Zagazig J. Agric. Res., Vol. 33 No. (4) 2006 665 - 683

EFFECT OF CHICKEN MANURE AND DRY YEAST ON THE GROWTH, SEED YIELD AND ACTIVE INGREDIENTS OF *SILYBUM MARIANUM* L. PLANT

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Accepted 16 / 5 / 2006

ABSTRACT: This study was done throughout the two successive seasons of 2001/2002 and 2002/2003 at the Experimental Farm of Horticulture Research Institute, at El-Kassacin Station, Agriculture Research Center, Ismaellia Governorate.

The aim of the study was to investigate the effect of chicken manure at 0, 5, 10 and 20 m^3 / fed. and dry yeast at 0, 1, 2 and 4 g / l. as well as their interaction on the growth, seed yield, silymarin content and some chemical constituents of milk thistle plants. The results can be summarized as follows :

All treatments increased the plant height, dry weight and seed yield per plant. The highest effective treatments were that of chicken manure at 20 m^3 / fed., dry yeast at 4 g / l. and interaction treatment of chicken manure (20 m^3 / fed.) with dry yeast (4 g / l.). Also, all treatments mentioned above produced the highest values of nitrogen, phosphorus, potassium and the total carbohydrates per plant. Whereas the least values were produced from the control plants. The percentage of the main active ingredient (silymarin) was increased by all treatments compared with untreated plants.

Key words: Chicken manure, dry yeast, silymarin active ingredient, *Silybum marianum*.

INTRODUCTION

Milk thistle *Silybum marianum* L. belongs to family *Asteraceae*. It is one of the most important medicinal plants, native to the mediterranean region of Europe and found in dry rocky soils of southern and western Europe and in some parts of U.S.A (Weiss, 1988).

Medicinally, the active ingredient in milk thistle is silymarin. The constituent silymarin shows antifibrotic effects in early and advanced biliary fibrosis secondary to complete bile duct obliteration in rats. In patients with diabetes and alcohol-induced cirrhosis, silymarin has been shown to lower lipoperoxidative damage, blood glucose levels, glycosylated hemoglobin values and exogenous insulin requirements (Wagner and Seligman, 1985).

The value of chicken manure as fertilizer and soil conditioners was determined by their ability to increase plant height and dry weight per plant as mentioned by Ahmed *et al.* (1998) on roselle plants and El-Ghawwas *et al.* (2002) on fennel plants. Addition of chicken manure to the soil has a considerable effect on the improvement of NPK contents, total carbohydrates, seed yield per plant, and the active ingredients. These results are in agreement with those reported by Dragland (1996) on *Hypericum perforatum* plants, Vieira *et al.* (1999) on *Calendula officinalis* plants and El-Sayed *et al.* (2002) on spearmint and marjoram plants.

Dry yeast is a natural source of many growth substances such as Bs-vitamins and most of the nutritional elements (Skoog and Miller, 1957). Spraying dry yeast on plants enhancing plant height, dry weight per plant, NPK contents, the total carbohydrates and active ingredients per plant (Hewedy *et al.*,1996 on eggplant plants, Ahmed *et al.*,1998 on roselle plants, Tartoura, 2002 on pea plants and Navarro *et al.*, 2003 on *Sedum oxypetalum* plants.).

Therefore, the present work was carried out to study the effect of chicken manure fertilizer and dry yeast as well as their interaction aiming to obtain the highest of the main active ingredient (silymarin) in the seeds of milk thistle plants.

MATERIALS AND METHODS

This work was done at the experimental farm of Horticultural Research Station in EL-kassacin, Ismaellia Governorate, Egypt, during the two successive seasons of 2001-2002 and 2002-2003. This work was designed to study the effect of the interaction between some levels of chicken manure fertilizer and different

concentrations of dry yeast, on growth and active ingredients of *Silybum marianum*, L. plants. The seeds of milk thistle were obtained from the Department of Medicinal and Aromatic plants, Ministry of Agriculture, Dokki. The seeds were sown on September 15th in the two seasons. Five seeds were sown per hill rows. The irrigation system of the experiment was drip irrigation. The experimental plot area was 9 m^2 (3 x 3) and contained 3 rows at 100 cm apart and the distance between plants were 50 cm apart. The seedlings were thinned to one plant per hill after one month from sowing date. Each plot contained 18 plants. The physical and chemical analysis of the experimental field are presented in Table A.

