the second one, higher plant leaf area was recorded for T3 in the first season and T2 and T3 in the second one and the fresh and dry weights of aerial parts and roots resulted from applying T3in the two seasons. 2- The fertilization with T1in the first season and T2 in the second one resulted in higher values of leaf green color degree and applying T3 caused significant increases in total carbohydrates, N, P and K% in the both seasons. Concerning interaction between soil type and fertilization treatments, data showed that the planting in either clayey soil or clay +sand (2:1) soil and fertilization with treatments contain NPK at different percentages combined by

FYM at different levels caused significant increases in the most growth and chemical parameters investigated in the both seasons.

INTRODUCTION

Shrubs are a key foundation planting for many gardens. They offer structure and organizing plants; many also supply year-sound color, as well as food and shelter for wildlife. *Adhatoda vasica* L. is a evergreen plant of the Acanthaceae family. It is a large shrub grows crowded along wasle land, roadsides etc. It grows on plains of India and in the lower Himalayans, up to a range of 1000 meters above sea level, it grows well in low moisture areas and dry soils, leaves are simple (10 to 16 cm in length and 5 cm wide) , opposite, ovate-lanceolate, acute and shiny. It flowers during all year. The flower has large, attractive, white petals, streaked with purple on the lower lip. The fruit is a small capsule with four seeds hey have a smell similar to strong tea. It is used for a multitude of disorders and it is known for its antispasmodic, expectorant and blood-purifying qualities **(Pandita *et al*., 1983).**

Many factors affecting plant growth and quality such as potting media which play a major role in quality and production of ornamental plants. Choosing the most suitable growing media for the achievement of a successful plant production is very important in potted growth **(Aklibasinda *et al*., 2011).** Three functions of growing media are to support plant in soil to hold and provide water and nutrient elements and to enable plant roots to get sufficient amount of oxygen **(Ingram *et al.,* 2003).**The medium physical properties can also have a profound effect on supply of water and air to the growing plant **(Baiyeri, 2005).**

Nutritional requirements are one of the most important factors affecting growth and development of ornamental plants. N, P and K are essential to many physiological and biochemical processes in plant tissues such as photosynses , proteins , carbohydrate ,ADP ,ATP and phospholipids production as well as water balance **(Devlin,1975)** . Also ,FYM is an organic matter that has been decomposted and recycled as a fertilizer and soil amendment, it is a simple way to add nutrient-rich humus which fuels plant growth and restores vitality to depleted soil ,it also free, easy to make and good for the environment **(El-Nagar, 1996)**. Application of active dry yeast was beneficial in improving growth and chemical constituents of various crops **(Wang,1996).** They attributed that to its content from different nutrients, higher percentage of proteins, larger amount of vitamin B group content ,thiamine, riboflavin, pyridoxine and the natural plant growth hormones namely cytockinins **(Hegab *et al*.,1997)**. Salicylic acid is a phenolic compound of hormonal nature produced by plants and plays an important role in responses to several abiotic stresses and to pathogen attack **(Noreen**

***et al*., 2009)** and affect various physiological processes related to growth and development of plants under normal conditions **(Hegazi and El-Shrayi, 2007).** Also, ascorbic acid can be a regulator on cell division and differentiation and has an important role in a wide range of functions such as antioxidant defense, regulation of photosynthesis and growth **(Blokhina *et al*. 2003)**. Keeping in view the decorative and aesthetic value of *Adhatoda vasica* ,this work was undertaken to determine the effect of various combination of NPK, FYM, active dry yeast and salicylic and ascorbic acids on the growth and chemical composition of *Adhatoda vasica* grown in variable media (clay and clay + sand 2:1v/v)to find out the best fertilization treatment and appropriate growing medium to achieve the best growth ,as well as reducing the extensive use of chemical fertilizers by application of used natural materials to minimize the environmental pollution.

MATERIAL AND METHODS

Pots experiment was carried out at the Experimental Farm, Fac. Agric, Kafrelsheikh Univ. during two successive seasons (2013 and 2014) to study the effect of various combinations of fertilizer treatments (NPK, FYM , foliar application of active dry yeast and salicylic and ascorbic acids) on the growth and chemical composition of *Adhatoda vasica* L. grown in clayey and clay+ sand 2:1v/v soils. Six month old transplants of *Adhatoda vasica* L. were obtained from private nursery at Kafrelsheik governorate (40-42cm height) were planted on 21th March in each season as one transplant/pot 30cm diameter were filled with seven kg of clayey or clay +sand(2:1v/v)soils which their physical and chemical properties are shown in Table (1) according to **Jakson(1973).**

Table (1): Physical and chemical analysis of the experimental soil at the beginning of the experiment, (average of two seasons)

Soil type	Clay	Sand
Mechanical analysis		
Clay (%)	**60.00**	**2.60**
Silt (%)	**37.80**	**0.00**
Sand (%)	**2.20**	**97.40**
Soil texture	**Clayey**	**Sandy**
Chemical analysis		
pH	**8.44**	**7.70**
E.C. (dS/m)	**0.79**	**0.58**
Available nutrients (ppm)		
N	**224**	**2.75**
P	**1.13**	**0.16**
K	**380.40**	**58.00**
Soluble anions (meq/l)		
HCO_3^-	**2.23**	**2.66**
Cl^-	**4.00**	**1.31**
SO_4^{-2}	**1.57**	**1.78**
CO_3^{-2}	**0.00**	**0.00**
Soluble cations (meq/l)		
Ca^{+2}	**1.24**	**3.20**
Mg^{+2}	**1.76**	**1.15**
Na^+	**4.00**	**1.30**
K^+	**0.80**	**0.10**

Fertilizer types:

1-FYM was added as one dose before planting at 5 and 10% from soil dry weight per pot. The analysis of FYM used is shown in Table (2) according to laboratory of soil chemical and physical Res. Dept., Sakha Agric. Res. Station.

Table (2): FYM analysis report

Test	Result	Test	Result
Weight of full dried cubic meter	600 kg/m^3	Available potassium (ppm)	7440
Moisture percentages (%)	9.88	Calcium (%)	1.50
pH	8.58	Magnesium (%)	3.74
EC (dS/m)	7.60	Iron (ppm)	158.1
Water Holding Capacity	340	Manganese (ppm)	519.9
Available nitrogen (ppm)	2400	Cupper (ppm)	1.00
Organic matter (%)	30.59	Zinc (ppm)	28.0
Organic carbon (%)	17.75	Boron (ppm)	0.00
Ash (%)	35	Nematode	Non
C/N ratio	13:1	Herb seeds	Non
Available phosphorus (ppm)	390	Parasites	Non

Cations (meq./L)				Aations (meq./L)			
Ca	Mg	Na	K	CO3	HCO3	CL	SO4
15.00	6.44	53.06	1.50	-	18.75	42.24	15.01

2- Ammonium sulphate (20.5% N) at 12g/plant, calcium superphosphate (15.5% P_2O_5) at 6g/plant and potassium sulphate (48% K_2O) at 6g/plant as a full dose. Calcium superphosphate was applied at one dose before planting, while ammonium sulphate and potassium sulphate were divided into six equal doses. The first dose was added after 30 days from planting, and the other doses were added after the first one at 1 month interval.
3- Active dry yeast (ADY) was sprayed at 1and 2g/l after 15 ,45 and 75days from transplanting.
4- Salicylic (SA) was sprayed at 200 and 300 ppm after 20,50 and 80 days from transplanting .Ascorbic acids (AA):at200 and 300 ppm was sprayed after 25,55 and 85 days from transplanting.
The treatments were conducted as follows: 1- Control (NPK recommended dose), 2- 75% NPK + 5% FYM, 3- 50% NPK + 10% FYM, 4- 25% NPK + 5% FYM + 2g /l ADY + 200 ppm AA, 5- 5% FYM + 2g/l ADY + 300 ppm SA, 6- 5% FYM + 2g/l ADY + 300 ppm AA, 7- 2g/l ADY + 300 ppm SA + 300 ppm AA,8- 10% FYM + 2g /l ADY, 9- 10% FYM + 200 ppm SA + 200 ppm AA, 10- 10 % FYM + 1g/l ADY + 200 ppm SA + 200 ppm AA.

