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EFFECT OF CHICKEN MANURE FERTILIZATION, ACTIVE DRY YEAST FOLIAR SPRAY CONCENTRATIONS AND THEIR INTERACTION ON LAVANDER (*LAVANDULA OFFICINALIS*, CHAIX) PLANTS GROWTH AND PRODUCTIVITY

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ABSTRACT

A field experimental laid out at a completely randomized block design at the experimental farm of Fac. of Environ. Agric. Sci., Arish Univ., El-Arish, North Sinai Governorate, Egypt during the two successive summer seasons of 2017/2018 and 2018/2019, to study the effect of chicken manure (ChM) as N fertilizer source, dry yeast spraying concentrations and their interaction on vegetative, yield and chemical composition of lavender (*Lavandula officinalis*). Results showed that fertilization lavender plants with 100 % from the recommended N rate as chicken manure (ChM) recorded the maximum growth, yield and chemical constituents of lavender. Moreover, application of dry yeast at 200 ppm increased significantly lavender growth, yield and chemical constituents. For the interaction between chicken manure (ChM) as N fertilizer source and dry yeast concentrations the same trend were observed when plants fertilized with 100 % from the recommended N rate as chicken manure (ChM) and sprayed with 200ppm dry yeast.

Keywords: Lavender (*Lavandula officinalis*), chicken manure (ChM) fertilization and active dry yeast

INTRODUCTION

(*Lavandula officinalis*, Chaix) belongs to family Labiatae. Lavender is strong fragranceshrub with light green and narrow linear leaves and flowers color are violet-blue. The herb has been common for long time as diuretic and stomachic, spasmolytic and carminative. Its powerful as anti- bacterial for its ability to kill many chronic bacteria such as typhoid (Kulevanova *et al.*, 2000). The aromatic leaves and flowers are used fresh as salads dishes, dried aromatic leaves and flowers are used as a tea for calming baths and as warehouse insect militant (Kuhn and Winston, 2008).

Lavender oil used for large scale by various industries such as pharmaceutical, foods, beverages, liqueurs, perfumery and cosmetics and environmental save pesticides (Tonutti and Liddle, 2010 and Topalov, 1989).

Nowadays, great attention has been focused on the possibility of using natural and safety fertilizers and growth substances. Moreover, there is a very fast growing demand for organic grown food products (for the local and export markets). Organic fertilizers such as chicken manure (ChM) considered an important source for micro, macro elements and organic carbon for plant nutrition. Also, using chicken manure improves soil physical properties and encourage its ability for holding water (Amanullah *et al.*, 2007).

The dry bread yeast (*Saccharomyces cerevisiae*) considered under the used biofertilizers as soil fertilization

addition or as foliar spray on vegetable crops vegetative shoots (El-Ghamriny *et al.*, 1999). It has many active ingredients like protein and B vitamins (thiamin, riboflavin and pyridoxines). Yeast contains tryptophan a primer of IAA structure which plays an important role as growth regulator of plants. Also, dry bread yeast containing cytokinins which plays main role in delaying leaves senescence by inhibiting disintegration of chlorophyll and improve protein and RNA synthesis. In soil, yeast improves humus content and enhancement soil structure, it significantly lowers soil density and increases water holding capacity resulting in better nutrient and lower soil degradation (Kobayashi *et al.*, 1980)

So that the present work aimed to improve lavender plants (*Lavandula officinalis*) productivity by using dry yeast concentrations under different chicken manures (ChM) fertilization levels.

MATERIALS AND METHODS

Field experiment was carried out at the Experimental Farm of Fac. of Environ. Agric. Sci., Arish University, North Sinai Governorate during the two successive summer seasons of 2017/2018 and 2018/2019, to study the effect of active dry yeast and different chicken manure fertilization on the vegetative growth, oil yield and some chemical constituents of *Lavandula officinalis* plant.