The chicken manure fertilizer was added to the soil before planting at the levels of 0, 5, 10 and 20 m^3 / fed., while the dry yeast concentrations used were 0, 1, 2 and 4 gm / l., and the plants were sprayed by aqueous solution of dry yeast three times; the first was on November 6th, while the second and third ones were at 21 days intervals after the first one in both seasons. The experimental design was complete randomized blocks in factorial experiment with three replicates.

The normal agricultural practices for milk thistle production were applied whenever required. The analytical data of chicken manure fertilizer are presented in Table B. The analysis of dry yeast elements are illustrated in Table C (Nagodawithana, 1991). The following data were recorded:

Growth Parameters

The different growth characters; i.e., Plant height (cm) and dry weight / plant (gm) were recorded at two times, (20th of February), at flowering stage, while the second one was at the 25 days after the first one during the two seasons.

Seed Yield Per Plant

At harvesting date (10th of May) the weight of seeds per plant (gm) was recorded.

Chemical Analysis

Samples from seeds were used to determine the following measurements:

1. Total nitrogen was determined according to the method described by Koch and Mc-Meekin (1924).

2. Total phosphorus was determined according to Troug and Mayer (1939).
3. Potassium determination was done photometrically according to the method described by Brown and Lilleland (1946).
4. Total carbohydrate percentage was carried out according to Dubois *et al.* (1956).

Active Ingredients

Silymarin was determined according to the method described by Martinelli *et al.* (1991).

Statistical Analysis

The statistical analysis of the present data was carried out according to Snedecor and Cochran (1972).

Table A : The physical and chemical properties of the soil

Physical properties		Chemical properties	
Coarse sand	59.42 %	Organic matter	0.39 %
Fine sand	31.04 %	Available N	17.00 ppm
Silt	3.46 %	Available P	1.00 ppm
Clay	5.08 %	Available K	45.00 ppm
Texture	Sandy soil	PH	8.50
		E.C.	2.36 mmhos/cm

Table B : The analytical data of chicken manure fertilizer

Chicken manure	1st season	2nd season
Weight of m^3 / kg	258	254
Total nitrogen %	3.31	4.6164
Ammonia mg /kg	911.1	940.2
Nitrate mg /kg	69.8	74.6
Humidity %	7.1	8.6
Total phosphorous %	0.45	0.55
Total potassium %	2.95	2.20
Organic matter %	35.679	39.29
Organic carbon %	25.57	28.62
Ash %	61.162	64.275
C:N ratio	5.2 : 1	5.7 : 1
Micro elements mg/kg;		
Iron	8297.8	8621.6
Manganese	186.7	209.5
Copper	49.20	40.60
Zinc	771.8	798.3

Table C : Composition of dry yeast elements

Protein	**47 %**
Carbohydrate	**33 %**
Minerals	**8 %**
Nucleic acids	**8 %**
Lipids	**4 %**

Approximate composition of minerals :

Na	**0.12 mg/g**	**Cu**	**8.00 u/g**
Ca	**0.75 mg/g**	**Se**	**0.10 u/g**
Fe	**0.02 mg/g**	**Mn**	**0.02 u/g**
Mg	**1.65 mg/g**	**Cr**	**2.20 u/g**
K	**21.00 mg/g**	**Ni**	**3.00 u/g**
P	**13.50 mg/g**	**Va**	**0.04 u/g**
S	**3.90 mg/g**	**Mo**	**0.40 u/g**
Zn	**0.17 mg/g**	**Sn**	**3.00 u/g**
Si	**0.03 mg/g**	**Li**	**0.17 u/g**

Approximate composition of vitamins :

Thiamine	**60-100 u/g**
Riboflavin	**35-50 u/g**
Niacin	**300-500 u/g**
Pyridoxine HCL	**28 u/g**
Pantorhenate	**70 u/g**
Biotin	**1.3 u/g**
Cholin	**4000 u/g**
Folic acid	**5-13 u/g**
Vit. B_{12}	**0.001 u/g**

