Assiut J. of Agric. Sci., 39 (2) (143-165)

GROWTH, YIELD AND QUALITY OF HENNA (*Lawsonia alba*, Lam.) PLANT AS AFFECTED BY SOIL TYPE AND APPLICATION OF ACTIVE DRY YAEST.*

A.A.S. Abdel-Kader**; N.E.El-Keltawi*; A.A.Tawfik* and M.R.Khater**

*Hort. Dept.,Faculty of Agriculture, Assuit University

**Hort. Research Institute, A R C, Dokki, Giza, Egypt.

Abstract: This investigation was carried out at the Floriculture Experimental Farm, Faculty of Agriculture, Assiut University during the 2000/2001 and 2001/2002 seasons to study the response of henna plant to four soil types; clay loam, loamy sand, clay loam + loamy sand [1:1 by volume] and silt clay loam in addition to active dry yeast at O, 2, 4 and 8 g/l as soil drench on growth and active substances (lawsone and tannins), photosynthetic pigments, total carbohydrates, as well as nitrogen, phosphorus, potassium and protein contents in leaves. The obtained data showed that growing henna plants in a clay loamy soil or its mixtures with loamy sand soil pronouncedly improved plant growth characteristics, and leaf contents of lawsone, tannins, total carbohydrates, photosynthetic pigments, nitrogen, phosphorus and potassium. Meanwhile, the silt clay loamy soil showed little effect on most vegetative growth parameters and leaf contents. Likewise, loamy sand soil had similar effect on leaf content of tannins, nitrogen and protein compared to tested soil mixtures. Drenching yeast to the soil at the high or moderate level resulted in highly significant increments in most studied vegetative growth parameters and leaf analysis compared to that in the low one. The most effective treatment was drenching 4 g/l active yeast into clay loamy soil for all studied parameters. Meanwhile, henna plant can grow well with a slight improvement in their leaves production when biweekly drenched with active dry yeast at 8 g per litre. Thus, It could be recommended to grow henna plants in clay loamy soil and /or mixing it with the other soil types to enhance their qualities to be proper for growing henna. Drenching active dry yeast proved to be a beneficial, safe and cheap source for improving both quality (Lawsone & Tannins) and quantity of henna crop grown in any used soil type under this experiment.

Keywords: Henna, Active dry yeast, Lawsone, Tannins, Growth, Quality, Soil type

*Submitted to the 2nd Conference Of Junior Scientists, Fac. of Agric. Assiut Univ. May.,6,2008.

Introduction

Global warming and shortage of water resources in the arid regions, hot and dry weather with prolonged droughts favour high quality of henna. So, henna can grow successfully under Egyptian conditions.

Henna (*Lawsonia alba*, Lam.) plant is a handsome shrub which belongs to family Lythraceae used as hedges or as ornamental specimens for its white fragrant flowers, besides, multi medicinal uses and cosmetics from the earliest times. It is a best known shrub for the ground leaves traditionally used to develop a black, brown, orange or red colouring to hair, feet and toes or nails. As a medicinal plant, henna has been used for astringent, anti hemorrhagic, intestinal anti-euplastic, cardio-inhibitory and sedative effects. It has been used as folk remedy against amoebiasis, headache, jaundice and leprosy. Henna extracts show anti-microbial activity as antibacterial and anti-fungal; Pratibha and Korwar (1999).

Henna grows mainly along watercourses and semi aired regions and is adapted to a wide range of conditions. Dry, hot and iron-bearing soils produce henna with high lawsone (dye) level. On the contrast, fertile and moist soils produce henna with lower lawsone level.

The basic objective of henna growers is to get higher production through proper management practices and production technology. The final decision in export market for henna price depends on the quality of the products to satisfy the requirements of the foreign buyers, the directorate of marketing and inspection. Therefore, the world increasing demand for henna commodity as dye and/or drug for medicinal uses and cosmetics needs for improving its quality and yield.

The recent knowledge on the improvements resulted from applying active dry yeast on horticultural crops attracted us to carry out this experiment, particularly; it is safe and a natural material suitable for biodynamic agriculture. The possibility of using active dry yeast as a spray or as a soil drench encourages the researchers to test its effect on various crops under different conditions. On medicinal and aromatic crops, Ahmed *et al.* (1998) on roselle, Ahmed (1998) on marjoram, Ali (2001) on calendula and Badran *et al.* (2002) studied the foliage sprays of yeast. Meanwhile, Ahmed (2004) tested the yeast as soil drench and foliage spray on chamomile in certain concentrations and concluded that soil drench is easier and better for application to enhance the yield and quality compared to foliage sprays.

Thus, the present study was conducted to investigate the effect of different concentrations of active dry yeast drenching in four different soils on growth, yield and quality of henna plant. This work was extended to determine the photosynthetic pigments, carbohydrates, nitrogen, phosphorus and potassium contents.

Materials and Methods

The present study was carried out at the Floriculture Experimental Farm, Faculty of Agriculture, Assiut University, Assiut, Egypt, during the two consecutive seasons of 2000/2001 and 2001/2002. The objectives of this work aimed to study the responses of henna (*Lawsonia alba*, Lam.) plant to grow in four different soils and application of active dry yeast (*Saccharomyces cerevsiae*).

1- Materials:

a- Plant Material:

The mature stem cuttings (20 cm length with 7-8 nodes) from the local cultivar of *Lawsonia alba*, Lam.(syn. *L. inermis*, L.) were used in this study. The plant materials were obtained from the Horticulture Experimental Farm, Faculty of Agriculture, South Valley University, Qena, Egypt.

b- source of yeast:

A strain of dry yeast (*Saccharomyces cerevisiae*), was obtained from El-Amal group for export and import, Egypt, and used as a soil drench. Yeast dry matter was 95% and the live cells were 11.6×10^9/g.

c. Nature of Soil used:

Four soils were used and their properties are shown in Table (1). These soils were; clay loam (CL), loamy sand (LS), clay loam + loamy sand [1:1 by volume] and silt clay loam (SCL).

2 - Methods:

A. Practices and experimental design:

On the 24th of April, 2000 five cuttings of henna were inserted in pots 25 cm diameter filled with the four different soils as previously mentioned, then irrigated. After two months, two plants were kept per pot. A split plot in RCBD with three replicates was followed in this experiment. The main plots represented soils. Each main plot was divided into four sub-plots representing active dry yeast levels as follows:

1 -Tap water alone without yeast (as a control).

2 -Yeast solution at 2 g/l of water.

3 -Yeast solution at 4 g/l of water.

4 -Yeast solution at 8 g/l of water.

Each sub-plot contained six pots

The yeast solution was prepared by mixing raw dry yeast with sugar at the same concentrations of yeast (O, 2, 4 and 8 g/l) in hot water (about 35°C) and kept at room

temperature (25±1°C) for 12 hr. to allow the release of active substances according to **Skoog and** Miller (1957)

The levels of active dry yeast were applied as a soil drench at rate of 50 ml/plant for each one, added three times for each cut at two weeks interval after a week from April and August for first and second cuts, respectively in both seasons. All other horticultural practices for henna growing were done whenever needed as usual.

B- Data Recorded:

Harvesting was carried out in two cuts every season, the first cut was on the last week of July and the second one was on the last week of November. The cutting was performed for henna plants at 20 cm from the soil surface when most of branches were painted with brown colour then, the leaves of every plant were individually separated from the branches and air dried in shade at room temperature (about 25°C) then, packed in paper bags. For both seasons and both cuts, the following data were recorded:

a. Vegetative Growth and yield Studies:

Ten plants were selected at random from each sub-unit to measure the following parameters:

1 -Plant height (cm)

2 -Number of main branches per plant

3 -Number of lateral branches on main branch

4 -Branch diameter (cm)

5 -Fresh and dry weights of leaves (g/plant)

6 -Fresh and dry weights of branches (g/plant)

7 -Leaf : branch ratio: It was calculated by dividing the dry weight of leaves on the dry weight of their branches.

b. Active substances:

Lawsone and tannins are the main active substances in henna leaves. Lawsone (2-hydroxy,1,4-naphthoquinone) is mainly responsible for the colour development in leaves of henna.