The experimental layout was designed to provide a split randomized block design, the soil types were arranged as main plots and fertilization treatments were arranged as sub plots. The experiment contained three replicates, each replicate had 20 treatments for each kind of plants (10 fertilization treatments x2 soil types) using 6 plants of each kind of plants in each treatment **(Snedecor and Cochran, 1974).**All agricultural practices such as irrigation, controlling weeds, pestsides, etc. were done when it's needed.

Data recorded on Nov. 1st of each season were:1- Vegetative growth characters(plant height (cm), branches number/plant, main stem diameter (cm) (5 cm above soil surface),plant leaf area(cm^2) and fresh and dry weights of plant aerial parts and roots / plant(g) 2- Chemical analysis [leaf green color degree on Sept 10th in both seasons as SPAD units using "Minolta (chlorophyll meter) SPAD – 502" **(Yadava, 1986)** and total carbohydrate%(**Herbert *et al.* 971)**, N%**(Pregl ,1945)**, P% **(Murphy and Riely, 1962)** and K% **(Brown and Lilland, 1964)** in the dry leaves].

The means of the individual factor and their interaction were compared by Duncan's Multiple Range Test according to **Steel and Torrie (1980).**

RESULTS AND DISCUSSION

A- Effect of soil type, fertilization treatments and their interaction on vegetative growth traits of *Adhatoda vasica* L. in 2013 and 2014 seasons.

A.1-Effect of soil types:

Data in Table (3)cleared that growth traits were differently affected by planting in either clayey or clay + sand(2:1v/v) soils in the both seasons. It is clears that the plants grown in clayey soil had higher values of plant height, shoots numbers, stem diameter, plant leaf area and fresh and dry weights of aerial parts and roots in comparison to those grown in clay +sand(2:1v/v) in the two season, except for plant height and plant leaf area in the first one, where higher values resulted from planting in clay +sand (2:1v/v). The difference between the two used soils reached the significantly level in the two seasons, except for in case of shoots number, stem diameter, plant leaf area and fresh weight of aerial parts during the first season only as the difference between the two soils did not reach the significantly level.

The clayey soil enhance the vegetative growth traits of plants more than clay +sand(2:1v/v) may be due to that clay soil has macro and micro nutrients, water holding capacity, organic matter and beneficial microorganisms (N-fixing bacteria , P solubilizing bacteria and mycorrhizal fungi) which are sufficient for plant growth and reflected on cell division and elongation, bud initiation, photosynthesis, and enzymatic and metabolic processes **(Nelson,1991 and Heiskamen,1993)**.

These results are in accordance to those of **Adam(2008)** who concluded that the planting in clayey soil significantly enhanced the plant height, stem diameter, branches number, leaf area and the fresh and dry weights of leaves, shoots and roots of *Cassia didymobotrya* and *Tecoma stans* followed by plantation in clay +sand (1:1v/v) without significant difference between them in some traits in the both seasons, while the least significant values of the aforementioned traits of such shrubs resulted from the culture in sandy soil. **Omer *et al.*(2013)** found that significant increases in the vegetative growth characters of Artemisia resulted from planting in clayey loam soil comparing to those cultivated in sandy loam soil. Likewise, **El-Mahrouk *et al.*(2015)** revealed that *Duranta plumieri* var. variegata plants grown in clayey soil had higher values of plant height, stem diameter, shoots number/ plant, plant leaf area and fresh and dry weights of leaves, shoots and roots in both seasons in comparison with sandy soil and mixture of clay + sand(1:1v/v) except for plant height in the second season as the tallest plants resulted from culture in clay + sand (1:1v/v).They added that the differences between clayey soil and either sandy or clay +sand

(1:1v\v) reached the significancy level in the most traits in the two experimental seasons.

Table (3): Effect of soil type on vegetative growth parameters of *Adhetoda vasica* L. during 2013and 2014 season

Parameters	Soil types			
	1st season (2013)		2nd season (2014)	
	Clay	Clay + sand (2:1v\v)	Clay	Clay + sand (2:1v\v)
Plant height (cm)	99.18b		93.25	
Number of shoots / plant	110.37a		91.01	
Stem diameter(cm)	6.25a		5.10a	
Plant leaf area (cm^2)	5.98a		4.27b	
Aerial parts fresh weight / plant (g)	1.17a		1.13a	
	1.12a		0.99b	
Aerial parts dry weight /plant(g)	66.32a		87.73a	
	66.70a		73.10b	
Roots fresh weight/plant (g)	185.20a		164.58a	
Roots dry weigh/plant (g)	184.07a		138.73	
	71.77a		47.65a	
	59.25b		35.23b	
	73.18a		58.60a	
	46.07b		49.75b	
	22.75a		17.95a	
	15.32b		16.45b	

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

A.2-Effect of fertilization treatments:

Data in Table (4) pointed out that the used fertilization treatments differently significantly affected the vegetative traits of Adhatoda in both seasons. Whereas, the tallest significant plants were recorded for T8in the first season and for T9 in the second one without significant differences among all fertilization treatments. The plants received T2 had more significant shoots number in both seasons in comparison to the other treatments except for T1 and T3in the second one where the differences among T1, T2 and T3 did not reach the significancy level. The significantly thickest stem diameter resulted from applying T2,T4 and T7 in the first season and from T1 and T3 in the second one with non-significant difference between themselves. The largest significant plant leaf area resulted from T3in both seasons, in addition to T2 in the second one. Higher significant values of the fresh and dry weights of aerial parts and roots were recorded for the plants fertilized by T3 in the first and second seasons plus T1 in case of roots fresh weight and T2in case of roots dry weight in the first season. On the other side the least significant values of plant height, shoots number, plant leaf area and fresh and dry weights of aerial parts resulted from applying T7 in the two seasons, while the least significant values of stem diameter

were recorded for T1 and T10 in the first season and T7 in the second one, roots fresh weight from T9 in the first season and T10 in the second one and roots dry weight from T9 in the first season and T5 in the second one.

The superiority of 50% NPK dose +10% FYM than the other treatments for improving the most vegetative traits may be due to that this treatment had suitable amount from essential nutrients(N, P and K)for the growth and development of plant **(Riaz *et al*.,2008)**, because N,P and K partake in many important components in plant such as amino acids, protein, organic acids, carbohydrates, phospholipids and pigments **(Devlin,1975).** Also, FYM increase soil fertility by its composition from macro and microelements, amino acids, organic acids, sugars and organic matter **(Abo- El-Fadl *et al*. 1969)**. Likewise, **Herrera *et al*.(1997)** concluded that compost are of value in agriculture as well as their beneficial effects on soil properties, water retention capacity, aeration, drainage, porosity structure , PH , better nutrients availability and good growth.

