EFFECT OF ACTIVE DRY YEAST AND ORGANIC MANURE ON *THYMUS VULGARIS* L.

SHALAN, M. N., T. A. T. ABDEL-LATIF AND E. A. E. EL-GHADBAN

Medicinal and Aromatic Plants Research Department, Horticulture Research Institute, ARC, Egypt

(Manuscript Received 7 December 2005)

Abstract

To assess the effect of active dry yeast and chicken and cattle manures on the growth and essential oil content of thyme plant (*Thymus vulgaris*, L.), two experiments were carried out at Baramoon Experimental Station, Dakahlia Governorate, Egypt during the two successive seasons 2003/2004 and 2004/2005.

Chicken and cattle manure (at rates of 12, 18 and 24 m^3/fed.) were added to soil before sowing (during soil preparation). The active dry yeast was applied as foliar spray with four concentrations i.e., 0, 1, 2 and 3 gm/l three times, after one week from transplanting, one month later and another one month later.

The obtained results revealed that kind of manure caused significant differences on growth characteristics in both two seasons. Chicken manure gave better performance than cattle manure. Active dry yeast increased plant performance in all studied characters. Best growth characteristics were obtained with 24 m^3/fed of chicken manure with 3 gm/liter of active dry yeast, at two seasons.

Interactions between three factors i.e., kind of manure x levels of manure x active dry yeast levels shown significant differences on results in most treatments.

INTRODUCTION

Garden Thyme, *Thymus vulgaris*, L., Fam. Lamiaceae (formerly Labiatae), is an important aromatic and medicinal plant. Thyme herb is extensively used in the kitchen, either fresh or dried as one of the most important culinary herb. As a medicinal herb, thyme used to treat bronchitis, colic, rheumatic fever and other intestine and stomach disorders (Piccaglia and Marott, 1990). Essential oil of thyme is extensively used in pharmaceutical industry, i.e. antiseptic of wounds, antifungal ointment and antiparasitic. Recently, Deans *et al.*, (1993) reported about other effects and properties of thyme volatile phenolic oil as antioxidative, antimicrobial, natural food preservative mammalian age-delaying.

In Egypt, it grows well and widely particularly in Sinai. So, it can be successfully extended to the newly reclaimed soils in the South El-Wady region.

Yeast treatments were suggested to impose a beneficial role during stress due to its cytokinin content (Barnett *et al.*, 1990). It improves the formation and initiation of flowers due to its effect on carbohydrates accumulation (Winkler *et al.*, 1962). Also, it was reported about its simulator effect on cell division and enlargement, protein

nucleic acid synthesis and chlorophyll formation (Fathy and Farid, 1996 and Khedr and Farid, 2000).

Human health has received a great attention nowadays. It was documented that chemical fertilizers have a pollutant effect on the soil and plants, in turn, on the human health. Owing to this fact, the scientists are looking forward to substitute the chemical fertilizers (wholly or partially) with the natural ones like yeast. Therefore, great attention has been focused on the possibility of using natural and safe subsistent, i.e. yeast in order to improve plant growth, flowering, fruit setting and total yield of some horticulture plants (El-Ghadban *et al.*, 2003).

Yeasts were found in the rhizosphere of various plants in different soils and (Moawad *et al.*, 1986). Although, the numbers of yeast species are low in comparison with other micro-organisms, many investigators claimed that this group of organisms seem to play an important role in the soil fertility and they are capable of producing certain growth promoting substances as hormones, amino acids and vitamins (Monib *et al.*, 1982).

In addition, yeast is a natural source of most nutritional elements (Na, Ca, Fe, Mg, K, P, Zn and Si) as well as organic compounds (Nagodawithana, 1991). N.R.P. (1977) stated the analysis of dry yeast which consisted of dry matter 93%, protein 47.2%, arginine 2.6%, glycine 2.6%, histidine 1.4%, isolysine 2.9%, leucine 3.5%, lysine 3.8%, methionine-cyctine 0.6%, phenyl-alanine 3%, tyrosine 2.1%, threonine 2.6%, tryptophan 0.5%, and vitamin B 2.9%.

The addition of organic matter improves the physical, chemical and biological properties of soil and potting mixes, and in turn improving the aeration and drainage of compacted soils, the water-holding capacity and also increases the soil exchange capacity i.e. its ability to absorb nutrients (Bryan and Lance, 1991). Organic matter (chicken manure) produced the highest uptake of all essential nutrients analyzed and decreased soil pH (Warman, 1990). Cattle manure increased the growth of *Ocimum bacilicum* plants (Raviv *et al.*, 1998).

The objective of the present work was to study the effect of chicken and cattle manure uses during soil preparation, and to investigate the effect of spraying active dry yeast as well as their combinations on the growth, yield and volatile oil of thyme plants, in order to reduce the production cost, reduce the environmental pollution and to improve soil fertility.