1. Lawsone pigment content: was determined in the air dried henna leaves according to Pratibha and Korwar (1999). Lawsone yield in g per plant: was calculated by multiplying leaves dry weight in gram per plant by its lawsone percentages.

2. Tannins content: was determined in fine powdered henna leaves according to modified Vanillin-HCl method of Price *et al.* (1978) as described by Babiker and El-Tinay (1992). Tannins yield (g/plant) was calculated by multiplying dry weight of leaves in gram per plant by its tannins percentage.

c. Chemical analysis:

1. Soil analysis:

Physico-chemical analyses of the used soils were done according to the methods described by Black *et al.* (1982) and Jackson (1973). Some chemical analysis of farmyard manure mixtures with soil were done according to Jackson (1973).

2- Photosynthetic pigments:

Samples of fresh leaves were taken at random to determine chlorophyll "a", "b" and carotenoids. The spectrophotometric method recommended by Metzner *et al.* (1965) was applied.

3- Total carbohydrates percentage:

Total carbohydrates including poly-saccharides in dry leaves of each experiment unit were colorimetrically determined with the anthrone sulphuric acid method; (Fales, 1951).

4- Protein percentage was estimated by multiplying nitrogen percent by 6.25.This was based on the assumption that the protein contain 16% nitrogen, according to the method by Ranganna (1978).

5- Elemental analysis:

The extraction was made on a known weight of the dried leaves sample (0.5 g). The wet digestion procedure was performed according to Jackson (1973) to determine the following minerals:

a) Total nitrogen was determined by using semi-micro-kjeldahl method according to Black *et al.* (1982).

b) Phosphorus percentage was colorimetrically determined following Jackson (1973). The developed blue color was measured at wave length of 660 nm using spectrophotometer.

c) Potassium percentage was determined using a flame photometer as described by Jackson (1973).

C. Statistical analysis:

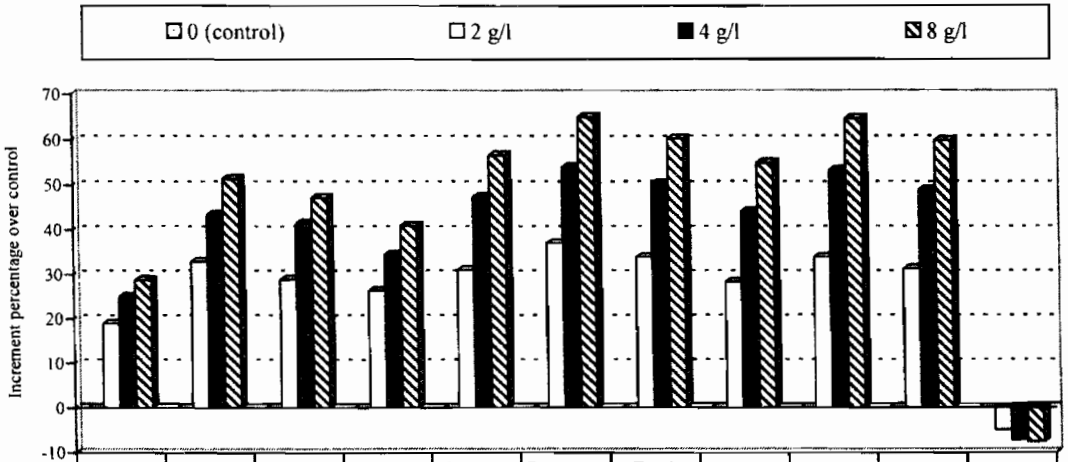
Data were subjected to statistical analysis using "F" test according to Snedecor and Cochran (1973) and L.S.D. value for comparisons according to Gomez and Gomez (1984).

Results and Discussion

The effect of soil types:

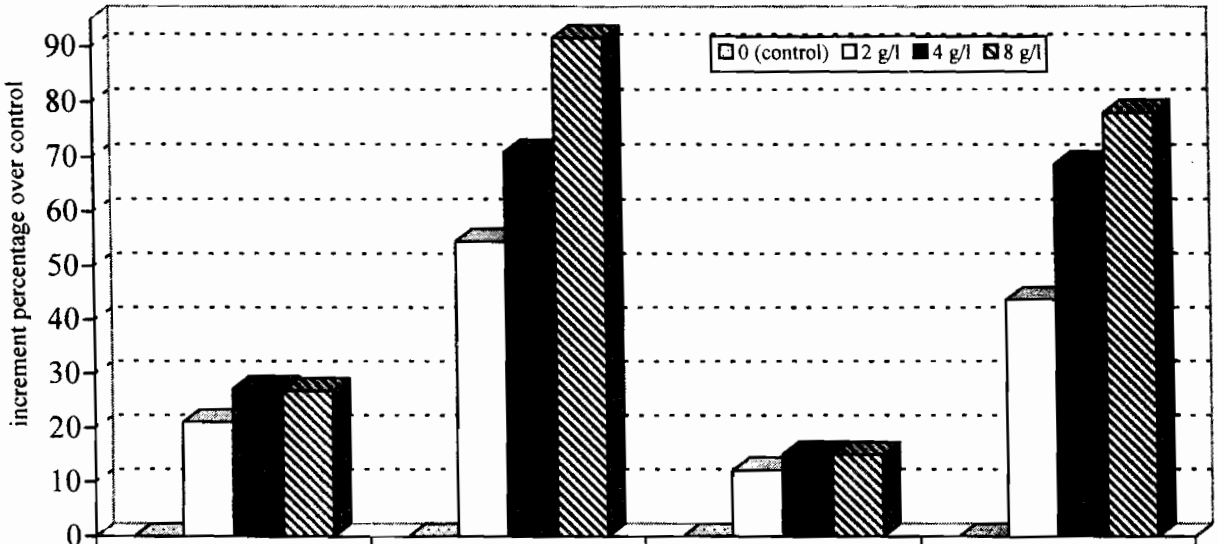
The present results on henna grown in clay loam, loamy sand, clay loam + loamy sand and silt clay loamy soils on growth parameters and leaf analysis compared to their grand means of both seasons are illustrated in Fig. (1 and 2), respectively. It is clear that clay loamy soil is the best type followed by its mixtures with loamy sand for growing henna to produce leaves with high contents of both active ingredients (lawsone and tannins). Although, the reduction in total dry weight of plant ranged from 4.8 to 8.96% for loamy sand and silt clay loam and

Fig. (1): The general effect of soil types on henna growth as increment or decrement percentages of their grand means in both seasons.



	Plant height	No branches/ plant	No lateral branches	Branch diameter	Leaves fresh wight	Branches fresh wieght	Total fresh wieght	Leaves dry wieght	Branches dry wieght	Total dry wieght	Leaf:branch ratio
0 (control)	0	0	0	0	0	0	0	0	0	0	0
2 g/l	18.9	32.95	28.85	26.32	31.03	37.03	33.88	28.32	33.92	31.28	-4.91
4 g/l	24.95	43.45	41.47	34.5	47.44	53.98	50.3	44.13	53.3	48.93	-7.13
8 g/l	28.72	51.42	47.24	40.94	56.59	65.06	60.29	54.91	64.74	59.91	-7.62

Fig. (2): The general effect of soil types on leaf contents of henna as increment or decrement percentages of their grand means in both seasons.



	lawsone %	lawsone/plant	taninns %	taninns/plant
0 (control)	0	0	0	0
2 g/l	21.09	54.55	12.13	43.75
4 g/l	27.23	70.91	15.14	68.75
8 g/l	26.87	91.64	15.03	78.13

increased leaf: branch ratio with 2.1%. It did not make difference in growing henna, but the active substance percentage were slightly reduced (6.4 – 9.1 %). Therefore, clay loamy soil still on the top for its physical and chemical properties as prevailing conditions for growing henna as appeared in Table (1). On the other hand Ebers Papyrus Parmacopoeia stated that dry, hot, iron-bearing soils produce henna with high lawsone level. Although, henna plant prefers sandy soil it can tolerate clay and stony and sand soil.