These results are in harmony with those of **Aly (2003)** studied the effect of organic fertilizer (sheep manure) and NPK fertilizers each at different levels on vegetative growth of sweet fennel. It was found that treating the plants with $20m^3$/fed. organic manure and 300kg/fed. ammonium sulphate led to the tallest plants and the heaviest fresh and dry weights/plant under Sinai condition. Also, **El-Mahrouk *et al*.(2009)** found that ½ NPK (15,12 and 6g NPK/plant as ammonium sulphate, calcium superphosphate and potassium suplphate , respectively) plus compost at 15% from soil dry weight in pot achieved the best vegetative growth traits of *Cestrum aurantiacum* in the two seasons. As well as ,**Alosif (2015)** mentioned that the treatment of ½ g N, ¼ gP_2O_5 and ¼ g K_2O /kg soil produced the best values of vegetative growth traits of *Acacia saligna* .

Table (4): Effect of fertilization treatments on vegetative growth parameters of *Adhetoda vasica* L. during 2013and 2014 seasons

Parameters	Fertilization treatments									
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
	1st season (2013)									
Plant height (cm)	106.25d	106.08d	113.33b	99.92g	100.00fg	100.92f	94.16h	115.92a	103.92e	107.25c
Number of shoots / plant	7.42b	8.25a	7.50b	6.67c	5.17e	4.33f	3.75g	5.83d	6.42c	5.83d
Main stem diameter(cm)	1.11b	1.17ab	1.13b	1.31a	1.14b	1.14b	1.17ab	1.14b	1.05b	1.11b
Plant leaf area (cm^2)	70.51c	72.87b	78.53a	73.92b	67.90d	60.46g	54.59h	64.02e	62.33f	59.98g
Aerial parts fresh weight / plant (g)	217.08b	211.00c	237.00a	201.25d	170.08g	154.17h	118.17i	175.83f	180.58e	181.17e
Aerial parts dry weight /plant(g)	68.33c	79.58b	87.58a	69.00c	62.00d	55.67f	50.33g	59.17e	61.67d	61.75d
Roots fresh weight/plant (g)	70.08a	62.83c	70.50a	62.75c	65.58b	56.50d	53.58e	62.25c	45.58g	46.58f
Roots dry weigh/plant (g)	21.08	21.67ab	22.42a	19.50c	19.17c	17.33d	18.50c	18.50c	16.00e	16.17e
	2nd season (2014)									
Plant height (cm)	92.08	83.23	92.83	92.83	93.50	92.33	82.50	100.00	101.50	90.50
Number of shoots / plant	5.42a	5.42a	5.08ab	4.33cd	4.75bc	4.50c	3.17e	3.92d	5.50	4.75bc
Main stem diameter(cm)	1.19ab	1.16b	1.21a	1.07cd	1.02de	1.00ef	0.92g	1.04cde	0.96fg	1.07c
Plant leaf area (cm^2)	89.52b	93.81a	93.50a	80.42c	74.87e	77.66d	60.98f	81.18c	77.50d	74.75e
Aerial parts fresh weight / plant (g)	154.17de	169.75b	195.33a	138.08f	149.67e	141.75f	111.08g	161.83c	154.75d	140.17f
Aerial parts dry weight /plant(g)	48.08c	51.25b	56.33a	37.25f	39.00e	35.67g	27.42h	41.83d	38.58e	39.00e
Roots fresh weight/plant (g)	53.58d	54.58d	65.50	51.17e	51.50e	61.00b	50.25ef	56.42c	48.17g	49.58f
Roots dry weigh/plant (g)	18.42b	17.83bc	22.33a	16.50e	14.75f	16.83de	17.25cd	16.17e	15.42f	16.50e

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

T1- Control NPK R.D T2-75%NPK+5%FYM T3-50%NPK+10%FYM T4-25%NPK+5%FYM+2g.A.D.Y +200ppm A.A T5- 2g.A.D.Y+300ppmS.A+5%FYM T6-2g.A.D.Y+300ppm A.A+5%FYM T7-2g.dy+300ppm of each S.A or A.A T8-10%FYM+2g.A.D.Y T9-10%FYM+200ppm of each S.A or A.A T10-10%FYM+1g.A.D.Y+200ppm of each S.A or A.A

R.D: Recommended dose A.D.Y: Active dry yeast S.A: Salicylic acid
A.A: Ascorbic acid

A.3. Effect of interaction between soil type and fertilization treatments:

It is noticed from data in Tables (5 and 6) that the growth parameters of *Adhutoda* vasica were significantly affected by plantation in either clayey or clay + sand (2:1 v/v) soils and applying different fertilization treatments in the two seasons, whereas data in Table (5) cleared that the significantly tallest plants resulted from planting in clay + sand (2:1) and fertilization with T_8 in the first season and in the second one resulted from planting in clayey soil and fertilization by T9, while the significantly shortest plants were recorded from culture in clayey soil and utilization of T_7 in the first season and in the second one resulted from culture in clay + sand (2:1) and applying T_2. The plants grown in cay + sand (2::1) and received T_2 in the first season and those grown in clayey soil and received T_2 and T9 in the second season had larger significant shoots number/plant, but the plants grown in clay + sand (2:1) and fertilized with T_7 in both seasons, in addition to T_6 and T_8 in the second one, besides to those grown in clayey soil and received T_7 in the second season had the smallest significant shoots number per plant. As well as the plants grown in clay + sand (2:1) and received T_4 in the first season and those grown in clayey soil and fertilized by T_4 and T_7 in the first season and T_1 and T_2 in the second one had the thickest significant stem diameter, while the plants grown in clay + sand (2:1) and fertilized by T_9 in the first season and T_7 in the second one had the significantly thinnest stem diameter. Also, the plantation in clayey soil and applying T_3 in the first season and T_2 in the second one realized the largest significant plant leaf area, on the opposite, plantation in clay + sand (2:1) and utilization of T_7 recorded the significantly minimum plant leaf area in both seasons. Also, data in Table (6) revealed that the plants grown in clayey soil and fertilized by T_3 resulted in the significantly heaviest fresh and dry weights of plant aerial parts and roots in the two seasons except for in case of root fresh weight in the second season as achieved from fertilization by T_6. On the other side, data in Table (6) showed that lower significant values of fresh and dry weights of plant aerial parts resulted from planting in clayey and clay + sand (2:1) soils, respectively and fertilization by T_7 during both seasons. Also, the significantly least values of fresh and dry weights of roots/plant resulted from planting in clay + sand (2:1) and utilization of T_{10} during the two seasons except for dry weight of roots in the second one resulted from applying T_1.

It is evident from data in Tables (5 and 6) that the planting in clayey soil and fertilization by 50% NPK dose + 10% FYM gave the best values of most growth traits may be attributed to the same reasons mentioned before in case of effect of either soil types or fertilization treatments on vegetative growth traits.