Lavender seedlings about 10 cm length with two branches were obtained from El-Ahaly Farm in El-Qanater El-Khayrea, Qallubia Governorate, Egypt. Seedlings were

transplanted on 1st May during the two seasons.

The soil used was sandy in texture. It was sampled before fertilizer application to a depth of 0-30 cm and analyzed for some chemical and physical characteristics as shown in Table 2. The experiment was conducted under drip irrigation system conditions using well water. Chemical analysis for irrigation is also presented in Table 2.

Soil analysis

1- Particle size distribution was performed using the international pipette method with sodium hexameter phosphate as a dispersing agent (Piper, 1950).

2- Calcium carbonate content was measured using the Collin's calcimeter (Wright, 1939).

3- Organic matter was determined according to the method of Walkley and Black (Jackson, 1973).

4- Dissolving ions and pH were determined according to the standard methods recommended by the U.S. Salinity Laboratory (Richards, 1954).

5- Electrical conductivity (EC) of the soil saturation extract was measured using a conductivity bridge (U.S. Sal. Lab.) (Richards, 1954).

6- Available phosphorus was determined calorimetrically in 0.5 M NaHCO₃ extract by the method of Olsen *et al.*, (Jackson, 1973).

7- Total and available nitrogen were determined volumetrically using the Kjeldahl technique (Page, 1982).

Chicken manure analysis

Total nitrogen, organic carbon and available phosphorus were determined as described by American Public Health Association (A.P.H.A, 1985 and A.O.A.C, 1975).

Fertilizer Description

Chicken manure used as nitrogen fertilization source in this work. The chemical analysis of chicken manure showed that it contained total nitrogen (23.5g.kg⁻¹), total phosphorus (0.40g.kg⁻¹), and total potassium (1.2g.kg⁻¹) with C/N ratio (12.9). Chicken manure (ChM) obtained from Animal and Poultry Experimental Farm, Fac. Environ. Agric. Sci., Arish Univ. at the rates presented in Table 2 (0.0 %, 25%, 50 and 100% from the recommended kg. N/ fed.) were added during soil preparation. Phosphorus fertilization at (31.0 kg P/ fed.) as calcium super phosphate (15.5% P₂O₅) as well as potassium at (24.0 kg K/ fed.) as potassium sulphate (48 % K₂O). All amounts of phosphorus and potassium were added in one dose prior to planting during soil preparation.

Dry yeast concentrations

Dry yeast as foliar spray were applied at (0.0 (distilled water), 50 ppm, 100 ppm or 200 ppm). Spray was applied twice first one after one month from transplanting and the second one after one month later. The experimental unit area was 15 m². Every unit contained three dripper lines with 15 m length. The distance between lines 50cm and between drippers was 50 cm (between plants) (16800 plant per fed.). Control plots were cultivated in the same way.

Data recorded

Vegetative growth parameters

After 165 days later from transplanting the following data were recorded:

Plant height (cm), branches number, Herb fresh weight / plant (g) and Root length (cm)

Yield characteristics

1- Herb fresh yield / fed.

2- Herb dry yield / fed.

3- Oil percentage was determined from fresh samples at harvest of the two seasons (100g). Each sample was transferred to distillation flask to which 500 ml water were added and subjected to water steam distillation. The process was continued to about 5 hours.

4- Oil yield / fed. (l) were calculated by multiplying the oil percentage × herb fresh yield / fed.

Chemical constituents in herb

1- Total nitrogen percentage (%)

2- Total phosphorus percentage (%)

3- Total potassium percentage (%)

Chemical analysis were determined in dried samples of leaves at 70°C, half gram powder of dried plant material of each sample was acid digested using a mixture of sulfuric and perchloric (Chapman and Pratt, 1961).