MATERIALS AND METHODS

This study was carried out at the experimental farm of Baramoon Research Farm, Dakahlia Governorate, Egypt during two successive seasons 2003/2004 and 2004/2005

Uniform cuttings of *Thymus vulgaris*, L. (thyme) about 8-10 cm were taken from symmetry mother plants grown in the Medicinal and Aromatic Plants Farm in Dokki and planted in the nursery under shaded conditions for rooting on Oct. 15th 2003 and 2004 seasons. The experimental plot area was (3m x 3m). The ridges were 60 cm apart. Each plot has 5 rows. The growing were transplanted 45 days after planting in the nursery. Rooted cuttings were transplanted 25 cm apart on the western side of each row in an irrigated soil so each plot contains 60 plants.

The application of active dry yeast (*Saccharomyces cerevisiae*) was done as foliar spray with four concentrations 0, 1, 2 and 3 gm/l during the growing season, thus each treated plot would receive 50 cm^3. Foliar spray was carried out three times through the growing season as follows:

1. After one week from transplanting.
2. After one month from the first.
3. After one month from the second application.

Two kinds of farmyard manure were used, chicken manure and cattle manure. Each kind of manure was applied at three rates (12, 18, and 24 m^3/fed) during soil preparation, thus the treated experimental units received 26, 39 and 51 $decimeter^3$ per plot, respectively.

The design of the experiment was split-split plots with three replicates, the main plots were the kind of farmyard, the sub-plots were the manure rate, and the sub-sub-plots were the levels of active dry yeast.

The chemical analysis of fertilizers and soil were done at the Water and Soil Lab. at Mansoura. The obtained results are shown in Tables (1 and 2).

Table 1. The physical and chemical properties of experimental soil

Sand (%)	15.98	Total nitrogen (%)	0.63
Silt (%)	36.71	Water soluble phosphorus (%)	0.06
Clay (%)	47.32	Available potassium (mg/l)	0.07
Organic matter (%)	1.65	Available iron (ppm)	17.91
Ec mmhos/cm	1.47	Available manganese (ppm)	3.6
P^{11}	7.87	Available zinc (ppm)	5.3

Table 2. Analytical data of chicken and cattle manure before adding to the experimental soil

Organic fertilizer	Chicken manure		Cattle manure	
Report	1st season	2nd season	1st season	2nd season
Density (kg/m^3)	332	340	265	260
% humidity	6.90	8.70	7.60	8.00
Total nitrogen %	3.35	4.16	1.20	1.18
Ammonia (mg/kg)	10.10	9.30	1.17	1.27
Nitrate (mg/kg)	71.3	75.9	917.0	930.1
Total phosphorus %	0.49	0.73	0.39	0.68
Total potassium %	2.15	1.90	1.75	1.87
Organic matter %	45.34	36.76	45.19	39.47
Organic carbon %	43.12	31.32	27.95	22. 95
C : N	15.0 : 1	15.1 : 1	18.3 : 1	19.4 : 1
Microelements (mg/kg)				
Iron	834.2	854.9	973.6	988.3
Manganese	196.8	212.5	342.5	327.8
Copper	50.1	41.2	42.9	43.0
Zinc	78.38	79.29	80.3	79.3

The following data were recorded in the samples taken at the harvest date on June 15th of both seasons:

1. Plant height (cm).
2. Herb fresh and dry weights (g).
3. Essential oil percentage.
4. Essential oil yield (ml).
5. Chemical composition of essential oil: The dehydrated oil was separately subjected to GLC analysis at the Central Laboratory of Cairo University by GLC (Varian VISTA series 6000, FID detector). The constituents of essential oil were identified by matching their retention time (RT) with those of authentic samples under the same conditions according to Guenther and Joseph (1978).

Statistical analysis:

Data of the present study were statistically analyzed and the differences between treatment means were considered significant when they are more than least significant differences (LSD) at the level of 5% according to Steel and Torrie (1980).

RESULTS AND DISCUSSIONS

Manure applications (chicken and cattle) as organic fertilization at the rates of 12, 18 and 24 m^3/fed under four levels of active yeast 0, 1, 2 and 3 gm/l, had obvious effect on the vegetative growth of thyme plants during 2003/2004 and 2004/2005 seasons.

1. Plant height

Data presented in Table (3) display plant height under different treatments. Significant difference account to manure kind, the chicken manure significantly elongated plant height than plants received cattle manure by about 2.14 cm. this result can be due to the greater percentage nitrogen and potassium for chicken manure or its capacity to increase plant height. The effects of organic manures concentrations either for chicken or cattle increase plant height with each concentration increment, what may also due to increase of nutrition concentrations. The average plant heights in the first season were 18.77, 22.25, 28.23 and 31.18 for plants did not yeast treated, treated with 1, 2 and 3 gm/liter, respectively. Remarkably, the yeast treatments significantly increased plant height and each increment of yeast percentage significantly added new increment. These results can be attributed to the stimulation effects of organic compounds produced by yeast cells, in addition to the nutrition elements excreted from them. Similar results were reported on different plant (El-Ghadban *et al.*, 2003).

The effects of the first interactions between manure kind with their levels and with yeast treatments were insignificant, while the first interaction between manure concentration and yeast concentration was significant. This result displayed that the best treatment for plant height was the combination between Chicken manure at 24 m^3/fed and 3 gm/liter active yeast. These results were assured in the two seasons.