Table (5): Effect of interaction between soil type and fertilization treatments on plant height, number of shoots / plant ,main stem diameter and plant leaf area (cm2) of *Adhetoda vasica* L. during 2013and 2014 seasons

Fertilization treatments	Soil types			
	1st season (2013)		2nd season (2014)	
	Clay	Clay + sand (2:1v\v)	Clay	Clay + sand (2:1v\v)
	Plant height (cm)			
Control NPK R.D	103.00hi		94.00	
75%NPK+5%FYM	109.50d		90.17	
50%NPK+10%FYM	105.33g		94.50	
25%NPK+5%FYM+2g.A.D.Y+200ppm A.A	106.83f		71.97	
5%FYM+ 2g.A.D.Y+300ppmS.A	118.33c		87.00	
5%FYM+ 2g.A.D.Y+300ppm A.A	108.33e		98.67	
2g.dy+300ppm of each S.A or A.A	96.00j		89.17	
10%FYM+2g.A.D.Y	103.83h		96.50	
10%FYM+200ppm of each S.A or A.A	91.67l		93.67	
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	108.33e		93.33	
	92.33l		94.33	
	109.50d		90.33	
	81.33m		75.67	
	107.00f		89.33	
	104.83g		99.83	
	127.00a		100.17	
	105.17g		108.67	
	102.67i		94.33	
	93.83k		95.66	
	120.67b		85.33	
	Number of shoots / plant			
Control NPK R.D	6.67def		6.33a	
75%NPK+5%FYM	8.17b		4.50c	
50%NPK+10%FYM	7.33c		6.00ab	
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	9.17a		4.83c	
5%FYM+ 2g.A.D.Y+300ppmS.A	7.00d		5.67b	
5%FYM+ 2g.A.D.Y+300ppm A.A	8.00b		4.50c	
2g.dy+300ppm of each S.A or A.A	6.83de		3.83d	
10%FYM+2g.A.D.Y	6.50ef		4.83c	
10%FYM+200ppm of each S.A or A.A	5.33h		4.67c	
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	5.00i		4.83c	
	4.33k		5.83b	
	4.33k		3.17e	
	5.00i		3.17e	
	2.50l		3.17e	
	7.00d		4.67c	
	4.67j		3.17e	
	6.67def		6.33a	
	6.17g		4.67c	
	6.33fg		4.50c	

	5.33h	5.00c
	Main stem diameter(cm)	
Control NPK R.D	1.04fg	1.34a
75%NPK+5%FYM	1.17b-f	1.03ef
50%NPK+10%FYM	1.13b-g	1.38a
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	1.21bcde	0.94ij
5%FYM+ 2g.A.D.Y+300ppmS.A	1.17b-f	1.29b
5%FYM+ 2g.A.D.Y+300ppm A.A	1.10c-g	1.14cd
2g.dy+300ppm of each S.A or A.A	1.37a	1.12d
10%FYM+2g.A.D.Y	1.24abc	1.01gh
10%FYM+200ppm of each S.A or A.A	1.23bcd	1.07
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	1.05fg	0.97hi
	1.12d-g	1.01fgh
	1.15b-f	0.99fgh
	1.26ab	0.93ijk
	1.07efg	0.90jk
	1.18b-f	1.15cd
	1.09d0g	0.93ijk
	1.09c-g	0.89k
	0.99g	1.02fg
	1.13b-g	1.17c
	1.09d-g	0.97ghi
	Plant leaf area (cm^2)	
Control NPK R.D	73.84c	96.12b
75%NPK+5%FYM	67.18fg	82.92e
50%NPK+10%FYM	79.01b	105.20a
25%NPK+5%FYM+2g.A.D.Y+200ppm A.A	66.74gh	82.42ef
5%FYM+ 2g.A.D.Y+300ppmS.A	83.23a	95.10b
5%FYM+ 2g.A.D.Y+300ppm A.A	73.83c	91.90c
2g.dy+300ppm of each S.A or A.A	65.57hi	91.97c
10%FYM+2g.A.D.Y	82.27a	68.87i
10%FYM+200ppm of each S.A or A.A	63.84j	80.60f
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	71.95d	69.14i
	56.43m	81.00ef
	64.50ij	74.32h
	60.06k	74.23h
	49.12n	47.72j
	69.77e	88.67d
	58.26l	73.70h
	56.15m	87.67d
	68.50ef	67.33i
	55.31m	76.77g
	64.64ij	72.73h

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

R.D: Recommended dose A.D.Y: Active dry yeast S.A: Salicylic acid
A.A: Ascorbic acid

Similar results were obtained by **Adam (2008)** who found that the plants of *Cassia didymobotrya* and *Tecoma stans* grown in either

clayey or sandy clay (1:1) soils and fertilized with ½ NPK dose (15 g ammonium sulphate + 12 g calcium super phosphate + 6 g potassium sulphate/plant had the best significant values of plant height, shoots number, plant leaf area, stem diameter and fresh and dry weights of leaves, shoots and roots. Likewise, **El-Mahrouk *et al*. (2009)** found similar results on *Cestrum aurantiacum*. Also, **El-Morsy (2015)** found that *Duranta plumieri* var. variegata and *Murraya exotica* grown in clayey soil and received 12 + 6 + 6 g/plant from ammonium sulphate, calcium superphosphate and potassium sulphate, respectively had the best values of vegetative growth traits.

Table (6): Effect of interaction between soil type and fertilization treatments on fresh and dry weights / plant (g) of aerial parts and roots of *Adhetoda vasica* L. during 2013and 2014 seasons

Fertilization treatments	Soil types			
	1st season (2013)		2nd season (2014)	
	Clay	Clay + sand (2:1v\v)	Clay	Clay + sand (2:1v\v)
	Aerial parts fresh weight / plant (g)			
Control NPK R.D	227.33b		173.50c	
75%NPK+5%FYM	206.83e		134.83h	
50%NPK+10%FYM	213.83c		161.67d	
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	208.17d		177.83c	
5%FYM +2g.A.D.Y+300ppmS.A	260.33a		236.50	a
5%FYM+ 2g.A.D.Y+300ppm A.A	213.67c		154.17e	
2g.dy+300ppm of each S.A or A.A	197.67g		141.17g	
10%FYM+2g.A.D.Y	204.83f		135.00h	
10%FYM+200ppm of each S.A or A.A	158.67o		154.50e	
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	181.50j		144.83fg	
	131.67p		148.83f	
	176.67l		134.67h	
	113.33r		100.67k	
	123.00q		121.50i	
	171.17m		188.67b	
	180.50j		135.00h	
	194.00h		176.50c	
	167.17n		133.00h	
	184.00i		163.83d	
	178.33k		116.50j	
	Aerial parts dry weight /plant(g)			
Control NPK R.D	68.83e		57.00b	
75%NPK+5%FYM	67.83ef		39.17j	
50%NPK+10%FYM	83.67b		50.00e	
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	75.50c		52.50c	
5%FYM +2g.A.D.Y+300ppmS.A	103.00a		68.17a	
5%FYM +2g.A.D.Y+300ppm A.A	72.17d		44.50g	
2g.dy+300ppm of each S.A or A.A	73.17d		39.67j	
10%FYM+2g.A.D.Y	64.83g		34.83k	
10%FYM+200ppm of each S.A or A.A	67.00f		42.67h	
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	57.00i		35.33k	
	61.00h		41.33i	
	50.33k		30.00n	

	58.17i	30.67mn
	42.50l	24.17p
	61.67h	51.50d
	56.67i	32.17l
	72.50d	45.67f
	50.83k	31.50lm
	68.67ef	49.83e
	54.83j	28.17o
	Roots fresh weight/plant (g)	
Control NPK R.D	88.33b	60.33d
75%NPK+5%FYM	51.83k	46.83l
50%NPK+10%FYM	74.17f	56.33f
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	51.50k	52.83h
5%FYM+ 2g.A.D.Y+300ppmS.A	93.50a	71.83b
5%FYM+ 2g.A.D.Y+300ppm A.A	47.50n	59.17e
2g.dy+300ppm of each S.A or A.A	75.83e	52.50h
10%FYM+2g.A.D.Y	49.67l	49.83ij
10%FYM+200ppm of each S.A or A.A	76.83d	54.00g
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	54.33j	49.00jk
	64.33g	73.50a
	48.67m	48.50k
	61.67h	46.00l
	45.50o	54.50g
	87.17c	62.50c
	37.33p	50.33i
	53.83j	52.33h
	37.33p	44.00m
	56.17i	56.67f
	37.00p	42.50n
	Roots dry weigh/plant (g)	
Control NPK R.D	26.00b	24.50a
75%NPK+5%FYM	16.17h	12.33j
50%NPK+10%FYM	25.00c	17.83d
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	18.33fg	17.83d
5%FYM+ 2g.A.D.Y+300ppmS.A	28.67a	24.83a
5%FYM +2g.A.D.Y+300ppm A.A	16.17h	19.83b
2g.dy+300ppm of each S.A or A.A	25.17bc	15.67fg
10%FYM+2g.A.D.Y	13.83jk	17.33df
10%FYM+200ppm of each S.A or A.A	20.67e	13.50i
10%FYM+1g.A.D.Y+200ppm of eachS.A or A.A	17.67fg	16.00f
	19.83e	18.50c
	14.83i	15.17g
	22.67d	14.67h
	14.33ijk	19.83d
	23.50d	16.83e
	13.50k	15.50fg
	17.50g	15.33g
	14.50ij	15.50fg
	18.50f	17.83d
	13.83jk	15.17gh