Experimental design and statistical analysis

Treatments were laid out in split plot design with three replicates. Chicken manure (ChM) fertilization were randomly arranged in the main plot and dry yeast concentrations were randomly distributed in sub plots. The Complete Randomized Block Design was used in this experiment with three replicates. The means were compared using computer program of Statistics version 9

Table 1 Chicken manure amounts depending on its total nitrogen content

Treatment (% of recommended rate)	Total N (kg.N/ fed.)	Total amount of chicken manure (ChM) kg/ fed.
0%	0.0	0.0
25 %	15.37	654
50 %	30.75	1308
100%	61.5	2617

Table 2. Some initial chemical and physical characteristics of soil and well water

Parameters	Soil		Well water
	1 st season (2017-2018)	2 nd season (2018-2019)	
Soluble ions* meq.L⁻¹ (soil past extract)			
Ca ⁺⁺	3.03	2.10	18.12
Mg ⁺⁺	2.11	2.20	20.20
Na ⁺	1.18	4.49	17.72
K ⁺	0.48	0.31	0.25
Cl ⁻	1.02	2.30	38.40
Co ₃ ⁻	Nd	Nd	Nd
Hco ₃ ⁻	2.00	2.40	6.25
So ₄ ⁻	3.78	4.40	11.64
ECe(dsm ⁻¹)	0.68	0.91	5.65
pH (1:2.5)	8.10	8.20	6.70
Organic carbon (g.kg ⁻¹)	0.93	1.22	-
Organic matter (g.kg ⁻¹)	1.60	2.10	-
Ca CO ₃ (g.kg ⁻¹)	3.95	3.95	-
Particular size distribution %			
Clay	0.16	0.16	-
Silt	0.33	0.33	-
Fine sand	76.1	76.1	-
Coarse sand	18.71	18.71	-
Soil texture	Sandy soil	Sandy soil	-

(Analytical software, 2008). Differences between means were compared by using (DMRT) Duncan multiple range tests at 0.05 (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on *Lavandula officinalis*, Chaix vegetative growth during 2017 - 2018 and 2018 - 2019 seasons

Plant height (cm)

Data illustrated in Table3 show that chicken manure fertilization significantly increased lavender height compared with control and addition 100 % from the

recommended N rate as chicken manure (ChM) recorded the maximum plant height (cm) for both seasons (58.82 and 44.51, respectively). Furthermore, spraying lavender plants with 200 ppm dry yeast significantly recorded the highest plant height (cm) during the two seasons (50.66 and 41.69, respectively). With regarding of combination of chicken manure percentage (%) and dry yeast spraying concentrations results recorded that the 100 % from the recommended N rate as chicken manure (ChM) with spraying lavender plants with 200 ppm dry yeast increased plant height (cm). The increase of lavender plant height may be due to increasing chicken manure fertilization because nitrogen found to increase number of nodes as well as internodes length and consequently plant height. These results are in a harmony with those found by Pujiastuti *et al.*, (2018) on *Brassica oleraceaea*

Table 3. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on plant height (cm) of *Lavandula officinalis*, Chaix during 2017- 2018 and 2018-2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				Mean (F)
	0.0	50	100	200	
First season (2017 - 2018)					
0.0 (Control)	30.00 m	33.55 l	36.33 kl	38.66 jk	34.63 D
25	40.33 ij	42.66 hi	45.50 gh	47.33 fg	43.95 C
50	49.55 ef	51.23 de	53.50 cd	56.00 bc	52.57 B
100	57.33 b	58.11 ab	59.20 ab	60.66 a	58.82 A
Mean (D)	44.30 D	46.38 C	48.63 B	50.66 A	
Second season (2018 - 2019)					
0.0 (Control)	29.56 i	32.23 h	34.56 gh	37.02 fg	33.34 D
25	38.23 e-g	39.03 d-f	39.05 d-f	39.68 c-f	38.99 C
50	40.23 c-f	41.03 b-e	41.23 b-e	42.50 b-d	41.13 B
100	43.03 bc	43.05 bc	44.43 b	47.56 a	44.51 A
Mean (D)	37.76 D	38.83 C	39.81 B	41.69 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