The effect of active dry yeast applications:

Results showed that the high concentration of yeast (8 g/l) is the best treatment for increasing the plant height, number of main and lateral branches with high diameter and their weights as well as fresh and dry weight of leaves per plant. Consequently, the total plant dry weight as final resultant of plant growth was increased by 60 % over the control. Meanwhile, the yeast treatments reduced the leaf : branch ratio. It means that the yeast drench is more effective for producing branches as represents 64.7 % increment over the control, but that was 54.9% for leaves as shown in Fig. (3). This was noticed by El-Sallami (2003) on Leucaena seedlings. Similar results also were obtained concerning leaves analyses for active ingredients, photosynthetic pigments, carbohydrates and N, P, K contents as illustrated in Figs. (4, 5 and 6). It was noticed by other investigators, as Ahmed *et al.* (1998); Ahmed (2004); El-Sayed *et al.* (2002); Naguib and Khalil (2002) and Al-Qadasi (2004) on marjoram, chamomile, coriander, black cumin and sweet basil, respectively. This could be explained to various ingredients in yeast exudates as reported by Larson *et al.* (1962), Ferguson *et al.* (1987) and Ahmed *et al.* (1997) like vitamin B and natural growth hormones.

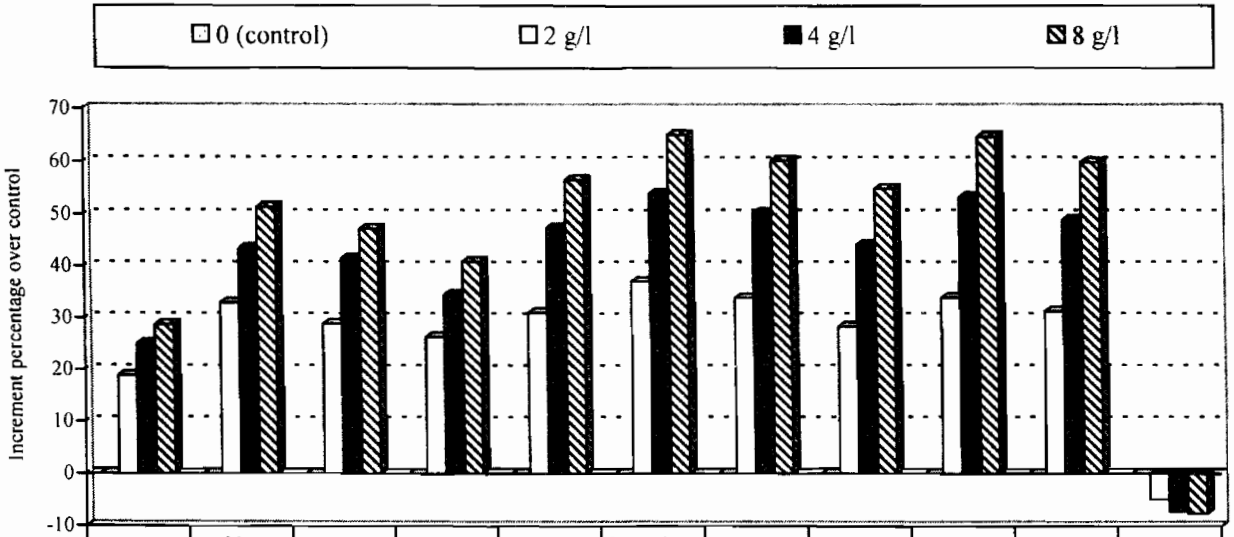
The effect of yeast and soil types interactions:

Concerning the combined effects of the yeast and soil types, Fig. (7) revealed that the economical parameters as the main leaf henna production were favourably responded to increasing the applied concentration of yeast up to 8 g/l into clay loamy soil and its mixture with loamy sand. The maximum values were 31.5 and 59.4 grams for leaves and total plant fresh weights, respectively. However, the branches fresh weight value was 27.9 g/plant. This means that yeast application improved leaves fresh weight more than branches (31.5 and 27.91grams, respectively), but on dry weight it was 12.2 and 13.8 g/plant. This difference is negligible and proved that yeast application is the favourable treatment at 8 g/l soil drench into any soil type to improve leaf formation. Also, it was noticed that

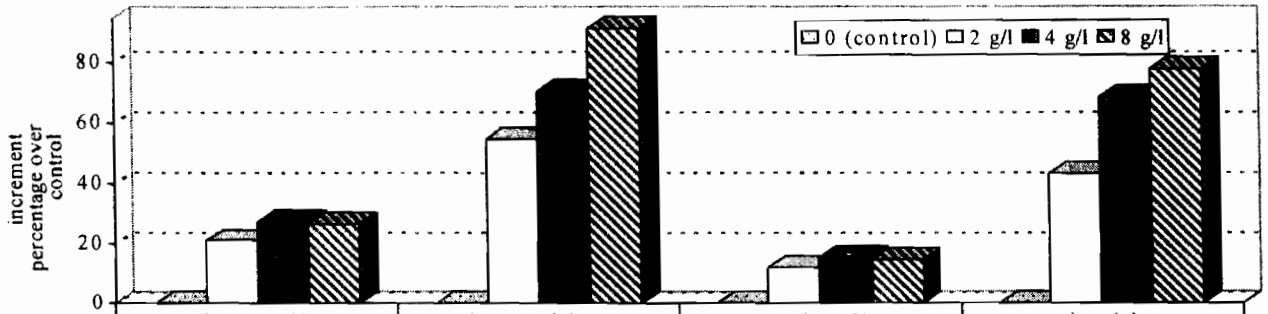
Table (1): Some physical and chemical characteristics of the used soil types before planting the experiment.

Particle size distribution (%)				pH (1:2.5) soil suspension	E.C. dS/m (1:5) soil extract	Total $CaCO_3$ %	Organic matter %	Soluble ions (meq/l.) [soil paste]								Total N %	Total P %	Total K %
								Anions				Cations						
Sand	Silt	Clay	Texture grade					Cl^-	CO_3^-	HCO_3^-	SO_4^-	Ca^{++}	Mg^{++}	Na^+	K^+			
33.50	22.30	44.20	Clay loam (CL)	8.50	0.67	1.60	1.27	2.01	-	3.89	1.48	2.03	0.31	3.06	1.83	0.28	0.164	0.221
78.40	11.10	10.50	Loamy sand (LS)	8.37	4.68	0.98	0 13	0.67	-	2.33	47.55	44.75	0.21	3.67	1.83	0.16	0.037	0.044
Mixture of CL+LS (1.1 v/v)				7.67	2.92	1.23	0.47	0.77	-	2.66	28.16	24.17	0.33	4.89	2.09	0.23	0.099	0.155
20.80	55.10	24.10	Silt clay loam	7.91	0.54	0.74	1.07	3.12	-	2.17	0.63	1.71	0.71	2.27	1.14	0.21	0.144	0.111

Fig. (3): General means of increment percentages over control of vegetative characteristics of henna growth as affected by active dry yeast application.