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

R.D: Recommended dose A.D.Y: Active dry yeast S.A: Salicylic acid

A.A: Ascorbic acid

B. Effect of soil type, fertilization treatments and their interaction on the chemical composition of *Adhatoda vasica* in 2013 and 2014 seasons:

B.1. Effect of soil type:

Data in Table (7) revealed that the plants grown in either clay + sand (2:1) in the first season or clayey soil in the second season had a significant increase in leaf green color degree, also those grown in sand + clay (2:1) resulted in the highest significant total carbohydrates % in both seasons comparing to plants cultured in clayey soil. On the other side, the plants cultured in clayey soil had higher significant N, P and K% over than those cultured in clay + sand (2:1) during the two seasons, with two exceptions in case of N and P% in the second one, where the difference between the two soils did not reach the significant level.

The clayey soil enhanced the most chemical parameters investigated may be due to that it has macro and micro-nutrients, water holding capacity, organic matter and beneficial microorganisms (N-fixing bacteria, P solubilizing bacteria and mycorrhizae) which are sufficient for plant growth and reflected on photosynthesis, metabolic process, and N, P and K uptake **(Nelson, 1991 and Heiskamen, 1993).**

These results are in accordance to those of **El-Sallami (2002)** who mentioned that the highest foliar concentration of N, P and K chlorophyll (a and b) of *Chorisia speciosa*, *Leucaena leucocephala* and *Prosopis juliflora* were produced from planting in clayey soil followed by sandy clay soil, then sandy soil. Likewise, **El-Mahrouk *et al*. (2009)** on *Cestrum aurantiacum* concluded that planting in sand + clay (1:1) or clayey soils caused more chlorophyll and N and P% in the leaves than sandy soil. Also, **Abdelaziz (2014)** cleared that *Ocimum gratissimum* leaves had total carbohydrates, N, P and K% and chlorophyll (a) when plants grown in clayey soil more than those grown in sandy soil.

Table (7): Effect of soil type on chemical composition of *Adhetoda vasica* L. during 2013and 2014 season

Parameters	Soil types			
	1st season (2013)		2nd season (2014)	
	Clay	Clay + sand (2:1v\v)	Clay	Clay + sand (2:1v\v)
Leaf green color degree	33.84b	36.04a	36.66a	35.70b
(SPAD units)	21.46b	24.45a	22.40b	24.65a
Total carbohydrates (%)	1.70a	1.42b	1.57	1.53
Nitrogen (%)	0.39a	0.34b	0.33	0.32
Phosphorus (%)	3.59a	3.21b	3.42a	2.73b
Potassium (%)				

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

B.2. Effect of fertilization treatments:

Data illustrated in Table (8) showed that higher significant leaf green color degree resulted from applying $T_1$and T_2 in the first season and T_2 in the second one, while lower significant value of this parameter was recorded for T_7 in both seasons. Higher significant total carbohydrates % was recorded for plants received T_3, T_4, T9 and T_{10} in the first season , but in the second one resulted from utilization of T_3, on the other hand, the significantly least total carbohydrates % resulted from T_5 and T_7 in the first season and T_8 and T_9 in the second one without significant difference between themselves. Concerning N%, data cleared that T_1, T_2, T_3 and T_4 in the first season and T_3 in the second one gave higher significant N%, whilst the fertilization by T_7 and T_9 in the first season and T_5, T_7 and T_8 in the second one, resulted in lower significant N%. Also, data in Table (8) obviously pointed out that T_3 achieved higher significant P and K% in the two seasons, in addition to T_5, T_6, T_9 and T_{10} in case of P% in the first season without significant differences among such treatments. On the opposite, T_1 and T_7 in case of P% and T_2 in case of K% in the first season and T_1 and T_2 in case of P% and T_7 in case of K% in the second season recorded lower significant percentage of P and K.

From the results that T_3 (50%NPK dose + 10% FYM) resulted in the best results of most chemical traits measured may be attributed to that treatment is the best to rich the root zone with N, P and K which partake in many compounds in plant cells such as pigments, carbohydrate, proteins **(Devlin, 1975)**, as well as applying FYM led to improving the physical and chemical characters of soil by its composition from organic matter, macro and micronutrients, sugars, amino acids and some growth regulators **(Lampkin, 1990 and Gomaa 2002)** all that reflect on N, P and K uptake, consequently, better photosynthesis and metabolic processes.

These results are similar to those of **Adua *et al*. (2004)** found that 3 g/pot NPK at 2:1:1 ratio caused an increase in N, P, K and carbohydrate % and chlorophyll (a and b) in leaves of *Bougainvillea glabra*, also**, Gabra (2004)** on the same plant concluded that the best chemical parameters resulted from the treatment of 18 g ammonium aulphate + 12 g calcium superphosphate + 6 g potassium sulphate per pot plus FYM + microbine. Likewise, **Ali (2011)** mentioned that the highest values of total chlorophyll and total carbohydrate , N, P and K% resulted from ½ NPK dose + 5% compost for *Dendranthema*

granndiflora cv. Monaliza White and ¾ NPK dose + 3% compost for *Carthamus tinctoria* cv. Zangibar.

Table (8): Effect of fertilization treatments on chemical composition of *Adhetoda vasica* L. during 2013and 2014 seasons

parameters	Fertilization treatments									
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
	1st season (2013)									
Leaf green color degree (SPAD units)	39.46a	38.95ab	38.54b	34.92d	32.81e	31.48f	29.66g	33.26e	35.92c	34.41d
Total carbohydrates (%)	20.75c	21.50c	25.83a	25.42a	17.98d	23.50b	19.00d	23.08b	26.25a	26.25a
Nitrogen (%)	2.03a	1.84a	1.92a	1.70ab	1.42bc	1.39bc	1.25c	1.38bc	1.25c	1.39bc
Phosphorus (%)	0.28c	0.37b	0.40ab	0.36b	0.39ab	0.43a	0.28c	0.35b	0.39ab	0.39ab
Potassium (%)	3.40cd	2.60g	4.50a	3.31de	2.98f	3.23e	3.48c	2.94f	3.79b	3.76b
	2nd season (2014)									
Leaf green color degree (SPAD units)	41.75b	43.67a	38.77c	38.83c	36.61d	31.25h	29.56i	32.05g	33.89f	35.41e
Total carbohydrates (%)	22.75cd	24.08b	26.42a	24.40b	23.58bc	24.75b	24.75b	20.50e	21.50de	22.50cd
Nitrogen (%)	1.52bcd	1.69bc	2.35a	1.74b	1.21d	1.53bcd	1.25d	1.32d	1.36cd	1.52bcd
Phosphorus (%)	0.27d	0.27d	0.41a	0.30cd	0.34bc	0.29d	0.30cd	0.34bc	0.35b	0.34bc
Potassium (%)	3.11d	2.36f	4.13a	3.62b	3.37c	3.62b	2.10g	3.21d	2.75e	2.50f