2. Number of branches

Concerning the effect of kind of manures on branches number, the data were shown in Table (4). Chicken manure realized more branches than obtained with cattle manure in both two seasons. Data also revealed that different rates of organic manure gave significant differences in number of branches, increasing manure dose translated to more branches/plant. The level of chicken manure (24 m^3/fed) produced the highest number of branches. Yeast application until 1 gm/liter caused significant increment of branches/plant and any other increment of yeast concentration in this study increase branching activity. The induction effect of yeast treatment may be due to stimulation effects of active yeast cells. The obtained results agreed with those obtained by (El-Ghadban *et al.*, 2003) on Castor bean. All interactions between studied

treatments were insignificant that mean that the final effect of any combination accounted for the accumulation additive effect of the three studied factors. The same trend of those treatments was identical in investigation seasons.

3. Fresh and dry weight (gm) per plant and per plot of thyme plants as affected by factors under study

Data presented in Tables (5, 6, 7, and 8) revealed that there were significant differences in the fresh and dry weight per plant and per plot as response to studied treatments. Chicken manure, compared with cattle manure, significantly increased both average dry and fresh weights either per plant or per plot in both seasons. Moreover, increasing manure dose caused significant increments in plant weight and finally in plot yield. The level of chicken manure 24 m^3/fed gave the over-all improvement of both fresh and dry weight per plant and per plot. Active yeast application increased both fresh and dry weight of plants and consequently of plots. In addition, more yeast concentration caused more plant weight either fresh or dray. Application 3 gm/l established greatest significant weight compared with all remain levels of active yeast in both two seasons.

The interaction between kind of manure and manure levels as shown in Tables (5, 6, 7, and 8) recorded statistically significant differences in both two seasons, at the time that interaction between kind of manure and active yeast levels produced insignificant differences in first season in opposite of second season concerning of fresh weight (gm) per plant whereas remain characteristics were significant in both two seasons. On the other hand, interaction between manure levels and active yeast levels caused significant differences in both two seasons in suspension of characteristics under study except it was insignificant in the first season concerning with dry weight (gm) per plot. The obtained results agreed with those obtained by (El-Ghadban *et al.*, 2003) on Castor bean plant.

The interactions between the three factors, regarding fresh weight (gm) per plant and per plot and dry weight (gm) per plant, were statistically significant in both two seasons, while they were insignificant attaching with dry weight (gm) per plot in both two seasons. The best results had obtained when plants received chicken manure at level 24 m^3/fed combined with active dry yeast at level 3 gm/l followed by cattle manure at level 24 m^3/fed interacted with active dry yeast at level 3 gm/l in both two seasons. The improving in thyme resulted from both kinds of manure and active yeast application could be interpreted from elongated plants and increasing branches/plant. The trends from both seasons were nearly identical.

Effect of kind of manure, manure levels and active dry yeast levels on volatile oil percentage, volatile oil yield (ml/plant) and ml/plot

Data presented in Tables (9, 10 and 11) illustrated volatile oil production in thyme plants measured as oil percentage, oil yield/plant and oil yield/plot in response to manure and active yeast applications and their interactions. Chicken manure realized better oil percentage, oil yield/plant and oil yield/plot comparing with cattle manure. Concerning volatile oil percentage, oil yield ml/ plant and ml/ plot, each increment in manure, ignoring manure kind, increased oil production. These results mean that the healthy plants, the more productive, regarding volatile oil. Applying active yeast significantly increased oil production either on percentage evaluation, oil ml/plant or ml/plot. In addition, every increment in yeast concentration from 1 to 3 gm/liter significantly increases oil production. Similar results were reported on Castor bean plant (El-Ghadban *et al.*, 2003).

Interactions as shown in Tables (9, 10 and 11) revealed that interaction between kind of manure and manure doses, kind of manure and active dry yeast concentration, manure doses and active dry yeast concentrations and second interaction between the three factors displayed statistically significant differences in both two seasons except volatile oil percentage in first season which showed insignificant differences. These results suggest important role of the interaction between those factors and may be a subject for further studies.

Effect of chicken manure levels, cattle manure levels and active dry yeast levels on chemical structure of essential oil.

As for the kind of fertilizers, the results of GLC analysis in Table (12) showed that hydrocarbons were decreased from 61.35 to 27.65% with increasing levels of chicken manure, cattle manure and active dry yeast except both of 12 m^3/fed of chicken manure, 12 m^3/fed of cattle manure and 1 gm/l of active dry yeast which caused increasing in hydrocarbons (64.80, 62.41 and 61.62%, respectively) with p-cymene and limonene as major components. In general, hydrocarbons determination (%) recorded the highest value by using the lowest level of fertilizers.

Concerning the oxygenated compounds, treatments generally stimulated the accumulation of oxygenated compounds to be the maximum with the highest levels 24 m^3/fed of both chicken manure, cattle manure and 3 gm/l of active dry yeast. They were raised from (35.81 to 67.62%). Thymol was the principal oxygenated compound, which increased from (18.75 to 55.42%). A similar trend was found in case of borneol from (1.10 to 3.06%). The opposite was true in case of carvacrol from (11.76 to 7.30%). Linalol recorded a percentage of (6.93, 6.90 and 6.88%) by using the moderate level of chicken manure, cattle manure and active dry yeast, respectively.

RECOMMENDATION

It can be recommended to use active dry yeast as a foliar spray with 3 gm/l to improve the growth and characteristics of essential oil of thyme plants.