RESULTS AND DISCUSSION

Growth Parameters

Plant height

Data in Tables 1, 2 show that, in first season, all chicken manure treatments caused an increase in plant height compared with the control at both dates except the treatment (5 m^3 / fed.) at first date. The tallest plants were produced from the treatment 20 m^3 / fed. at both of the first and the second dates. In the second season, the results indicated that all chicken manure treatments had significant effect on plant height. The positive results are similar to

Table 1: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D.Y.) and their interactions on plant height (cm) of *Silybum marianum* L. plants during the first season of 2001/2002

Chicken manure (Ch. M)	Dry yeast (D. Y)									
	1st date					2nd date				
	0	1 gm/L	2 gm/L	4 gm/L	Mean	0	1 gm/L	2 gm/L	4 gm/L	Mean
0	23.00	27.00	31.00	36.00	29.25	84.00	89.00	104.0	110.0	96.75
5 m^3 / fed.	25.00	30.00	36.00	39.00	32.50	87.00	105.0	115.0	125.0	108.0
10 m^3 / fed.	27.00	32.00	37.00	42.00	34.50	89.00	119.0	128.0	139.0	118.75
20 m^3 / fed.	28.00	35.00	41.00	52.00	39.00	92.00	121.0	132.0	148.0	123.25
Mean	25.75	31.00	36.25	42.25		88.00	108.50	119.75	130.50	

L. S. D. of Ch. M. at 5 %	5.10	10.12
L. S. D. of D. Y. at 5 %	5.10	10.12
L. S. D. of Inter. at 5 %	10.20	20.25

Table 2: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D. Y.) and their interactions on plant height (cm) of *Silybum marianum* L. plants during the second season of 2002/2003

Chicken manure (Ch. M)	Dry yeast (D. Y)									
	1st date					2nd date				
	0	1 gm/L	2 gm/L	4 gm/L	Mean	0	1 gm/L	2 gm/L	4 gm/L	Mean
0	21.00	25.00	28.00	35.00	27.25	81.00	87.00	106.0	113.0	96.75
5 m^3 / fed.	23.00	27.00	32.00	41.00	30.75	86.00	107.0	119.0	128.0	110.0
10 m^3 / fed.	25.00	28.00	32.00	43.00	32.00	91.00	121.0	129.0	141.0	120.5
20 m^3 / fed.	27.00	36.00	43.00	50.00	39.00	94.00	123.0	131.0	151.0	124.75
Mean	24.00	29.00	33.75	42.25		88.00	109.50	121.25	133.25	

L. S. D. of Ch. M. at 5 %	5.15	9.44
L. S. D. of D. Y. at 5 %	5.15	9.44
L. S. D. of Inter. at 5 %	10.31	18.89

those of Ahmed *et al.* (1998) on roselle plants, Dong ChenSheng *et al.* (2000) on *Pteridium aquilinum* plants, Mohamed and Matter (2001) on *Tagetes minuta* plants, El-Ghawwas *et al.* (2002) and Abdou and Mahmoud (2003) on fennel plants. Increasing plant height of *Silybum marianum* plants after chicken manure applications may be due to the increase in the soil organic matter content, cations exchange capacity and mineral nutrients which in turn encouraged the plant growth.

The effect of dry yeast on the plant height of *Silybum marianum* plants in both seasons are presented in Tables 1 and 2. Both seasons clear that all treatments of dry yeast had a significant effect on increasing plant height if compared with control and the tallest plants resulted from the treatment (4 g / l.) at both dates. The positive influence of dry yeast was also reported by Hewedy *et al.* (1996) on eggplant plants, Eid (2001) on coriander plants and Hend (2002) on *Oenothera biennis* plants. The effect of dry yeast on plant height may be due to that yeast is a natural source of cytokinins that enhance cell division (Muller and Leopold, 1966).