Table 4. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on branches number/ plant of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				Mean (F)
	0.0	50	100	200	
First season (2017 - 2018)					
0.0	25.56 k	28.02 jk	29.23 ij	29.26 ij	28.01 D
25	30.23 h-j	31.56 g-i	32.56 f-i	33.03 e-h	31.84 C
50	34.02 d-g	35.23 c-f	36.04 c-e	37.23 b-d	35.63 B
100	38.56 a-c	39.56 ab	40.03 ab	41.13 a	39.82 A
Mean (D)	32.09 C	33.59 B	34.47 AB	35.15 A	
Second season (2018 - 2019)					
0.0	33.88 i	36.66 hi	39.16 gh	39.44 gh	37.28 D
25	40.80 fg	43.11 f	47.32 e	49.69 de	45.23 C
50	50.66 c-e	52.71 cd	54.08 c	57.99 b	53.86 B
100	59.16 ab	60.13 ab	61.70 a	62.44 a	60.85 A
Mean (D)	46.12 D	48.15 C	50.56 B	52.39 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

cephala they observed that increasing chicken manure dose recorded a very significant effect on the plant height. Concerning the effect of dry yeast, Mattar and El sayed (2015) on caraway reported that plant growth parameters improved with spraying active dry yeast at 0, 2 or 4 g/L.

Branches number/ plant

The presented data in Table 4 show that branches number/ plant increased with significant differ by chicken manure fertilization compared with control and fertilization lavender plants with 100 % from the recommended rate of chicken manure (ChM) achieved the highest branches number/ plant for both seasons (39.82 and 44.51,

respectively). Moreover, the maximum branches number/ plant were obtained with spraying lavender plants with 200 ppm dry yeast during the two seasons (35.15 and 52.39, respectively). With reference to data in Table 4 the interaction between chicken manure percentage (%) and dry yeast spraying concentrations results showed that branches number/ plant observed when lavender plants fertilized with 100 % from the recommended N rate as chicken manure (ChM) in combination with spraying lavender plants with 200 ppm dry yeast during both seasons (41.13 and 62.44, respectively). The obtained data were in the same trend which noticed by Khan *et al.*, (2017) on cucumber cultivars they found that addition of poultry manure at 20 ton ha⁻¹ increased all growth

Table 5. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on herb fresh weight (g)/ plant of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				
	0.0	50	100	200	Mean (F)
First season (2017 - 2018)					
0.0	72.43 m	74.70 lm	76.67 kl	79.75 jk	75.89 D
25	81.60 ij	84.19 hi	87.04 gh	90.14 g	85.74 C
50	93.77 f	96.24 f	100.61 e	105.55 d	99.04 B
100	109.65 c	115.33 b	118.41 b	124.77 a	117.04 A
Mean (D)	89.36 D	92.61 C	95.68 B	100.05 A	
Second season (2018 - 2019)					
0.0	69.83 o	78.03 n	89.65 m	96.02 l	83.38 D
25	102.23 k	105.44 j	109.33 i	112.40 h	107.35 C
50	115.40 h	122.08 g	127.23 f	132.64 e	124.34 B
100	137.50 d	142.56 c	146.04 b	149.02 a	143.78 A
Mean (D)	106.24 D	112.03 C	118.06 B	122.52 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

Table 6. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on root length (cm) of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				
	0.0	50	100	200	Mean (F)
First season (2017 - 2018)					
0.0	15.00 m	16.77 l	18.16 kl	19.33 jk	17.31 D
25	20.16 ij	21.33 hi	22.75 gh	23.66 fg	21.97 C
50	24.77 ef	25.60 de	26.75 cd	28.00 bc	26.28 B
100	28.66 b	29.05 ab	29.60 ab	30.33 a	29.41 A
Mean (D)	22.15 D	23.19 C	24.30 B	25.33 A	
Second season (2018 - 2019)					
0.0	16.94 i	18.33 hi	19.58 gh	19.72 gh	18.64 D
25	20.40 fg	21.55 f	23.66 e	24.84 de	22.61 C
50	25.33 c-e	26.35 cd	27.04 c	28.99 b	26.932 B
100	29.58 ab	30.06 ab	30.85 a	31.22 a	30.43 A
Mean (D)	23.06 D	24.07 C	25.28 B	26.19 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

characters. On the other side regarding the effect of dry yeast Abo EL-Fadl *et al.*, (2017) on sweet potato they observed that spraying of yeast extract gave the highest means of number of shoots / plant of two cultivars in both seasons.