Organic manure (chicken or cattle) could be used to enhance the growth and yield of both vegetative growth and essential oil of thyme plants using level of 24 m^3/fed from chicken or cattle manure, without using chemical fertilization.

REFERENCES

1. Barnett, J. A., R. W. Payne and D. Yarrow. 1990. Yeasts, characteristics and identification. Cambridge University Press, Public. By the Prese Syndicate of the Univ. of Cambridge Camb. pp. 999.
2. Bryan, H. H. and C. J. Lance. 1991. Compost trials on vegetables and tropical crops. Biocycle., 27: 36-37.
3. Deans, S. G., E. Simpson, R. C. Noble, A. Macpherson and L. Penzes. 1993. Natural antioxidants from *Thymus vulgaris* essential oils. The beneficial effects upon mammalian lipid metabolism. Acta Horticulture, 332: 177-182.
4. El-Ghadban, E. G. E., S. A. Kutb and M. I. Eid. 2003. Effect of foliar spraying with active dry yeast and complete fertilizer (Sengral) on growth, yield and fixed oil of ((*Ricinus communis* L.) plant. Egypt. Pharm. J. Vol. 1, pp 55-66.
5. Fathy, E. S. L. and S. Farid. 1996. The possibility of using vitamin B_6 and yeast to delay senescence and improve growth and yield of common beans (*Phaseolus vulgaris*, L.). J. Agric. Sci., Mansoura Univ., 21 (4): 1415-1423.
6. Guenther, Z and S. Joseph. 1978. Handbook Series in Chromatography. GRC Press Inc.
7. Khedr, Z. M. A. and S. Farid. 2000. Response of naturally virus infected tomato plants to yeast extract and phosphoric acid application. Annals Agric. Sci., Moshtohor, 38 (2): 927-939.
8. Moawad, H., S. H. Salem, S. M. S. Badr-ElDin, T. Khater and M. Iskandar. 1986. Yeasts in soils of Egypt. Zbl. Microbiol., 141: 431-435.
9. Monib, M., M. K. Zahra and R. R. Armanios. 1982. Some biochemical activities of yeasts isolated from Egyptian Soils. Zbl. Microbiol., 137: 375-380.
10. N. R. P. 1977. Nutrient requirements of domestic Animals, No. 1,7th Rev. Edition. National Academy of Science, Washington. D. C.
11. Nagodawithana, W. T. 1991. Yeast technology. Univ. Foods Corporation Milwaukee, Wisconsin. Published by Van Nostrand Reinhold New York. P. 273.

12. Piccaglia, P. and M. Marott. 1990. Chemical composition of Italian *Thymus vulgaris* L. Chemo type. 21st International Symposium on Essential Oil Lahti, Final, p. 75.
13. Raviv, M., R.Reveni and B. Z. Zaidman. 1998. Improved medium for organic transplants. Division of Organic Agriculture, Ministry of Agric. Agricultural Research Organization, Israel. Biological Agric. and Hort., 16 (1): 53-64.
14. Steel, R. C. and J. M. Torrie. 1980. Principles and Procedures of Statistics A. Biometrical Approach. McGraw-Hill Book Company, New York.
15. Warman, P. R. 1990. Fertilization with manures and legume intercrops and their influence on brassica and tomato growth and on tissue and soil copper, manganese and zinc. Biological Agricultural and Horticulture, 6 (4): 325-335. (C.F. Hort. Abst.,60: 7204).
16. Winkler, A. J., J. A. Cook, W. M. Kliewer and L. A. Lider. 1962. General Viticulture. Univ. Calif. Press, USA.

Table 3. Plant height (cm) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	17.31	19.62	28.88	29.21	23.75	26.18	18.32	20.67	28.71	30.96	24.66	27.35
	18 m^3/fed	19.71	23.42	28.71	32.32	26.04		20.75	25.11	29.71	33.67	27.31	
	24 m^3/fed	22.34	26.73	30.26	35.62	28.74		23.33	28.92	31.38	36.72	30.09	
Cattle	12 m^3/fed	15.32	17.59	26.51	27.61	21.76	24.04	16.91	18.71	27.23	29.29	23.03	25.02
	18 m^3/fed	17.62	21.41	28.40	30.00	24.36		18.63	23.51	26.97	29.23	24.58	
	24 m^3/fed	20.34	24.71	26.62	32.31	26.00		21.45	25.72	29.11	33.54	27.45	
Means of (C)		18.77	22.25	28.23	31.18		Means of (B)	19.90	23.77	28.85	32.24		Means of (B)
Means B x C	12 m^3/fed	16.31	18.60	27.69	28.41		22.76	17.61	19.69	27.97	30.13		23.85
	18 m^3/fed	18.67	22.42	28.55	31.16		25.20	19.69	24.31	28.34	31.45		25.95
	24 m^3/fed	21.34	25.72	28.44	33.97		27.37	22.39	27.32	30.24	35.13		28.77
Means A x C	Chicken	19.79	23.26	29.28	32.38			20.80	24.90	29.93	33.78		
	Cattle	17.76	21.24	27.18	29.97			19.00	22.65	27.77	30.69		
LSD at 5%		A = ** B = 0.60 C = 0.61 A x B = NS A x C = NS B x C = 1.06 A x B x C = NS						A = ** B = 0.91 C = 0.92 A x B = NS A x C = NS B x C = 1.60 A x B x C = NS					