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

T1- Control NPK R.D T2-75%NPK+5%FYM T3-50%NPK+10%FYM T4-25%NPK+5%FYM+2g.A.D.Y +200ppm A.A T5- 2g.A.D.Y+300ppmS.A+5%FYM T6- 2g**.A.D.Y+300ppm A.A+5%FYM T7-2g.dy+300ppm of each S.A or A.A T8-10%FYM+2g.A.D.Y T9-10%FYM+200ppm of each S.A or A.A T10-10%FYM+1g.A.D.Y+200ppm of each S.A or A.A**

R.D: Recommended dose **A.D.Y**: Active dry yeast **S.A:** Salicylic acid A.A: Ascorbic acid

B.3. Effect of interaction between soil type and fertilization treatments:

Data in Table (9) showed that the culture in clayey soil and adding NPK recommended dose in the first season and culture in used soils and adding T_2 in the second one caused a significant increase in leaf green color degree, while the significantly least leaf green color degree value resulted from planting in clayey soil and applying either T_5 in the first season or T_6 in the second one. For total carbohydrate , its evident from data in Table (9) that the plants grown in either clayey soil or clay + sand (2:1) and received T_3 or T_4,T_8, T_9 and T_{10}

respectively in the first season and those grown in clay + sand (2:1) and fertilized by T_6 in the second season had higher significant total carbohydrates% in their leaves, while the plants grown in clayey soil and fertilized with T_5 in the first season and T10 in the second one contain lower significant carbohydrates in their leaves. Concerning N%, the planting in clayey soil or clay + sand (2:1) and utilization T_3 and T_1, respectively in the first season and T_3 for both used soils in the second one caused a significant increase in N%, but the plants cultured in clay + sand (2:1) and received T_5 had lower significant N% in the two seasons. Regarding P%, the planting in clayey soil and applying T_6 in the first season and the planting in clayey or sand + clay (2:1) soils and applying T_3 in addition to apply T9 in clayey soil in the second season caused a significant increase in P%, on contrary, the planting in clayey soil and utilization of T_7 in the first season or T_1 and T_2 in the second one gave lower significant P%. In respect of K%, the plants grown in clayey soil and received T_3 in the first season or T_6 in the second one had higher significant K% in their leaves, while the plants grown in clay + sand (2:1) and received T_6 in the first season and T_7 in the second one resulted in lower significant K%.

The best results of chemical parameters measured were achieved from the planting in clayey soil and fertilization treatments contain NPK combined with FYM, in the most cases may be due to the same aforementioned reasons in case of effect of either soil type or fertilization treatments on the chemical traits.

These results are in harmony with those of **El-Sallami (2002)** on *Chorisia speciosa* and *Prosopis juliflora*, **Auda *et al*. (2004)** and **Gabra (2004)** on *Bougainvillea glabra*, **El-Mahrouk *et al*. (2009)** on *Cestrum aurantiacum,* **Ali (2011)** on *Dandranthema grandiflora* and *Carthamus tinctoria* cv. Zangibar **and Abdellaziz (2014)** on *Ocimum gratissimum*.

CONCLUSION

It can be recommended to culture *Adhatoda vasica* in clayey soil and fertilize it with 5% NPK dose (6+3+3 g/plant as ammonium sulphate (20.5% N), calcium superphosphate (15.5% P_2O_5 and potassium sulphate (48.5% K_2O) plus 10% FYM (from soil dry weight), where FYM and calcium superphosphate are applied before planting at soil preparation. While, the amounts of ammonium sulphate and potassium sulphate are divided into six equal doses, the first dose is added after 30 days from the transplanting and the other ones are added after the first one at one month interval.

Table (9): Effect of interaction between soil type and fertilization treatment on some leaf components of *Adhetoda vasica* L. during 2013and 2014 seasons

Fertilization treatments	Soil types			
	1st season (2013)		2nd season (2014)	
	Clay	Clay + sand (2:1v\v)	Clay	Clay + sand (2:1v\v)
	Leaf green color degree (SPAD units)			
Control NPK R.D			41.06c	42.43b
75%NPK+5%FYM	40.55a	38.36c	43.59a	43.74a
50%NPK+10%FYM	38.22c	39.69b	39.66e	37.88g
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	38.66c	38.42c	40.29d	37.37h
5%FYM +2g.A.D.Y+300ppmS.A	34.35e	35.48d	38.63f	34.60k
5%FYM +2g.A.D.Y+300ppm A.A	31.28h	34.33e	30.20n	31.31n
2g.dy+300ppm of each S.A or A.A	29.16i	33.80ef	30.50o	28.62p
10%FYM+2g.A.D.Y	26.70j	32.62g	32.17lm	31.94m
10%FYM+200ppm of each S.A or A.A	32.91g	33.62f	35.27j	32.51l
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	33.61f	38.22c	34.21k	36.60i
	32.92g	35.89d		
	Total carbohydrates (%)			
Control NPK R.D	19.50fg	22.00e	23.00ef	22.50f
75%NPK+5%FYM	19.50fg	23.50cd	23.00ef	25.17d
50%NPK+10%FYM	27.50a	24.17bcd	26.50bc	26.33bcd
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	23.33cd	27.50a	25.33cd	23.47ef
5%FYM+ 2g.A.D.Y+300ppmS.A	15.47i	20.50f	23.17ef	24.00e
5%FYM+ 2g.A.D.Y+300ppm A.A	23.00de	24.00bcd	20.50g	29.00a
2g.dy+300ppm of each S.A or A.A	18.00h	20.00fg	25.50cd	24.00e
10%FYM+2g.A.D.Y	19.00gh	27.17a	20.00gh	21.00g
10%FYM+200ppm of each S.A or A.A	25.00b	27.50a	19.00hi	24.00e
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	24.33bc	28.17a	18.00i	27.00b
	Nitrogen (%)			
Control NPK R.D	1.81bc	2.24a	1.86bc	
75%NPK+5%FYM	1.82f	1.87bc	1.53cde	1.36de
50%NPK+10%FYM	2.32a	1.53cd	2.33a	1.85bc
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	2.09ab	1.31de	1.95b	2.37a
5%FYM+ 2g.A.D.Y+300ppmS.A	1.81bc	1.03e	1.12f	1.53cde
5%FYM+ 2g.A.D.Y+300ppm A.A	1.53cd	1.25de	1.40def	1.30def
2g.dy+300ppm of each S.A or A.A	1.26de	1.24de	1.27ef	1.65bcd
10%FYM+2g.A.D.Y	1.25de	1.52cd	1.40def	1.24ef
10%FYM+200ppm of each S.A or A.A	1.53cd	0.97e	1.40def	1.24ef
10%FYM+1g.A.D.Y+200ppm of each S.A or A.A	1.53cd	1.25de	1.59cde	1.32def
				1.44def
	Phosphorus (%)			
ControlNPK R.D	0.26ij	0.29hi	0.24f	0.30cde
75%NPK+5%FYM	0.38def	0.36efg	0.24f	0.31cd
50%NPK+10%FYM	0.44bc	0.35fg	0.40a	0.41a
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	0.40cde	0.32gh	0.26ef	0.34bc
5%FYM +2g.A.D.Y+300ppmS.A	0.46b	0.33gh	0.38ab	0.30cde
	0.52a	0.34fg	0.29de	0.29de
	0.23j	0.34fg	0.29de	0.32cd