Regarding the interaction effect between chicken manure and dry yeast on plant height of milk thistle plants in first and second seasons, data in Tables 1 and 2 show that most of interaction treatments had a significant effect on increasing plant height compared with control at both first and second dates. In the first season, the interaction between chicken manure (20 m^3 / fed.) and dry yeast (4 g / l.) produced the tallest plants of milk thistle followed by interaction treatment of chicken manure (10 m^3 / fed.) and dry yeast (4 g / l.) followed by interaction treatment of chicken manure (20 m^3 / fed.) and dry yeast (2 g / l.), respectively at both dates. These results are in agreement with Ahmed *et al.* (1998) on roselle plants.

Dry Weight Per Plant

The results of Tables 3 and 4 show that there were significant differences among the levels of chicken manure at the two dates in both seasons regarding the dry weight of herb per plant compared to control, except the treatment of 5 m^3 / fed. at the first date during the first season. Moreover, there was gradual and consistent increase in dry weight of herb per plant with increasing the level of

Table 3: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D. Y.) and their interactions on dry weight of herb per plant (gm) of *Silybum marianum* L. plants during the first season of 2001/2002

Chicken manure (Ch. M)	Dry yeast (D. Y)									
	1st date					2nd date				
	0	1 gm/L	2 gm/L	4 gm/L	Mean	0	1 gm/L	2 gm/L	4 gm/L	Mean
0	41.10	52.30	71.20	83.20	61.95	62.10	81.30	89.20	94.60	81.80
5 m^3 / fed.	42.90	57.20	71.30	84.30	63.92	67.30	85.60	99.30	111.20	90.85
10 m^3 / fed.	52.10	63.70	76.20	89.10	70.27	86.20	101.20	103.20	121.50	103.03
20 m^3 / fed.	56.10	72.10	88.30	91.50	77.00	92.10	107.30	129.10	181.30	127.45
Mean	48.05	61.32	76.75	87.02		76.92	93.85	105.20	127.15	
L. S. D. of Ch. M. at 5 %		3.07					3.45			
L. S. D. of D. Y. at 5 %		3.07					3.45			
L. S. D. of Inter. at 5 %		6.15					6.91			

Table 4: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D. Y.) and their interactions on dry weight of herb per plant (gm) of *Silybum marianum* L. plants during the second season of 2002/2003

Chicken manure (Ch. M)	Dry yeast (D. Y)									
	1st date					2nd date				
	0	1 gm/L	2 gm/L	4 gm/L	Mean	0	1 gm/L	2 gm/L	4 gm/L	Mean
0	49.20	57.20	67.30	87.10	65.20	64.60	89.20	99.30	109.20	90.57
5 m^3 / fed.	56.10	67.20	72.30	85.10	70.17	87.10	91.20	93.10	109.90	95.34
10 m^3 / fed.	59.20	71.30	79.40	90.20	75.02	88.10	94.20	109.20	118.30	102.45
20 m^3 / fed.	59.80	78.20	91.30	98.70	82.00	91.20	110.50	123.40	152.50	119.40
Mean	56.07	68.47	77.57	90.27		82.75	96.27	106.25	122.48	

L. S. D. of Ch. M. at 5 %	2.80	4.30
L. S. D. of D. Y. at 5 %	2.80	4.30
L. S. D. of Inter. at 5 %	5.61	8.60

chicken manure. The increase of dry weight of herb per plant as results of chicken manure application are in harmony with those of Abou El-Defan (1990) on tomato plants, Dragland (1996) on *Hypericum perforatum* plants and Ahmed *et al.* (1998) on roselle plants. The positive effect of chicken manure on dry weight of herb may be due to the addition of manures to the sandy soil and consequently increasing the soil water holding capacity, which in turn, allows higher absorption of water and nutrients from the soil and enables photosynthesis to occur efficiently within the plant leaves (Hartman *et al.*, 1981).

Data presented in Tables 3 and 4 show the effect of dry yeast spraying on dry weight of *Silybum marianum* herb. It is evident that application of dry yeast significantly increased the dry weight of herb per plant and these results hold true in both seasons. The results are in line with those of Fathy and Farid (1996) on common bean plants, Abd El-Aziz (1997) on tomato plants, Hend (2002) on *Oenothera biennis* plants and Tartoura (2002) on pea plants. The increase of dry weight may be due to the yeast contents of nutrients and also growth regulators as well as different vitamins.