Table 4: Number of branches/plant of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x	Means of	Yeast levels (C)				Means A x	Means of
Kind of manure (A)	Manure levels (B)	0	1	2	3	B	(A)	0	1	2	3	B	(Â)
Chicken	12 m^3/fed	24.5	26.9	29.7	30.1	27.8	30.2	23.5	25.8	28.7	29.1	26.8	29.2
	18 m^3/fed	26.7	28.4	30.3	32.3	29.4		25.6	27.6	29.7	31.8	28.7	
	24 m^3/fed	29.6	31.7	33.8	37.8	33.2		28.6	30.8	32.4	36.6	32.1	
Cattle	12 m^3/fed	22.8	23.7	25.6	30.0	25.5	27.7	21.7	22.9	24.7	28.8	24.5	27.0
	18 m^3/fed	24.7	27.3	28.1	29.1	27.3		23.6	26.2	28.2	29.7	26.9	
	24 m^3/fed	27.3	30.2	31.2	32.0	30.2		26.9	29.8	30.2	31.8	29.7	
Means of (C)		26.0	28.0	29.8	31.9		Means of (B)	25.0	27.2	29.0	31.3		Means of (B)
Means B x C	12 m^3/fed	23.7	25.3	27.7	30.0		26.7	22.6	24.4	26.7	28.9		25.7
	18 m^3/fed	25.7	27.8	29.2	30.7		28.4	24.6	26.9	29.0	30.8		27.8
	24 m^3/fed	28.5	31.0	32.5	34.9		31.7	27.8	30.3	31.3	34.2		30.9
Means A x C	Chicken	27.0	29.0	31.3	33.4			25.9	28.1	30.3	32.5		
	Cattle	24.9	27.1	28.3	30.4			24.1	26.3	27.7	30.1		
LSD at 5%		A = ** B = 0.7 C = 1.0 A x B = NS A x C = NS B x C = NS A x B x C = NS						A = ** B = 0.6 C = 0.9 A x B = NS A x C = NS B x C = NS A x B x C = NS					

Table 5. Fresh weight (g/plant) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	22.41	25.62	29.11	30.81	26.99	31.82	23.52	26.71	29.87	30.73	27.71	32.83
	18 m^3/fed	24.11	33.23	35.31	37.73	32.59		25.12	34.51	36.39	38.59	33.65	
	24 m^3/fed	27.31	36.21	39.11	40.91	35.88		28.67	37.67	40.29	41.91	37.13	
Cattle	12 m^3/fed	21.11	28.61	28.42	30.11	27.06	29.34	22.33	25.91	27.45	31.12	26.45	29.80
	18 m^3/fed	23.91	26.70	32.31	35.71	29.66		24.25	27.83	33.87	36.89	30.71	
	24 m^3/fed	25.61	29.71	32.31	37.60	31.31		26.71	30.79	33.85	37.55	32.22	
Means of (C)		24.08	30.01	32.76	35.48		Means of (B)	25.10	30.57	33.62	35.97		Means of (B)
Means B x C	12 m^3/fed	21.76	27.11	28.76	30.46		27.02	22.92	26.31	28.66	30.42		27.08
	18 m^3/fed	24.01	29.97	33.81	36.72		31.13	24.69	31.17	35.13	37.74		32.18
	24 m^3/fed	26.46	32.96	35.71	39.25		33.60	27.69	34.23	37.07	39.73		34.68
Means A x C	Chicken	24.61	31.69	34.51	36.48			25.77	32.96	35.52	37.08		
	Cattle	23.54	28.34	31.01	34.47			24.43	28.18	31.72	34.5		
LSD at 5%		A = ** B = 0.81 C = 1.05 A x B = 1.14 A x C = NS B x C = 1.81 A x B x C = 2.56						A = ** B = 0.59 C = 0.66 A x B = 0.84 A x C = 0.93 B x C = 1.14 A x B x C = 1.62					

Table 6. Fresh weight (kg/plot) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	1.79	2.05	2.33	2.45	2.15	2.54	1.88	2.14	2.38	2.46	2.21	2.63
	18 m^3/fed	1.93	2.66	2.82	3.02	2.61		2.09	2.76	2.91	3.09	2.71	
	24 m^3/fed	2.18	2.90	3.13	3.27	2.87		2.29	3.01	3.22	3.35	2.97	
Cattle	12 m^3/fed	1.69	1.97	2.25	2.41	2.08	2.32	1.79	2.05	2.19	2.41	2.11	2.38
	18 m^3/fed	1.91	2.14	2.58	2.86	2.37		1.94	2.23	2.71	2.95	2.46	
	24 m^3/fed	2.05	2.38	2.58	3.01	2.51		2.14	2.46	2.71	3.00	2.58	
Means of (C)		1.92	2.35	2.62	2.84		Means of (B)	2.02	2.44	2.69	2.88		Means of (B)
Means B x C	12 m^3/fed	1.74	2.01	2.29	2.43		2.12	1.84	2.10	2.29	2.43		2.16
	18 m^3/fed	1.92	2.40	2.70	2.94		2.49	2.01	2.49	2.81	3.02		2.59
	24 m^3/fed	2.12	2.64	2.86	3.14		2.69	2.21	2.74	2.96	3.17		2.77
Means A x C	Chicken	1.97	2.54	2.76	2.91			2.09	2.64	2.84	2.97		
	Cattle	1.88	2.16	2.47	2.76			1.96	2.25	2.54	2.79		
LSD at 5%		A = ** B = 0.08 C = 0.07 A x B = 0.11 A x C = 0.10 B x C = 0.12 A x B x C = 0.17						A = ** B = 0.06 C = 0.04 A x B = 0.09 A x C = 0.05 B x C = 0.07 A x B x C = 0.92					