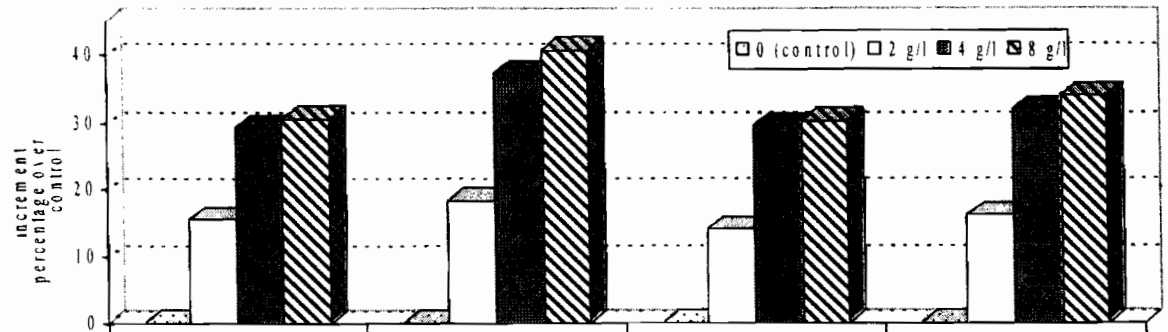


	Plant height	No branches/ plant	No lateral branches	Branch diameter	Leaves fresh wight	Branches fresh wieght	Total fresh wieght	Leaves dry wieght	Branches dry wieght	Total dry wieght	Leaf:branch ratio
0 (control)	0	0	0	0	0	0	0	0	0	0	0
2 g/l	18.9	32.95	28.85	26.32	31.03	37.03	33.88	28.32	33.92	31.28	-4.91
4 g/l	24.95	43.45	41.47	34.5	47.44	53.98	50.3	44.13	53.3	48.93	-7.13
8 g/l	28.72	51.42	47.24	40.94	56.59	65.06	60.29	54.91	64.74	59.91	-7.62



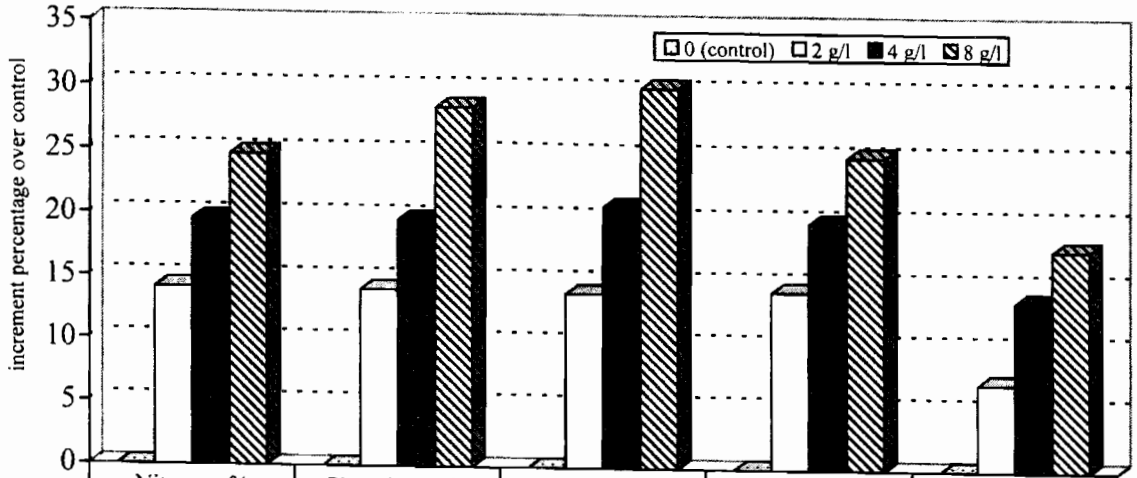
	lawsone %	lawsone/plant	taninns %	taninns/plant
0 (control)	0	0	0	0
2 g/l	21.09	54.55	12.13	43.75
4 g/l	27.23	70.91	15.14	68.75
8 g/l	26.87	91.64	15.03	78.13

Fig. (4): General means of increments percentage of active substances over control as affected by active dry yeast application.



	Chlorophyll a	Chlorophyll b	Carotenoids	Total
0 (control)	0	0	0	0
2 g/l	15.71	18.46	14.1	16.12
4 g/l	29.41	37.43	29.76	32.1
8 g/l	30.69	40.84	30.39	34.09

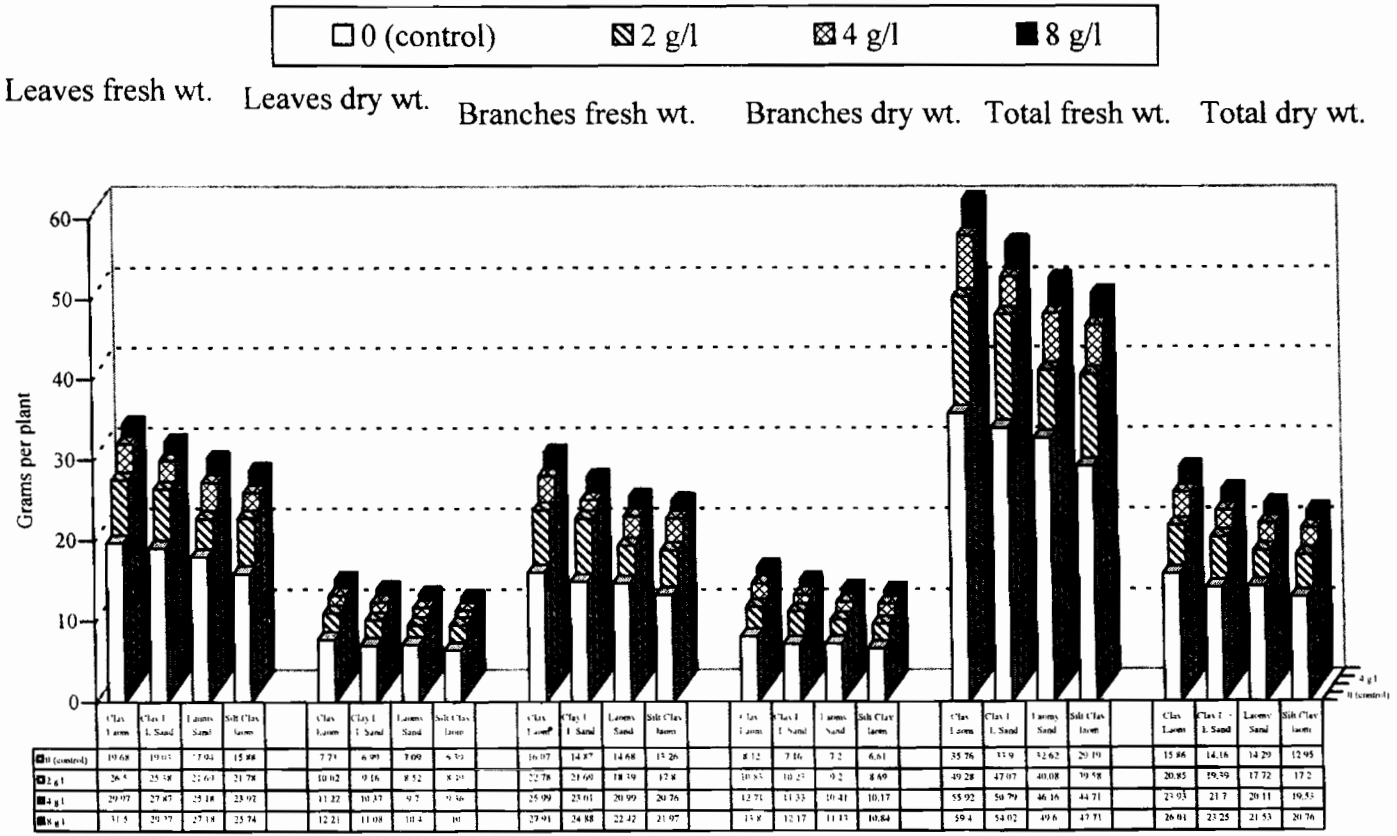
Fig. (5) General means of increments percentage of leaf photosynthetic pigments over control as affected by active dry yeast application.