Herb fresh weight (g)/ plant

As presented in Table 5 show that chicken manure fertilization significantly increased herb fresh weight (g)/ plant compared with control and addition of with 100 % from the recommended N rate as chicken manure (ChM) resulted in the highest herb fresh weight (g)/ plant for both seasons (117.04 and 143.78, respectively). In

addition, spraying lavender plants with 200 ppm dry yeast significantly recorded the maximum herb fresh weight (g)/ plant during the two seasons (100.05 and 122.52, respectively). Concerning the effect of combination of chicken manure percentage (%) and dry yeast spraying concentrations results suggested that 100 % from the recommended N rate as chicken manure (ChM) with spraying lavender plants with 200 ppm dry yeast significantly increased herb fresh weight (g)/ plant. The obtained results were similar as found by Mohamed *et al.*, (2017) on *Ocimum basilicum*, L. var Genoves plant they reported that fresh and dry weights increased especially the interaction treatment between chicken manure 20 m³/ fed. with yeast extract 100 M/ L in the two cuts and in the

Table 7. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on herb fresh yield / fed. (kg) of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				
	0.0	50	100	200	Mean (F)
First season (2017 - 2018)					
0.0	1167.60 p	1254.67 o	1288.33 n	1339.80 m	1262.60 D
25	1370.90 l	1414.40 k	1462.30 j	1514.40 i	1440.50 C
50	1575.30 h	1616.80 g	1690.20 f	1773.20 e	1663.90 B
100	1842.10 d	1937.50 c	1989.30 b	2096.10 a	1966.30 A
Mean (D)	1489.00 D	1555.90 C	1607.50 B	1680.90 A	
Second season (2018 - 2019)					
0.0	1216.80 p	1310.90 o	1506.10 n	1613.10 m	1411.70 D
25	1717.50 l	1771.40 k	1836.70 j	1888.30 i	1803.50 C
50	1938.70 h	2050.90 g	2137.50 f	2228.30 e	2088.90 B
100	2310.00 d	2395.00 c	2453.50 b	2503.50 a	2415.50 A
Mean (D)	1795.70 D	1882.10 C	1983.40 B	2058.30 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

Table 8. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on herb dry yield / fed. (kg) of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				
	0.0	50	100	200	Mean (F)
First season (2017 - 2018)					
0.0	420.00 p	472.20 o	541.00 n	578.60 m	502.9 D
25	607.00 l	659.10 k	701.40 j	740.90 i	677.10 C
50	797.00 h	824.00 g	868.10 f	920.60 e	852.40 B
100	944.20 d	992.9 c	1071.7 b	1129.00 a	1034.40 A
Mean (D)	692.03 D	737.06 C	795.52 B	842.27 A	
Second season (2018 - 2019)					
0.0	505.70 o	507.40 o	533.20 n	565.80 m	528.00 D
25	576.70 l	605.60 k	643.80 j	731.60 i	639.40 C
50	761.50 h	808.20 g	847.40 f	912.70 e	832.50 B
100	944.50 d	996.70 c	1096.50 b	1115.50 a	1038.30 A
Mean (D)	697.11 D	729.50 C	780.23 B	831.43 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

two seasons. Moreover, Mattar and El sayed (2015) on caraway they reported that spraying active dry yeast at 0, 2 or 4 g/L improved plant growth characters. Moreover, Taha *et al.*, (2016) studied the effect of foliar spraying neem plants with dry yeast (*Saccharomyces cerevisiae*) extract at different concentrations (0, 5, 10, 15 and 20%) on growth. Results showed that growth parameters increased significantly by spraying plants with yeast extract at 15%.
Root length (cm)