5%FYM+ 2g.A.D.Y+300ppm A.A	0.35fg	0.36efg	0.38ab	0.30cde
2g.dy+300ppm of each S.A or A.A	0.42bcd	0.36efg	0.40a	0.31cd
10%FYM+2g.A.D.Y	0.46b	0.32gh	0.37ab	0.31cd
10%FYM+200ppm of each S.A or A.A				
10%FYM+1g.A.D.Y+200ppm of eachS.A or A.A				
	Potassium (%)			
Control NPK R.D	3.75c	3.04f	3.62d	2.60hi
75%NPK+5%FYM	2.50h	2.70g	2.61hi	2.10j
50%NPK+10%FYM	4.40b	4.60a	4.30b	3.96c
25%NPK+5%FYM+2g.A.D.Y +200ppm A.A	3.47e	3.15f	3.73d	3.30e
5%FYM +2g.A.D.Y+300ppmS.A	3.60d	2.34i	3.04f	3.70d
5%FYM+2g.A.D.Y+300ppm A.A	4.33b	2.11j	4.77a	2.47i
2g.dy+300ppm of each S.A or A.A	3.81c	3.15f	2.53hi	1.66l
10%FYM+2g.A.D.Y	2.53h	3.35e	3.75d	2.67h
10%FYM+200ppm of each S.A or A.A	3.74c	3.85c	2.84g	2.65h
10%FYM+1g.A.D.Y+200ppm of eachS.A or A.A	3.72cd	3.80c	4.04c	1.95k

Means within a column have the same letters are not significantly different according to Duncan's Multiple Range Test.

R.D: Recommended dose **A.D.Y**: Active dry yeast **S.A:** Salicylic acid

A.A: Ascorbic acid

REFERANCES

Abdelaziz, Amany, B. (2014). Response of *Ocimum gratissimum* plants grown in clayey and sandy soils to some fertilization treatments. M. Sc. Thesis, Fac. Agric. Saba Basha, Alex.Univ.

Abou El-Fadl M.; S.G. Rizk; A.F. Abdel Ghani; M.K. El-Mifty; M.F.A. Khadr; S.M. Shetata and F.A. Farag (1969). Utilization of water hyacinth as an organic manure with special reference to water borne helminthes. J. Microbial A.R. E., 3 (1): 27-34.

Adam, Amani,I.H. (2008). Physiological studies on some ornamental shrubs. Ph.D. Thesis, Fac. Agric., Kafrelsheikh Univ., Egypt.

Aklibasinda, M.; T. Tunc; Y. Bulut and U. Sahin (2011). Effects of different growing media on Scotch pine (*Pinus sylvestris*) production. J. Animal & Plant Sci., 21(3): 535-541.

Ali, Asmaa,M.A. (2011). Response of chrysanthemum cv. " Monaliza White" and safflower cv. " Zangibar" to some fertilization treatments. Ph.D. Thesis, Fac. Agric., Kafrelsheikh Univ., Egypt.

Alosif, A.M.O. (2015). Effect of mineral and biofertilization on growth and nutritional value of *Acacia saligna* seedlings. M.Sc. Thesis, Fac. Agric., Alex. Univ., Egypt.

Aly, M.S. (2003). Effect of organic fertilizer (FYM) and/or some percentages of NPK fertilizer on fennel plants. J. Agric Sci. Mansoura Univ., 28(4): 3215-3226.

Auda, M.S.; S. Allam Samira, and B.B. Rezk (2004). Effect of pinching and chemical fertilization on growth, flowering and chemical

constituents of potted *Bougainvillea glabra,* Choisy. J. Agric. Res., Tanta Univ., 30(1): 114-131.

Baiyeri ,K.P. (2005). Response of Musa species to macro- propagation. II The effects of genotype, initiation and weaning media on sucker growth and quality in the nursery .Afr. J . Biotechnol.,4(3):229-234.

Blokhina, O.; E. Virolainen and K. V. Fagerstedt (2003). Antioxidant, oxidative and oxygen deprivations stress. A Review Ann. Bot., 91:179-194.

Brown, J.D. and O. Lilland (1964). Rapid determination of potassium and sodium in plant material and soil extracts by flame photometry. Proc. Amer. Soc. Hort. Sci., 73:813-821.

Devlin, R.M. (1975). Plant Physiology. 3rd Ed. Affiliated East West Press, New Delhi.p. 159-205.

El-Mahrouk, E.M.; Y.M. Kandeel; M.A. Hegazi; Mary, N. Nasr and Amani, I. Adam (2009). Effect of soil type and fertilization treatments on growth and chemical composition of some ornamental shrubs. I-*Cestrum aurantiacum* (Lindley). Alex. J. Agric. Res., 54(1): 111-121.

El-Mahrouk, E.M.;E.M. Nofal ; Samia, Z. El-bably and Noha A. El-Morsy (2015). Responses of *Duranta plumieri* var. variegata grown in different soil types to variable fertilization treatments.J. Agric. Res. Kafr El-Sheikh Univ.,41(1):370-392.

El-Morsy, Noha,A.(2015). response of Some ornamental shrubs grown in different soil types to variable fertilization treatments. Ph.D. Thesis, Fac. Agric., Kafrelsheikh Univ., Egypt.

El-Nagar,E. M.(1996).Effect of applying some organic residues to sandy soil and calcareous soils on growth and composition of some plants. M.Sc. Thesis, Fac. Agric. Mansoura, Univ., Egypt.

El-Sallami, I.H. (2002). Seedling responses of some ornamental trees to soil-type and NPK fertilization. Assiut J. Agric. Sci., 33(3): 49-83.

Gabra, Georgena W.R. (2004). Physiological studies on some ornamental plants. M.Sc. Thesis, Fac. Agric. Kafrelsheikh, Tanta Univ., Egypt.

Gomaa, W.A.B. (2002). Physiological studies on *Coriandrum sativum,* L. and *Majorana hortensis,* Moench. M.Sc. Thesis, Fac. Agric. Kafr El-Sheikh, Tanta Univ., Egypt.

Hegab, M.Y.; F.F. Ahmed and A.H. Ali (1997). Influence of spraying active dry yeast on growth and productivity of Valencia orange trees (*Citrus sinensis*) Proc 1st Scientific Conf., Assiut Fac. Agric. 10: 73-85.

Hegazi, A.M. and A.M. El-Shrayi (2007). Impact of salicylic acid and paclobutrazol exogenous application on the growth, yield and nodule formation of common bean. Aust. J. Basic Appl. Sci. 1:834-840.

Heiskamen, J. (1993). Favorable water and aeration conditions for growth media used in containerized seedling production. A Review, Scandinavian J. Res., 8: 337-358.

Herbert, D.; P. Phipps and J. Strange (1971). Determination of total carbohydrates. Methods in Microbiology, 5(8): 290-344.

Herrera, E.; N. Temrblay; B.Desrches and A. Gossellin(1997). Optimization of substrate and nutrient solution of organic cultivation of medical transplants in multi-cell floats. J.H. Species and Medicinal Plants 4(4): 69-82. (Hort. Abst, 1997, 67:9837).

Ingram, D.L.;R.W. Henley and T.H.Yeager (2003).Growth media for container grown ornamental plants. Environ. Hort. Depart., Florida cooperative Extension Service Inst. Food and Agric. Sci., Florida Univ., BUL 241.

Jackson, M.L. (1973).Soil Chemical Analysis. Prentice-Hall of India, Private Limited; New Delhi, p.115.

Lampkin, N. (1990). Organic Fanning. Fanning Press Book, United Kingdom. P. 63

Murphy, J. and J.P. Riely (1962). A modified single solution methods for the determination of phosphate in natural water. Ann. Acta., 27:31-36.