	Nitrogen %	Phosphorus %	Potassium %	Protein %	Carbohydrates %
0 (control)	0	0	0	0	0
2 g/l	14.13	14.05	13.88	14.17	6.87
4 g/l	19.57	19.62	20.84	19.65	13.45
8 g/l	24.7	28.45	30.09	24.85	17.6

Fig. (6): General means of increments percentage in leaf content of N, P, K, protein and carbohydrates over control as affected by active dry yeast application.

Fig. (7): General means of the interaction effects between soil types and active dry yeast levels on vegetative growth of henna.



there are accumulative effects of yeast and soil type on growing henna as shown in Fig. (7).

With regard to active substances (lawsone and tannins) in leaves, photosynthetic pigments, carbohydrates and N, P, K contents, the combined effects of drenching active dry yeast into growing media of henna are illustrated in Figs. (8, 9, 10 and 11). The present results indicated that henna plant responded variably to the growing soils. However, it was positively, enhanced with increasing the content ratios of applied yeast, but in decreased effect per microorganism count. The soil type keeps its effect on each determined parameter. The most effective treatment is drenching 4 g/l active dry yeast into clay loamy soil for all studied parameters regardless the cuts and seasons. Meanwhile, henna can grow well with a slight difference in their leaves production when biweekly drenched with active dry yeast at 4 g or 8 g per litre. This is true for the other economical parameters as lawsone and tannins as well as leaves contents of pigments, carbohydrates and NPK. A slight effect with insignificant differences was noticed in leaf : branch ratio. These effects are in harmony with El-Sallami (2003) on Leuceanea; Ahmed *et al.* (1998) on roselle and Badran *et al.* (2002) on marjoram plants.

The yeast × soil interactions were significant for parameters of leaf phosphorus and potassium. It means that the secretion of yeast exudates may be depend on the soil composition and it may be reflected on releasing phosphorus and potassium to become available for absorption by henna plants. Accordingly, phosphorus, potassium and tannins were influenced. This was in agreement with the suggestion with Ali (2001) on pot marigold; El-Sayed *et al.* (2002) on coriander and El-Sallami (2003) on Leuceanea

Conclusion

Finally, it seems to lay a stress in this conclusion upon the economic characteristic for the production of henna plants as medicinal and/or dye commodity, saving the other parameters for the scientific information. Under the present conditions of this experiment, it could be concluded that:

- It is recommended to grow henna plants in clay loamy soil and /or mixing it with the other soil types under investigation to enhance their qualities to be proper for growing henna.

- Drenching active dry yeast proved to be a beneficial, safe and cheap source for improving both quality and quantity of henna crop grown in any used soil type under this experiment.

- The most effective treatment is drenching 4 g/l active yeast into

Fig. (8): General means of the interaction effects between soil types and active dry yeast levels on active substances and leaf: branch ratio.

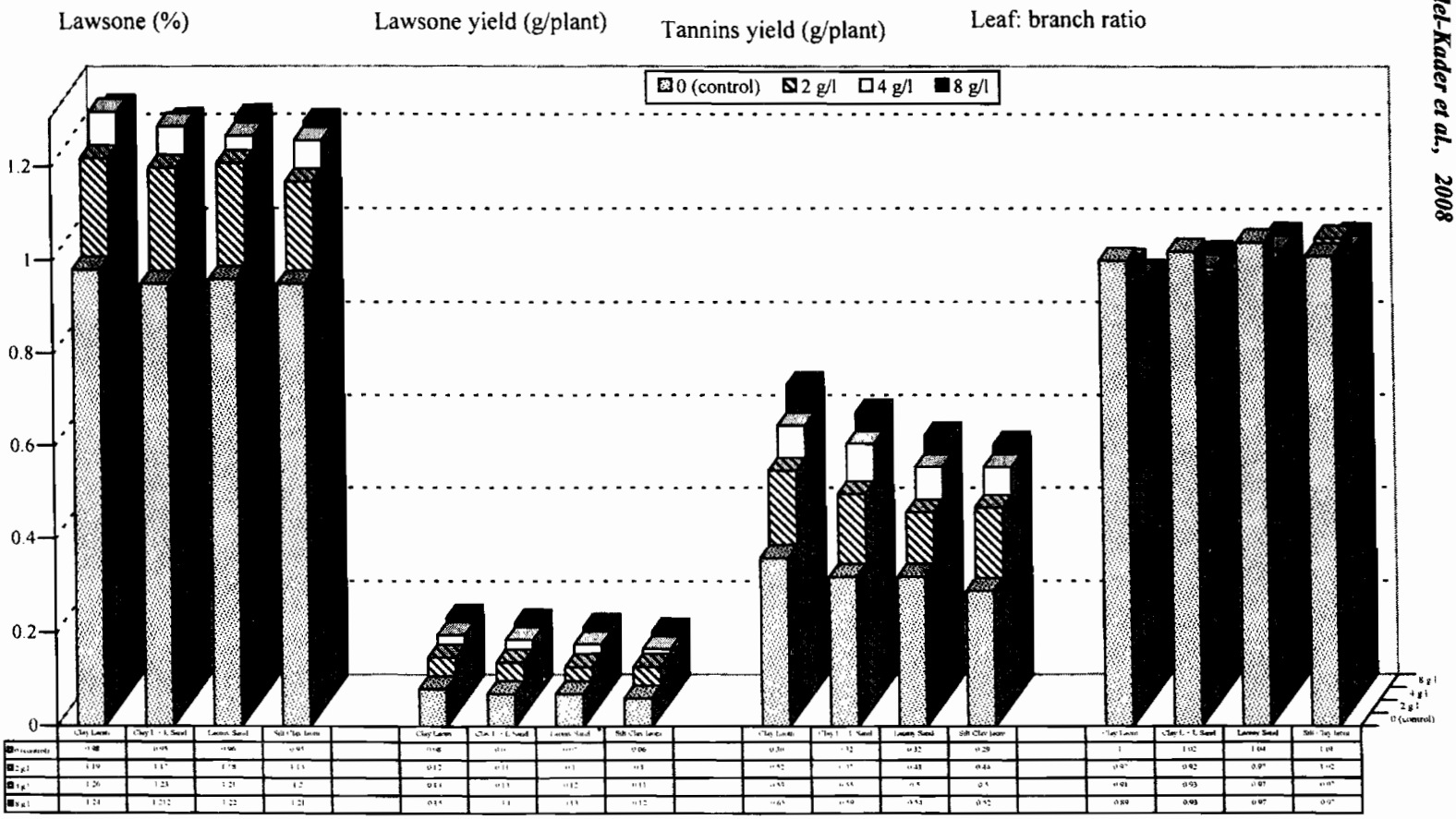


Fig. (9): General means of the interaction effects between soil types and active dry yeast levels on photosynthetic pigments content.