Data in Table 6 illustrate that root length (cm) increased with significant differ by chicken manure fertilization compared with control and fertilization lavender plants

with 100 % from the recommended N rate as chicken manure (ChM) achieved the tallest root length (cm) for both seasons (29.41 and 30.43, respectively). Furthermore, the maximum root length (cm) was observed with spraying lavender plants with 200 ppm dry yeast during the two seasons (25.33 and 26.19, respectively). With reference to data in Table 6

the interaction between chicken manure percentage (%) and dry yeast spraying concentrations, results showed that root length (cm) enhanced when lavender plants fertilized with 100 % from the recommended N rate as chicken manure (ChM) in combination with spraying lavender

Table 9. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on oil percentage (%) of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				
	0.0	50	100	200	Mean (F)
First season (2017 - 2018)					
0.0	0.13 h	0.15 gh	0.17 fg	0.19 ef	0.16 D
25	0.14 gh	0.17 fg	0.20 de	0.23 c	0.18 C
50	0.17 fg	0.20 de	0.22 c	0.26 b	0.21 B
100	0.20 de	0.23 c	0.26 b	0.30 a	0.24 A
Mean (D)	0.16 D	0.18 C	0.21 B	0.24 A	
Second season (2018 - 2019)					
0.0	0.13 g	0.16 f	0.19 e	0.21 de	0.17 D
25	0.16 f	0.20 de	0.23 c	0.25 bc	0.21 C
50	0.20 de	0.23 c	0.25 bc	0.27 b	0.23 B
100	0.21	0.26 bc	0.28 b	0.31 a	0.26 A
Mean (D)	0.17 D	0.21 C	0.23 B	0.26 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

Table 10. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on oil yield/ fed. (l) of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)				
	0.0	50	100	200	Mean (F)
First season (2017 - 2018)					
0.0	151.78 l	188.25 k	218.96 j	254.56 hi	203.39 D
25	191.92 k	240.45 i	292.46 fg	348.31 ef	268.28 C
50	267.80 h	323.37 ef	371.85 de	461.04 c	356.01 B
100	368.42 de	445.64 c	517.22 b	628.84 a	490.03 A
Mean (D)	244.98 D	299.43 C	350.12 B	423.18 A	
Second season (2018 - 2019)					
0.0	158.18 l	209.74 k	286.16 ij	338.76 hi	248.21 D
25	274.80 j	354.27 h	422.44 fg	472.07 ef	380.90 C
50	378.75 gh	471.72 ef	534.37 d	609.08 c	500.73 B
100	485.10 de	622.70 c	686.97 b	776.09 a	642.71 A
Mean (D)	326.46 D	414.61 C	482.48 B	549.00 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

plants with 200 ppm dry yeast during both seasons (30.33 and 31.22, respectively). Results were in the same way with those reported by Jagadeesh *et al.*, (2018) on beet root Cv. crimson globe they stated that root length recorded the highest values with FYM (50%) + poultry manure (50%) furthermore, root diameter was maximum with poultry manure (100%).

Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on yield of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Herb fresh yield/ fed.