Table 7. Dry weight (g/plant) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	7.32	8.41	9.54	10.07	8.84	10.43	7.69	8.75	9.76	10.08	9.07	10.75
	18 m^3/fed	7.90	10.90	11.58	12.37	10.69		8.14	11.28	11.93	12.65	11.00	
	24 m^3/fed	8.95	11.87	12.82	13.41	11.76		9.40	12.35	13.21	13.74	12.18	
Cattle	12 m^3/fed	6.90	8.07	9.21	9.87	8.51	9.50	7.30	8.47	8.97	8.37	8.25	9.63
	18 m^3/fed	7.84	8.75	10.59	11.71	9.72		7.94	9.12	11.10	12.09	10.06	
	24 m^3/fed	8.40	9.74	10.59	12.23	10.27		8.76	10.09	11.10	12.31	10.56	
Means of (C)		7.89	9.62	10.72	11.63		Means of (B)	8.20	10.01	11.01	11.54		Means of (B)
Means B x C	12 m^3/fed	7.11	8.24	9.38	9.97		8.67	7.49	8.61	9.36	9.23		8.67
	18 m^3/fed	7.87	9.82	11.09	12.04		10.20	8.04	10.20	11.52	12.37		10.53
	24 m^3/fed	8.68	10.81	11.70	12.87		11.01	9.08	11.22	12.16	13.02		11.37
Means A x C	Chicken	8.06	10.39	11.31	11.95			8.41	10.79	11.63	12.16		
	Cattle	7.71	8.85	10.13	11.30			8.00	9.23	10.39	10.92		
LSD at 5%		A = ** B = 0.13 C = 0.19 A x B = 0.18 A x C = 0.27 B x C = 0.33 A x B x C = 0.47						A = ** B = 0.14 C = 0.23 A x B = 0.21 A x C = 0.33 B x C = 0.40 A x B x C = 0.57					

Table 8. Dry weight (kg/plot) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	0.59	0.67	0.76	0.81	0.71	0.83	0.62	0.70	0.79	0.81	0.73	0.86
	18 m^3/fed	0.63	0.87	0.91	0.99	0.85		0.66	0.90	0.95	1.01	0.88	
	24 m^3/fed	0.72	0.95	1.03	1.07	0.94		0.75	0.99	1.06	1.10	0.98	
Cattle	12 m^3/fed	0.55	0.65	0.74	0.79	0.68	0.76	0.58	0.68	0.72	0.67	0.66	0.76
	18 m^3/fed	0.63	0.70	0.85	0.94	0.78		0.64	0.73	0.89	0.97	0.81	
	24 m^3/fed	0.67	0.78	0.85	0.99	0.82		0.71	0.71	0.89	0.98	0.82	
Means of (C)		0.63	0.77	0.86	0.93		Means of (B)	0.66	0.78	0.88	0.92		Means of (B)
Means B x C	12 m^3/fed	0.57	0.66	0.75	0.80		0.69	0.60	0.69	0.75	0.74		0.70
	18 m^3/fed	0.63	0.79	0.88	0.97		0.81	0.65	0.81	0.92	0.99		0.84
	24 m^3/fed	0.69	0.87	0.94	1.03		0.88	0.73	0.85	0.98	1.04		0.90
Means A x C	Chicken	0.65	0.83	0.90	0.96			0.68	0.86	0.93	0.97		
	Cattle	0.62	0.71	0.81	0.91			0.64	0.71	0.83	0.87		
LSD at 5%		A = ** B = 0.04 C = 0.03 A x B = 0.05 A x C = 0.04 B x C = NS A x B x C = NS						A = ** B = 0.02 C = 0.04 A x B = 0.04 A x C = 0.06 B x C = 0.07 A x B x C = NS					