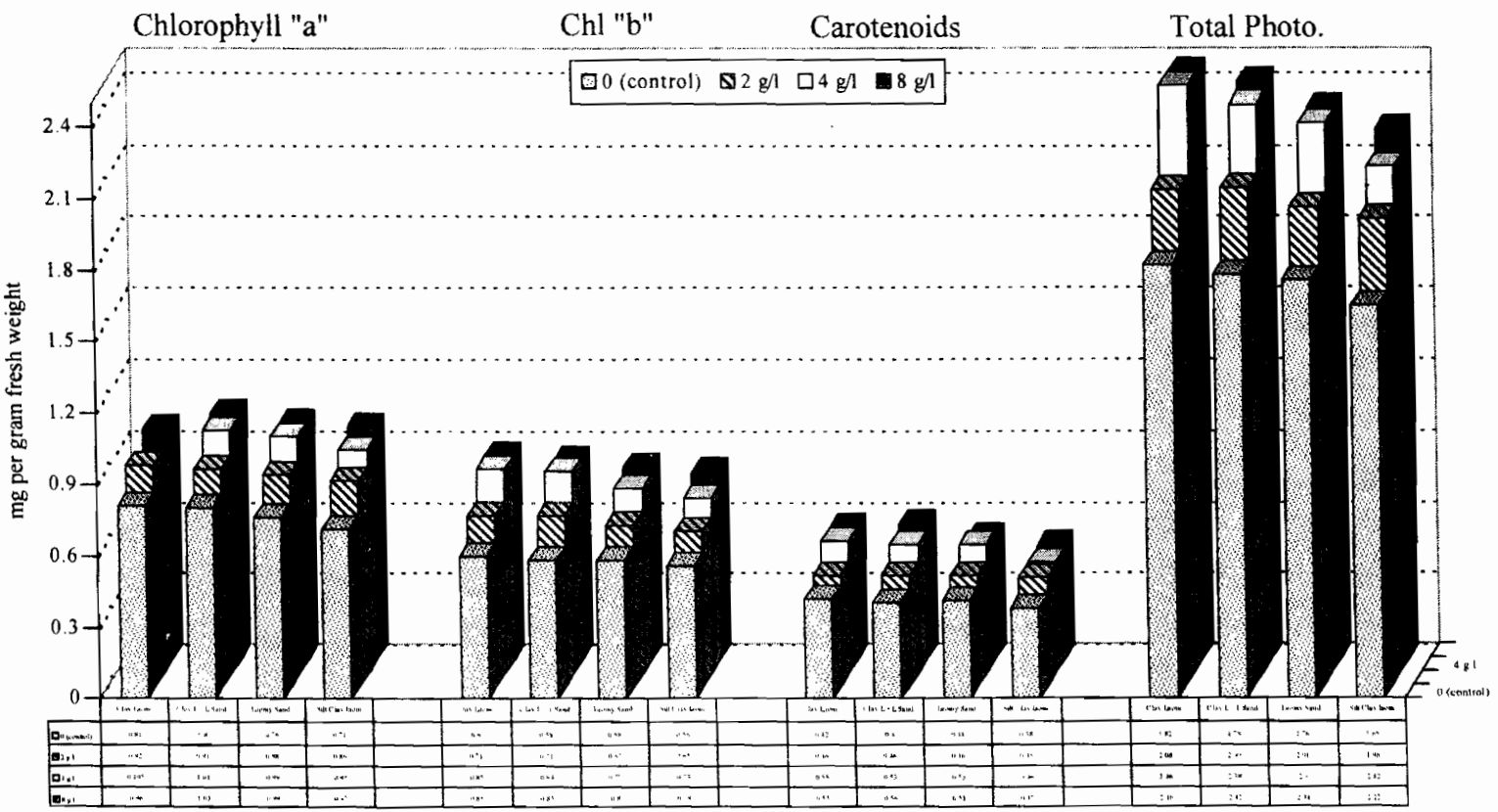
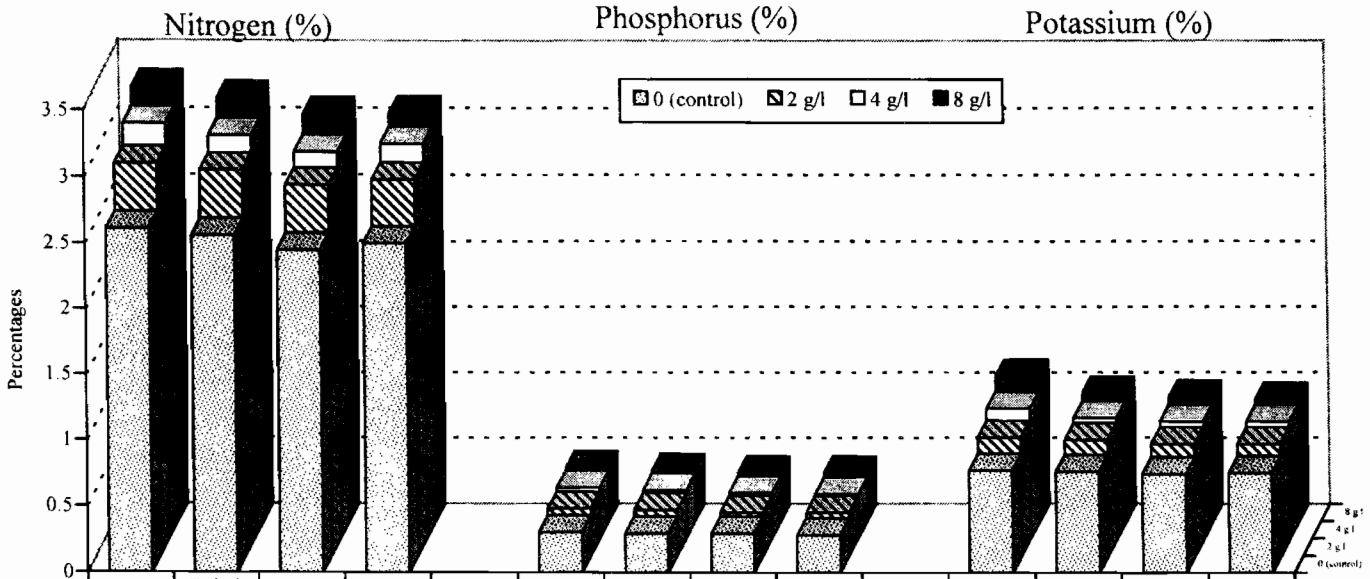
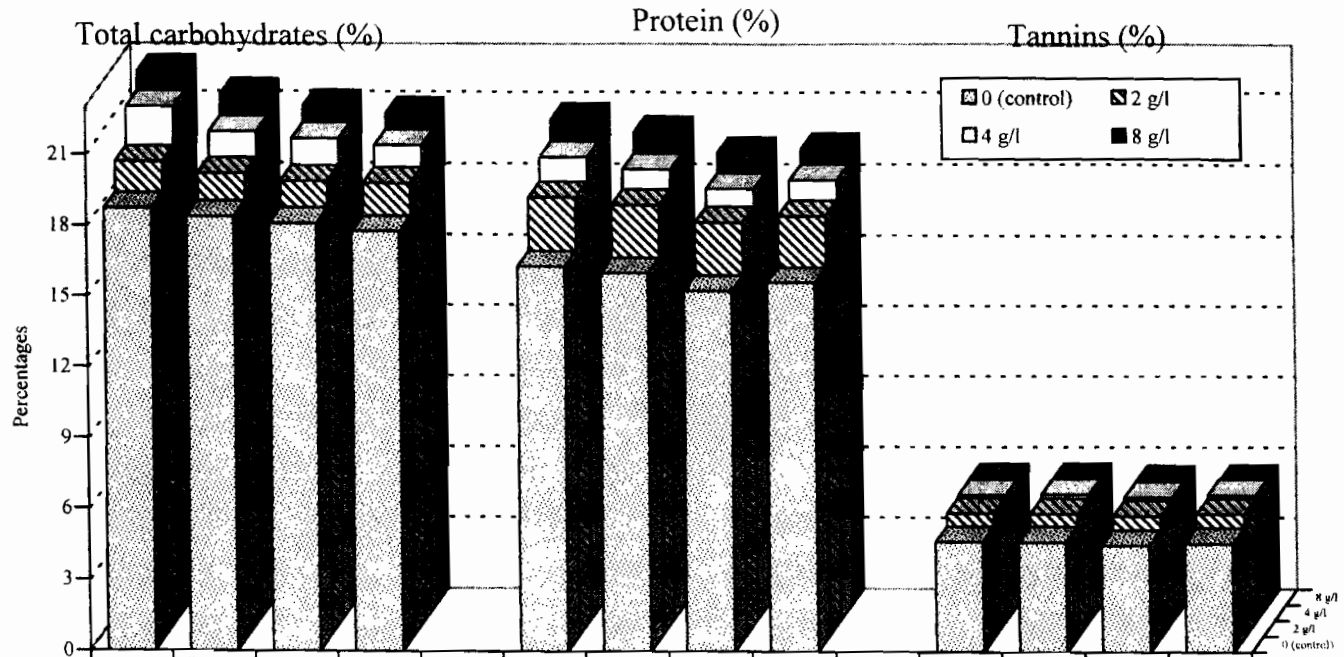