Data presented in Table 7 indicate that herb fresh yield/ fed. increased with differ significant with chicken manure fertilization compared with control and addition of 100 % from the recommended N rate as chicken manure (ChM) resulted in the highest herb fresh yield/ fed. for both seasons. Moreover, the increase in dry yeast spraying concentration significantly recorded /the maximum herb fresh yield/ fed. during the two seasons. Concerning the effect of combination of chicken manure percentage (%) and dry yeast spraying concentrations results showed that 100 % from the recommended N rate as chicken manure

Table11. Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on total nitrogen, phosphorus and potassium percentage (%) of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Chicken manure (%)	Dry yeast concentrations (ppm)									
	0.0	50	100	200	Mean (F)	0.0	50	100	200	Mean (F)
	First season (2017 - 2018)					Second season (2018 - 2019)				
Total nitrogen percentage (%)										
0.0	1.40 i	1.60 hi	1.65 hi	1.70 h	1.58 D	1.60 i	1.64 hi	1.70 hi	1.73 h	1.66 D
25	1.70 h	1.90 g	1.95 g	2.03 f	1.89 C	1.75 h	1.96 g	2.02 g	2.15 f	1.97 C
50	2.05 ef	2.12 e	2.20 de	2.35 cd	2.18 B	2.23 ef	2.28 e	2.32 de	2.40 cd	2.30 B
100	2.45 c	2.60 b	2.70 ab	2.74 a	2.62 A	2.48 c	2.64 b	2.75 ab	2.80 a	2.66 A
Mean (D)	1.90 D	2.05C	2.12 B	2.20 A		2.01 D	2.13 C	2.19 B	2.27 A	
Total phosphorus percentage (%)										
0.0	0.295 a	0.300 a	0.315 a	0.310 a	0.305 B	0.301 j	0.306 ij	0.314 h-j	0.318 hi	0.309 D
25	0.322 a	0.325 a	0.330 a	0.328 a	0.326 AB	0.325 gh	0.336 fg	0.340 e-g	0.348 d-f	0.337 C
50	0.334 a	0.360 a	0.344 a	0.360 a	0.349 A	0.352 de	0.358 cd	0.362 b-d	0.368 a-c	0.360 B
100	0.347 a	0.355 a	0.368 a	0.365 a	0.358 A	0.370 a-c	0.372 a-c	0.375 ab	0.380 a	0.374 A
Mean (D)	0.324 A	0.335A	0.339 A	0.340 A		0.337 C	0.343 B	0.347 B	0.353 A	
Total potassium percentage (%)										
0.0	2.20 j	2.27 ij	2.35 hi	2.40 gh	2.30 D	2.26 j	2.30 j	2.37 ij	2.45 hi	2.34 D
25	2.46 gh	2.53 fg	2.58 ef	2.61 d-f	2.54 C	2.48 g-i	2.55 f-h	2.60 e-g	2.63 d-f	2.56 C
50	2.64 c-f	2.66 b-f	2.69 a-e	2.72 a-d	2.67 B	2.67 c-f	2.70 b-e	2.73 a-d	2.77 a-c	2.71 B
100	2.74 a-d	2.77 a-c	2.79 ab	2.81 a	2.77 A	2.79 a-c	2.81 ab	2.83 a	2.85 a	2.82 A
Mean (D)	2.51 C	2.55 B	2.60 A	2.63 A		2.55 C	2.59 BC	2.63 AB	2.67 A	

Means within a Column having the same letter(s) are not significantly different according to Duncan's multiple range test (DMRT)

(ChM) with spraying lavender plants with 200 ppm dry yeast significantly increased herb fresh yield/ fed. during both seasons (2096.10 and 2503.50, respectively). the obtained results were in the same way with those found by Azmi *et al.*, (2019) on *Ficus carica* they suggested that trees provide high yield production as compared to other treatments by addition of chicken manure at 20% (v/v).

Herb dry yield/ fed.

As shown in Table 8 data clear that herb dry yield/ fed. (kg) increased significantly by chicken manure fertilization compared with control and fertilization lavender plants with 100 % from the recommended N rate as chicken manure (ChM) recorded the maximum herb dry yield/ fed. in the two seasons (1034.40 and 1038.30, respectively). Furthermore, the highest herb dry yield/ fed. observed with spraying lavender plants with 200 ppm dry yeast during the two seasons (842.27 and 831.43, respectively). Concerning the interaction between chicken manure percentage (%) and dry yeast spraying

concentrations, results revealed that herb dry yield/ fed. (kg) increased when lavender plants fertilized with 100 % from the recommended N rate as chicken manure (ChM) in combination with spraying lavender plants with 200 ppm dry yeast during both seasons (1129.00 and 1115.50, respectively). Results were in the same way with those

reported by Dewedar and Ibrahim (2016) on rice cultivars they recommended that maximum yield components were produced from foliar spraying with 6 or 8 g/L dry yeast where show enhancement in heading date.