Table 9. Volatile oil (%) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	0.65	0.79	0.91	1.09	0.86	1.26	0.67	0.81	0.94	1.10	0.88	1.28
	18 m^3/fed	0.71	1.13	1.65	2.05	1.38		0.75	1.13	1.64	2.08	1.40	
	24 m^3/fed	0.89	1.16	1.87	2.18	1.53		0.90	1.32	1.81	2.21	1.56	
Cattle	12 m^3/fed	0.51	0.62	0.89	1.21	0.81	1.05	0.54	0.63	0.89	1.25	0.83	1.09
	18 m^3/fed	0.59	0.81	1.41	1.62	1.11		0.63	0.82	1.56	1.71	1.18	
	24 m^3/fed	0.61	0.92	1.52	1.91	1.24		0.65	0.95	1.57	1.93	1.27	
Means of (C)		0.66	0.91	1.38	1.68		Means of (B)	0.69	0.94	1.40	1.71		Means of (B)
Means B x C	12 m^3/fed	0.58	0.71	0.90	1.15		0.83	0.61	0.72	0.91	1.17		0.85
	18 m^3/fed	0.65	0.97	1.53	1.84		1.25	0.69	0.98	1.60	1.89		1.29
	24 m^3/fed	0.75	1.04	1.69	2.05		1.38	0.77	1.13	1.69	2.07		1.42
Means A x C	Chicken	0.75	1.03	1.48	1.77			0.77	1.09	1.46	1.80		
	Cattle	0.57	0.78	1.27	1.58			0.61	0.80	1.34	1.63		
LSD at 5%		A = ** B = 0.04 C = 0.05 A x B = 0.06 A x C = NS B x C = 0.09 A x B x C = 0.13						A = ** B = 0.04 C = 0.04 A x B = 0.05 A x C = 0.05 B x C = 0.06 A x B x C = 0.09					

Table 10. Volatile oil yield (ml/plant) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	0.05	0.06	0.08	0.11	0.08	0.14	0.05	0.07	0.09	0.12	0.08	0.15
	18 m^3/fed	0.06	0.12	0.19	0.25	0.16		0.06	0.13	0.20	0.26	0.16	
	24 m^3/fed	0.08	0.15	0.24	0.29	0.19		0.08	0.16	0.24	0.30	0.19	
Cattle	12 m^3/fed	0.04	0.05	0.08	0.12	0.07	0.11	0.04	0.05	0.08	0.10	0.07	0.11
	18 m^3/fed	0.05	0.07	0.15	0.19	0.12		0.05	0.07	0.17	0.21	0.13	
	24 m^3/fed	0.05	0.09	0.16	0.24	0.14		0.06	0.10	0.17	0.24	0.14	
Means of (C)		0.05	0.09	0.15	0.20		Means of (B)	0.06	0.10	0.16	0.20		Means of (B)
Means B x C	12 m^3/fed	0.05	0.05	0.08	0.12		0.07	0.05	0.06	0.09	0.11		0.08
	18 m^3/fed	0.05	0.09	0.17	0.22		0.14	0.05	0.10	0.19	0.23		0.14
	24 m^3/fed	0.06	0.12	0.20	0.26		0.16	0.07	0.13	0.20	0.27		0.17
Means A x C	Chicken	0.06	0.11	0.17	0.22			0.06	0.12	0.18	0.23		
	Cattle	0.05	0.07	0.13	0.18			0.05	0.07	0.14	0.18		
LSD at 5%		A = ** B = 0.011 C = 0.009 A x B = 0.016 A x C = 0.013 B x C = 0.015 A x B x C = 0.022						A = ** B = 0.25 C = 0.007 A x B = 0.35 A x C = 0.0.01 B x C = 0.012 A x B x C = 0.017					

Table 11. Volatile oil yield (ml/plot) of *Thymus vulgaris* L. as affected by kind of manure, levels of manure, levels of active dry yeast and their interactions during 2003/2004 and 2004/2005 seasons.

Seasons		2003/2004						2004/2005					
		Yeast levels (C)				Means A x B	Means of (A)	Yeast levels (C)				Means A x B	Means of (A)
Kind of manure (A)	Manure levels (B)	0	1	2	3			0	1	2	3		
Chicken	12 m^3/fed	4.0	4.8	6.4	8.8	6.0	11.2	4.0	5.6	7.2	9.6	6.6	11.9
	18 m^3/fed	4.8	9.6	15.2	20.0	12.4		4.8	10.4	16.0	20.8	13.0	
	24 m^3/fed	6.4	12.0	19.2	23.2	15.2		9.6	12.8	19.2	23.4	16.3	
Cattle	12 m^3/fed	3.2	4.0	6.4	9.6	5.8	8.6	3.2	4.0	6.5	8.0	5.4	8.9
	18 m^3/fed	4.0	5.6	12.0	15.2	9.2		4.0	5.6	13.6	16.8	10.0	
	24 m^3/fed	4.0	7.2	12.8	19.2	10.8		4.8	8.0	13.6	19.2	11.4	
Means of (C)		4.4	7.2	12.0	16.0		Means of (B)	5.1	7.7	12.7	16.3		Means of (B)
Means B x C	12 m^3/fed	3.6	4.4	6.4	9.2		5.9	3.6	4.8	6.8	8.8		6.0
	18 m^3/fed	4.4	7.6	13.6	17.6		10.8	4.4	8.0	14.8	18.8		11.5
	24 m^3/fed	5.2	9.6	16.0	21.2		13.0	7.2	10.4	16.4	21.3		13.8
Means A x C	Chicken	5.1	8.8	13.6	17.3			6.1	9.6	14.1	17.9		
	Cattle	3.7	5.6	10.4	14.7			4.0	5.9	11.2	14.7		
LSD at 5%		A = ** B = 0.30 C = 0.28 A x B = 0.41 A x C = 0.39 B x C = 0.48 A x B x C = 0.68						A = ** B = 0.25 C = 0.22 A x B = 0.35 A x C = 0.32 B x C = 0.39 A x B x C = 0.55					

Table 12. The principal components percentage of *Thymus vulgaris* L. essential oil as affected by chicken manure levels, cattle manure levels and active dry yeast levels treatments.