Nelson, p.v. (1991). Greenhouse operation and management 4th ed. Reston publishing Co., Reston , Virginia.

Noreen S.;M. Ashraf;M. Hussain and A. Jamil (2009). Exogenous application of salicylic acid enhances antioxidative capacity in salt stressed sunflower (*Helianthus annus* L.) plants. Pakistan J. Bot. 41:473-479.

Omer,E.A.; E.A. Abouhussein;S.H. Hendawy; A.A.Ezz El-Din and G. El-Gendy (2013).Effect of soil type and seasonal variation on growth, yield ,essential oil and artemisinin content of *Artremisia annua* L. M. Sc. Thesis, Fac. Agic., Minufiya Univ. Shibin El- Kom, Egypt.

Pandita, K.; M. S. Bhatia; R. K. Thappa; S. G. Agarwal; K.L. Dhar and, C.K. Atal(1983) . Seasonal variation of alkaloids of *Adhatoda vasica* and detection of glycosides and N-oxides of vasicine and vasicinone .Planta Medica, 48 : 81 – 82 .

Pregl, F. (1945). Quantative Organic Micro Analysis. 4th ED. J. & Achurnil, London.

Riaz, A.; M. Arshad; A. Younis; A. Razaand and M. Hameed (2008). Effects of different growing media on growth and flowering of *Zinnia elegans* cv. Blue Point. Pak. J. Bot., 40(4): 1579-1585.

Snedecor, G.W. and W.G. Cochran (1974). Statistical Methods. 6th Ed. Iowa State Univ. Press. Ames. Iowa, USA.

Steel, R.C.D. and J.H. Torrie (1980). Principles and Procedures of Statistics 2nd Ed McGraw-Hill, Book Co., Inc., New York, U.S.A. 633 pp.

Wange, S.S. (1996). Effect of bio-fertilizers under graded nitrogen levels on carrot (*Daucus carota* L.). Plant Physiol., 10(1): 96-98.

Yadava, U. (1986). A rapid and non-destructive method to determine chlorophyll in intact leaves. Hort. Sci., 21(6): 1449–1450.

الملخص العربي
استجابة البوستاشبا الناميه في اراضي مختلفه لبعض المعاملات السماديه

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نفذت تجارب اصص بمزرعه كليه الزراعه – جامعه كفر الشيخ خلال موسمي 2014,2013 لدراسه تأثير نوعين من التربه (الطينيه والطين +الرمل بنسه 1:2 بالحجم) وبعض المعاملات السماديه [1- الكنترول (الجرعه الكامله من السماد الكيماوي (12+6+ 6جم/نبات من سلفات الامونيوم (20.5%ن), سوبر فوسفات الكالسيوم (15.5%فو$_2$ا$_5$) وسلفات البوتاسيوم (48%بو$_2$ا) علي التوالي 2- 75%من السماد الكيماوي + 5% مخلفات مزرعه من وزن التربه الجافه في القصريه 3- 50% من جرعه السماد الكيماوي +10% مخلفات المزرعه 4- 25% جرعه السماد الكيماوي +5% مخلفات المزرعه +2جم /لتر خميره جافه نشطه +200جزء فى المليون حامض الاسكوربيك 5- 5% مخلفات المزرعه +2جم /لتر خميره جافه نشطه +300 جزء فى المليون حامض الساليسليك 6- 5% مخلفات المزرعه +2 جم /لتر خميره جافه نشطه +300جزء فى المليون حامض الاسكوربيك 7- 2 جم /لتر خميره جافه نشطه +300 جزء فى المليون من كلا من حامضي الاسكوربيك والساليسليك 8- 10% مخلفات المزرعه + 2جم /لتر خميره جافه نشطه 9- 10% مخلفات المزرعه +200 جزء فى المليون من كل من حامضي الساليسليك والاسكوربيك 10- 10% مخلفات المزرعه + 1جم /لتر خميره جافه نشطه +200 جزء فى المليون من كل من حامضي الساليسليك والاسكوربيك .

ويمكن تلخيص أهم النتائج المتحصل عليها كالاتي:-

- **تأثير نوع التربه :**

1- الزراعه في التربه الطينيه أنتجت أعلى القيم لارتفاع النبات وعدد الافرع / نبات وقطر الساق الرئيسي والمساحه الورقيه للنبات والوزن الطازج والجاف للمجموع الخضري والجذري / نبات فى كلا الموسمين ما عدا ارتفاع النبات في الموسم الاول والفروق بين نوعي التربه لم تصل لمستوي المعنويه فى حاله عدد الافرع وقطر الساق الرئيسي ومساحه النبات الورقيه فى الموسم الاول وارتفاع النبات فى الموسم الثاني .

2- الزراعه في الطين + الرمل (1:2) أعطت أعلي قيم معنويه لدرجه اللون الاخضر فى الاوراق في الموسم الاول والنسبه المئويه للكربوهيدرات فى الموسمين. بينما الزراعه فى التربه الطينيه أعطت أعلى القيم للنسبه المئويه للنتروجين والفوسفور والبوتاسيوم فى الموسمين والفروق بين نوعي التربه المستخدمين لم تصل لحد المعنويه في النسبه المئويه للنتروجين والفوسفور في الموسم الثاني فقط .

- **تأثير المعاملات السماديه** :

1- نتجت أعلى قيمه معنويه لارتفاع النبات من المعامله رقم 8 فى الموسم الاول والمعامله رقم 9 فى الموسم الثاني . بينما أعلى قيم لعدد الفروع/ نبات نتجت من المعامله 2 فى الموسم الاول والمعاملات 1،2،3،9في الموسم الثاني. كذلك نتج أعلي قيم لقطر الساق الرئيسي من المعامله 4 في الموسم الاول والمعامله 3 في الموسم الثاني. سجلت أعلي قيمه للمساحه الورقيه للنبات للمعامله 3 في الموسم الاول والمعاملتين 2،3 في الموسم الثاني. بينما الوزن الطازج والجاف للمجموع الخضري والجذري نتج من المعامله 3 لكلا الموسمين.

2- التسميد بالمعامله 1 فى الموسم الاول والمعامله 2 فى الموسم الثاني انتجت أعلي قيم لدرجه اللون الاخضر فى الاوراق. بينما تطبيق المعامله 3 سبب زياده معنويه فى النسبه المئويه لكل من الكربوهيدرات والنتروجين والفوسفور والبوتاسيوم فى كلا الموسمين .

- **تأثير التفاعل بين نوع التربه والمعاملات السماديه**:

أوضحت النتائج أن الزراعه في كل من التربه الطينيه وتربه الطين + الرمل (1:2 بالحجم) والتسميد بالمعاملات المحتويه علي نسب مختلفه من السماد الكيماوي و مخلفات المزرعه أعطي أعلى القيم لصفات الخضريه والكيماويه المدروسه في معظم الحالات لكلا الموسمين.

من النتائج نوصي بزراعه شتلات البوستاشيا فى ارض طينيه والتسميد ب 50% من جرعه السماد الكيماوي الموصي بها (6+3+3 جم/نبات من سلفات الامونيوم والسوبر فوسفات الكالسيوم وسلفات البوتاسيوم علي التوالي) +10% من مخلفات المزرعه (من الوزن الجاف للتربه فى القصريه) علي أن يضاف السماد العضوي وسماد السوبر فوسفات قبل الزراعه وعند اعداد التربه للزراعه أما السماد النتروجيني والبوتاسي يقسم الي 6 جرعات متساويه تضاف الاولي بعد الزراعه بشهر والجرعات الأخري بعد الأولي بشهر بفتره زمنيه بين كل جرعه والأخري شهر.