Oil percentage (%) and oil yield/ fed. (l)

Data of both seasons in Table 9 and 10 clear that oil percentage (%) and oil yield/ fed. (l) increased with differ significant with chicken manure fertilization compared with control and addition of 100 % from the recommended N rate as chicken manure (ChM) resulted in the maximum oil percentage (%) and oil yield/ fed. (l) for the two seasons.

Furthermore, the increase in dry yeast spraying concentration significantly recorded the highest oil percentage (%) during the two seasons. For concerning the effect of combination of chicken manure percentage (%) and dry yeast spraying concentrations results showed that 100 % from the recommended N rate as chicken manure (ChM) with spraying lavender plants with 200 ppm dry yeast significantly enhanced oil percentage (%) and oil yield/ fed. (l) during both seasons (0.30 and 0.31 and 628.84, 776.09, respectively).

These results may be due to using organic manure such as chicken manure enhance soil organic matter, micro and

macro elements availability, nitrogen fixation and increase microorganisms of rizosphere that produced growth substances or phyto hormones which improve growth and dry matter accumulation which led to the concentration of oil (Edris *et al.*, 2003; Jung *et al.*, 2004).

The obtained results were in a harmony with Sakr *et al.*, (2015) on *Lavandula angustifolia* they recommended that addition of sheep manure at the rate of 15 m³/ feddan + 6 g/L active dry yeast recorded the highest essential oil production.

Effect of chicken manure (ChM) fertilization, dry yeast concentrations and their interaction on chemical constituents of *Lavandula officinalis*, Chaix during 2017 - 2018 and 2018 - 2019 seasons

Data illustrated in Table 11 present that increment of chicken manure (ChM) % resulted in significant increase on total nitrogen, phosphorus and potassium percentage (%) of the two seasons and the maximum values of the previous parameters were observed when lavender plants fertilized with 100 % from the recommended N rate as chicken manure (ChM) (2.62 and 2.66, 0.358 and 0.370 and 2.77, 2.82, respectively). Concerning the effect of dry yeast spraying, results showed that application of dry yeast at 200 ppm recorded the best values of the previous parameters during first and the second season (2.20 and 2.27, 0.340 and 0.353 and 2.63, 2.67, respectively). For the interaction effect of chicken manure (ChM) % with dry yeast spraying concentrations data clear that 100 % from the recommended N rate as chicken manure (ChM) with spraying lavender plants with 200 ppm dry yeast resulted in significant enhancement on total nitrogen, phosphorus and potassium percentage (%) of the two seasons. These results are similar with those found by Taha *et al.*, (2016) studied the effect of foliar spraying plants with dry yeast (*Saccharomyces cerevisiae*) extract at various

Concentrations (0,5, 10, 15 and 20%) on nitrogen content. Results suggested that nitrogen content was enhanced and recorded the maximum value in plants treated with dry yeast extract at 10%. Moreover, Ahmed *et al.*, (2011) on *Solanum tuberosum* L. plants used active yeast extract treatments (0, 1, 2, 3, 4 and 5 g/l) with four zinc treatments (0, 100, 200 and 300 ppm). Results stated that increasing of foliar application of active dry yeast concentration up to 5 g/l increased N, P, K and Zn showed positive responses to various yeast concentrations. Furthermore, Also, Fawzy *et al.*, (2012) on two varieties of onion plant “Giza 20 and Super X” the results indicated that, using yeast had positive promoting effects all chemical composition compared with control plants.

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