Treatments Components (%)	Active dry yeast levels				Chicken manure levels			Cattle manure levels		
	0.0	1 gm/L	2 gm/L	3 gm/L	12m³/fed	18 m³/fed	24 m³/fed	12 m³/fed	18 m³/fed	24 m³/fed
α-pinene	2.04	2.03	2.40	0.79	2.15	2.43	0.82	2.05	2.41	0.79
Camphene	1.49	1.30	1.40	0.33	1.41	1.41	0.37	1.40	1.40	0.35
P-Cymene	31.44	29.86	15.99	10.11	32.30	16.32	10.62	30.29	16.00	10.41
β-pinene	8.76	8.81	20.98	11.98	8.81	21.59	12.29	8.76	21.40	12.20
Myrcene	0.66	0.42	0.68	0.30	0.57	0.75	0.31	0.49	0.69	0.30
Terpinene	5.15	7.30	3.40	2.23	7.50	3.98	2.57	7.94	3.41	2.50
Limonene	11.81	11.90	6.00	1.91	12.06	6.01	2.03	11.98	6.00	1.98
Hydrocarbons	61.35	61.62	50.83	27.65	64.80	52.49	29.01	62.41	51.31	28.53
Linalool	1.82	1.10	6.88	0.16	1.30	6.93	0.21	1.20	6.90	0.18
Thymol	18.75	19.00	24.71	54.96	19.29	24.81	55.42	19.26	24.80	55.39
Carvacrol	11.76	9.10	10.91	7.30	9.48	11.15	7.41	9.45	11.00	7.36
Borneol	1.10	1.23	0.51	3.01	1.56	0.53	3.06	1.55	0.50	3.05
1,8 Cinol	2.38	0.76	1.06	1.39	0.88	1.07	1.52	0.86	1.07	1.41
Oxygenated comp.	35.81	31.19	44.07	66.82	32.51	44.49	67.62	32.32	44.27	67.39
Unknown	2.50	7.10	5.00	5.44	2.60	2.71	3.28	5.20	4.40	3.98

تأثير الخميرة النشطة والسماد العضوى على نبات الزعتر ***Thymus Vulgaris*** L.

محمد ناجى شعلان ، طه أحمد طه عبد اللطيف ، الموافى عبده الموافى الغضبان

قسم بحوث النباتات الطبية والعطرية ــ معهد بحوث البساتين ــ مركز البحوث الزراعية ــ الجيزة ــ مصر

تمت دراسة تأثير الخميرة الجافة النشطة وكلا من سماد الدواجن وسماد الماشية على النمو ومكونات الزيت الطيار فى نبات الزعتر(*Thymus vulgaris* L.) حيث نفذت تجربتين فى محطة بحوث تجارب مزرعة البرامون التابعة لمحطة بحوث البساتين بالمنصورة محافظة الدقهلية خلال موسمى ٢٠٠٣/٢٠٠٤ ، ٢٠٠٤/٢٠٠٥ بإضافة مستويات مختلفة من سماد الدواجن وسماد الماشية بمعدلات (١٢ ، ١٨ ، ٢٤ م^{٣} / فدان) كأسمدة عضوية أضيفت للتربة أثناء إعداد الأرض للزراعة، وإستخدمت الخميرة الجافة النشطة رشا بأربعة تركيزات هى (صفر ، ١ ، ٢ ، ٣ جم/ لتر) على ثلاث دفعات، الأولى بعد أسبوع من الشتل، والثانية بعد شهر من الأولى، والثالثة بعد شهر من الثانية بهدف دراسة التفاعلات المختلفة بين الثلاثة عوامل على النمو ونسبة وجودة الزيت الطيار فى نبات الزعتر.

ويمكن تلخيص النتائج فيما يلى :

أوضحت النتائج المتحصل عليها أن نوع السماد أدى إلى اختلافات معنوية فى خواص النمو فى كلا الموسمين.

وقد أعطى سماد الدواجن أداء أفضل من سماد الماشية، وحسنت الخميرة الجافة النشطة أداء النباتات فى كل الصفات المدروسة.

وكانت أفضل النتائج المتحصل عليها عند إستخدام سماد الدواجن بمعدل ٢٤ م^{٣} / فدان مع الخميرة الجافة النشطة بتركيز ٣ جم/ لتر فى كلا الموسميين.

وأظهرت التفاعلات بين الثلاثة عوامل تحت الدراسة وهى (نوع السماد العضوى ومستوياته المستخدمة وتركيزات الخميرة الجافة النشطة) فروقا معنوية فى نتائج معظم التفاعلات.

وتوصى الدراسة باستخدام الخميرة الجافة النشطة رشا على نبات الزعتر بتركيز ٣ جم/ لتر واستخدام سماد الدواجن بمعدل ٢٤ م^{٣} / فدان حيث أن استخدام تلك المعاملات آمن وفعال وغير ضار بالصحة وغير ملوث للبيئة عن استخدام الأسمدة الكيماوية.