Fig. (10): General means of the interaction effects between soil types and active dry yeast levels on Leaf N, P and K percentages.



	Clay Loam	Clay L. + L. Sand	Loamy Sand	Silt Clay loam		Clay Loam	Clay L. + L. Sand	Loamy Sand	Silt Clay loam		Clay Loam	Clay L. + L. Sand	Loamy Sand	Silt Clay loam
0 (control)	2.61	2.56	2.45	2.5		0.3	0.29	0.29	0.28		0.77	0.76	0.74	0.75
2 g/l	2.97	2.92	2.81	2.85		0.35	0.34	0.32	0.32		0.89	0.87	0.84	0.84
4 g/l	3.14	3.05	2.93	2.99		0.38	0.36	0.34	0.33		0.98	0.91	0.88	0.88
8 g/l	3.28	3.2	3.08	3.09		0.4	0.38	0.36	0.36		1.1	0.97	0.94	0.92

Fig. (11): General means of the interaction effects between soil types and active dry yeast levels on carbohydrates, protein and tannins.



	Total carbohydrates (%)				Protein (%)				Tannins (%)			
	Clay Loam	Clay L + L Sand	Loamy Sand	Silt Clay loam	Clay Loam	Clay L + L Sand	Loamy Sand	Silt Clay loam	Clay Loam	Clay L + L Sand	Loamy Sand	Silt Clay loam
0 (control)	18.74	18.39	18.11	17.78	16.31	16.02	15.27	15.64	4.64	4.62	4.48	4.57
2 g/l	20.04	19.56	19.23	19.15	18.57	18.25	17.54	17.81	5.18	5.15	5.06	5.15
4 g/l	21.68	20.64	20.36	20.08	19.6	19.09	18.29	18.66	5.29	5.32	5.19	5.29
8 g/l	22.5	21.52	21.05	20.74	20.51	19.98	19.14	19.3	5.31	5.3	5.21	5.23

clay loamy soil for all studied parameters. Meanwhile, henna plant can grow well with a slight improvement in their leaves production when biweekly drenched with active dry yeast at 8 gm per litre.

References

Ahmed, E.T. 1998. Influence of spraying active dry yeast on growth and volatile oil content of *Majorana hortensis*, Moench plants. Proc. 2nd Conf. Ornam. Hort., Ismailia, Egypt, October, 24-26.

Ahmed, F.F.; A.M. Akl; F.M. El-Morsy and M.A. Ragab 1997. The beneficial effect of biofertilizer on Red Roomy grape vine (*Vitis vinifera*, L.). The effect on growth and vine nutritional status. Annals of Agric. Sci. Moshtohor, 35, (1) : 489-495.

Ahmed, G.A. 2004. Influence of active dry yeast addition on growth and volatile oil content of chamomile (*Matricaria recutita*). Assiut Jour. Agric. Sci., 35 (3).

Ahmed, S.K.; E.O. El-Ghawas and A.F. Aly. 1998. Effect of active dry yeast and organic manure on roselle plant. Egypt. J. Agric. Res., 76 (3): 1115-1143.

Ali, A.F. 2001. Response of pot marigold (*Calendula officinalis*, L.) plants to some rock phosphate sources and yeast. Proceeding of the Fifth Arabian Horticulture Conference, Ismailia, Egypt, March 24-28, 31-42.

Al-Qadasi, A.S.S. 2004. Effect of biofertilization on *Ocimum basilicum* L. plant. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Babiker, E.E. and A.H. El-Tinay. 1992. Effect of alkali on tannin content and in *vitro* protein digestibility of sorghum cultivars. Food Chem., 45 (1): 55-60.

Badran, S.F.; A.A. Zayed and M.A. Hussain. 2002. Response of vegetative growth and yield of herb of *Majorana hortensis* plants to potassium fertilization and dry yeast. Proc. 2nd Conference of Sustainable Agricultural Development, Fayoum Faculty of Agriculture, May 8-10.

Black,C.A.; D.D. Evans; J.I. Nhite; L.E. Ensminger and F.E. Clark. 1982. Methods of Soil Analysis. J. Amer. Soc. Agron. Inc. Madison, Wisconsin U.S.A.

El-Sallami, I.H. 2003. Growth response of *Leucaena leucocephala* Lin. seedlings to soil type, organic manure and yeast. Assiut J. of Agric. Sci., 34 (1): 67-98.

El-Sayed, A.A.; M.K. Ali and M.H.I. Abd El-Gawad. 2002. Response of coriander plants to

some phosphorus, zinc and active dry yeast treatments. Proc. 2nd Inter. Conf. Hort. Sci., Kafr El-Sheikh. Tanta Univ., Egypt, Sept. 10-12; 434-446.

Fales, F.W. 1951. The assimilation and degradation of carbohydrates by yeast cells. J. Bio. Chem., 193: 113-124.

Ferguson, J.J; W.T. Avigen; L.H. Allen and K.E. Koch. 1987. Growth of CO_2 enriched sour orange seedlings treated with gibberellic acid and cytokinins. Proc. Florida State Hort. Soc., 99: 37-39.

Gomez, K.A. and A.A. Gomez. 1984. Statistical Procedures for Agricultural Research, 2nd ed., John Wily, NY. 680 pp.

Jackson, M.L. 1973. Soil Chemical Analysis. Prentice-Hall. Inc. Englewood, Cliffs, U.S.A.

Larson, P.; A. Hrbo; S. Kalangson and T. Ashain. 1962. On the biogenesis of some compounds in Acetobacter xyliam. Physiol. Plant, 15: 552-565.

Metzner, H.; H. Ran and H. Senger. 1965. Untersuchungen Zur Synchronisierbarkeit einzelner. Pigment-mangel mutanten von Chlorella. Planta, 65: 186-194.

Naguib, N.Y. and M.Y. Khalil. 2002. Studies on the effect of dry yeast, thiamine and biotin on the growth and chemical constituents of black cumin (*Nigella sativa*, L.). Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 10 (3): 919-937.

Pratibha, G. and G.R. Korwar. 1999. Estimation of lawsone in henna (*Lawsonia inermis*). Journal of Medicinal and Aromatic Plant Science, 21: 658-660.

Price, M.L.; V.S. Scogoc and L.G. Butler. 1978. A critical evaluation of the vanillin reaction as an assay for tannin in sorghum grain. J. Agric. Food Chem., 26: 12-14.

Ranganna, S. 1978. Manual of Analysis of Fruit and Vegetable Products. Tata McGraw-Hill Publishing Company. Limited New Delhi, Second Reprint, 634 pp.

Skoog, F. and C.O. Miller. 1957. Biological Action of Growth Substances. Cambridge Univ. Press, Camb., 200.

Snedecor, G.W. and W.G. Cochran. 1973. Statistical Methods. Sixth Edition, Iowa State Univ., Press, Ames., Iowa, USA.

النمو والمحصول وجودته في الحناء وتأثره بنوع التربة وإضافة الخميرة الجافة النشطة

عاطف عبده سيد عبد القادر**، نعيم عيسى القلتاوى* ، عزه عبد العزيز توفيق* ، ومرتضى رضا خاطر**

*قسم البساتين ــ كلية الزراعة ــ جامعة أسيوط

**قسم بحوث النباتات الطبية والعطرية ــ معهد بحوث البساتين ــ مركز البحوث الزراعية

تعتبر مصر واحدة من البلدان الهامة المنتجة لمحصول الحناء ، فهى محصول مناسب تحت الظروف المصرية خاصة فى ظل نقص مصادر المياه وارتفاع درجة الحرارة العالمى خاصة فى المناطق الجافة ونصف الجافة مثل مصر مما يشجع علي زراعتها في الأراضي القاحلة تحت ظروف الإجهاد البيئي دون منافسة للحاصلات الزراعية الأخري. والطلب العالمى المتزايد على الحناء كصبغة نباتية ثابتة او لأغراض التزيين والتجميل او كعقار طبى له استخدامات متعددة يحتاج منا العمل على تعظيم المحصول وتحسين جودته كى يلائم مواصفات التصدير واحتياجات الاسواق.

لذلك اجريت تلك الدراسة بالمزرعة البحثية لقسم البساتين – كلية الزراعة – جامعة أسيوط خلال موسمي 2001/2000 و 2002/2001 في أصص فخارية قطر 25 سم لدراسة استجابة نبات الحناء للنمو فى أربعة أنواع مختلفة من التربة ولإضافات الخميرة الجافة النشطة (كإضافة للتربة) والتي يمكن أن تحسن إنتاج المحصول وجودته. وقد صممت التجربة بنظام القطاعات العشوائية المنشقة لمرة واحدة مع استخدام ثلاث مكررات حيث اشتملت الوحدات الرئيسية علي أنواع التربة وهي التربة الطميية الطينية ، الرملية الطميية وخليطيهما بنسبة 1:1 حجماً إلي جانب التربة السلتية الطميية الطينية. كما اشتملت الوحدات المنشقة علي مستويات إضافة الخميرة وهي 2 ، 4 ، 8 جرام/لترماء إلي جانب معاملة الكنترول (بدون خميرة). وقد أضيفت الخميرة الجافة النشطة إلي التربة بمعدل 50 مل/نبات كل أسبوعين وبواقع ثلاث مرات لكل حشة ابتداءً من نهاية الأسبوع الأول من شهري أبريل وأغسطس للحشة الأولي والثانية علي التوالي في الموسمين . أخذت حشتين في كل موسم ، الأولي كانت في شهر يوليو بينما أخذت الثانية في شهر نوفمبر، وأخذت قياسات النمو الخضري وحللت الأوراق للمواد الفعالة مثل (اللوسون والتانينات) والكربوهيدرات الكلية وصبغات التمثيل الضوئي والتركيب المعدني من النيتروجين والفوسفور والبوتاسيوم. وحللت البيانات إحصائياً ،

وفيما يلى أهم النتائج المتحصل عليها :

ــ أعطت التربة الطميية الطينية أو خلطها بالتربة الرملية الطينية بصفة عامة أفضل النتائج بالنسبة لمعظم قياسات النمو الخضري مقارنة بالنوعين الآخرين من التربة (الرملية الطميية والسلتية الطميية الطينية) بينما لم تكن هناك فروق معنوية واضحة في معظم قياسات النمو الخضري بين زراعة نباتات الحناء في التربة الرملية الطميية والتربة السلتية الطميية الطينية. غير أن التربة السلتية الطميية الطينية أظهرت أقل تأثير علي صفات النمو الخضري. كذلك كانت التربة الطميية الطينية يليها خليطها بالتربة الرملية الطميية أكثر فاعلية في زيادة محتوي الأوراق من المواد الفعالة ومحصولها لكل نبات وكذلك محتواها من الكربوهيدرات وصبغات التمثيل الضوئي ومحتواها المعدني من النيتروجين والفوسفور والبوتاسيوم مقارنة بالنوعين الآخرين. بينما أظهرت التربة السلتية

الطمبية الطينية أقل محتوي في الأوراق من اللوسون ، الكربوهيدرات ، الكاروتينويدات ، والفوسفور والبوتاسيوم في حين أن التربة الرملية أعطت أقل محتوي من التانينات ، النيتروجين والبروتين في الأوراق.

- أدت إضافة الخميرة الجافة النشطة بأي مستوي بغض النظر عن نوع التربة المضافة إليها إلي زيادة معنوية جداً في معظم قياسات النمو الخضرية للنبات مقارنة بمعاملة الكنترول (بدون خميرة). كما أن إضافة الخميرة بالمستوي العالي (٨جرام/لتر) قد أدي إلي زيادة معنوية واضحة في معظم قياسات النمو الخضري المدروسة مقارنة بالمستوي المنخفض (٢ جرام/لتر) أو المتوسط (٤جرام/لتر) . كذلك أدت جميع معاملات الخميرة الجافة النشطة بغض النظر عن نوع التربة إلي زيادة معنوية جداً في محتوي الأوراق من الكربوهيدرات والمواد الفعالة وصبغات التمثيل الضوئي وكذلك محتواها المعدني من النيتروجين والفوسفور والبوتاسيوم مقارنة بالكنترول. كما أدي في معظم الأحوال إضافة الخميرة بالمستوي العالي أو المتوسط إلي زيادة معنوية كبيرة في محتوي الأوراق من المواد الفعالة والكربوهيدرات وكلوروفيل (أ ، ب) مقارنة بالمستوي المنخفض (٢ جرام/لتر)، وكذلك محتواها المعدني من النيتروجين والفوسفور والبوتاسيوم.

ـ كانت تأثيرات التداخل بين أنواع التربة ومستويات الخميرة معنوية في معظم الحشات في حالة الوزن الطازج الكلي للنبات والوزن الطازج للأوراق ومحتوي الأوراق من التانينات والفوسفور والبوتاسيوم بينما كانت غير معنوية في معظم القياسات الأخري المدروسة علي النمو الخضري والتحليل الكيماوي للأوراق. وعموماً كانت أحسن النتائج المتحصل عليها عندما زرعت الحناء في التربة الطمبية الطينية وإضافة الخميرة إليها بمعدل ٤ أو ٨ جرام/لتر.

ـ وخلصت الدراسة إلي إمكانية زراعة الحناء في أنواع مختلفة من التربة مما يتيح لمنتجي النباتات الطبية والعطرية زراعتها في الأراضي المستصلحة الحديثة والقاحلة تحت ظروف الإجهاد البيئي خاصة في صعيد مصر ، مع إضافة الخميرة الجافة النشطة بمعدل ٤ أو ٨ جرام/لتر كسماد حيوى رخيص وامن الى مثل هذه الأراضي الى جانب الأسمدة العضوية لتحسين صفاتها وبالتالي تحسين المحصول وجودته ليلائم مواصفات التصدير واحتياجات الأسواق.

• بحث مقدم إلى المؤتمر العلمي الثاني لشباب الباحثين بكلية الزراعة جامعة أسيوط ، ٦ مايو ٢٠٠٨.