Data presented in Tables 3 and 4 show the effect of treatments chicken manure combined with dry yeast on dry weight of herb. Generally, the highest dry weight was produced from the interaction treatment of 20 m^3 / fed. chicken manure combined with 4 g / l. dry yeast. The obtained results are similar to Ahmed *et al.* (1998) on roselle plants.

Seed Yield Per Plant

The results on the seed yield per plant in both seasons are presented in Table 5. The data show that the seed yield per plant of milk thistle plants was increased with increasing the levels of chicken manure compared to control plants and the greatest seed yield per plant was produced from the treatment of 20 m^3 / fed. The obtained results are in agreement with those of Vieira *et al.* (1999) on *Calendula officinalis* plants, Mohamed and Matter (2001) on *Tagetes minuta* plants and El-Ghawwas *et al.* (2002) on fennel plants.

Seed yield per plant in the two seasons after spraying with dry yeast are presented in Table 5. It can be noticed that the seed yield

Table 5: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D. Y.) and their interactions on seed yield per plant (gm) of *Silybum marianum* L. plants during the first season of 2001/2002 and the second season of 2002/2003

Chicken manure (Ch. M)	Dry yeast (D. Y)									
	1st season					2nd season				
	0	1 gm/L	2 gm/L	4 gm/L	Mean	0	1 gm/L	2 gm/L	4 gm/L	Mean
0	18.20	43.90	48.20	56.70	41.75	18.90	45.10	47.20	55.20	41.60
5 m^3 / fed.	62.10	68.10	73.10	79.60	70.72	61.10	69.90	72.50	80.30	70.95
10 m^3 / fed.	63.00	70.40	78.30	81.60	73.32	70.40	71.20	72.90	80.60	73.77
20 m^3 / fed.	76.10	81.10	89.80	93.60	85.15	75.10	78.80	92.30	95.70	85.47
Mean	54.85	65.87	72.35	77.87		56.37	66.25	71.22	77.95	
L. S. D. of Ch. M. at 5 %	7.37					7.45				
L. S. D. of D. Y. at 5 %	7.37					7.45				
L. S. D. of Inter. at 5 %	14.75					14.90				

per plant gradually increased with increasing the concentration of dry yeast and the differences between treatments and control were significant in both seasons. These results are in line with those of Hewedy *et al.* (1996) on eggplant plants and Ahmed *et al.* (1998) on roselle plants.

Data dealing with the effect of the interaction treatments of chicken manure combined with dry yeast on seed yield per plant are shown in Table 5. All the interaction treatments showed a significant increase on seed yield per plant if compared with control. The interaction treatment of chicken manure (20 m^3 / fed.) with dry yeast (4 g / l.) produced the highest seed yield per plant in both seasons, while the least seed yield per plant was produced from untreated plants. These results are similar to Ahmed *et al.* (1998) on roselle plants.

Chemical Constituents

Total silymarin content / plant

Silymarin contents which obtained from the different treatments during the second season were subjected to gas chromatographic analysis. The percentages of the silymarin contents (taxifolin (TXF), silychristin (SCN), silydianin (SDN), silybin (SBN), isosilybin (ISBN)) extracted from untreated plants are presented in Figure 1. From the results in Table 6, it is clear that all chicken manure treatments increased the total silymarin content per plant. These values gradually increased with the increase of chicken manure levels from 5 up to 20 m^3 / fed. Also, statistical analysis showed a significant differences between treatments and control.

Concerning the effect of different levels of dry yeast on silymarin content in the seeds of milk thistle plants, data in Table 6 indicate that dry yeast had a positive effect on silymarin content per plant and data also show that the highest content (2.318 gm / plant) was obtained from plants sprayed with the rate of 4 g / l., while the least value (1.270 gm / plant) was obtained from control.

It is evident from Table 6 that interaction treatments show a significant increase in silymarin content per plant in the seeds if compared with control. The treatment of (chicken manure at 20 m^3 / fed. and dry yeast at 4 g / l.) produced the highest content of silymarin if compared with control

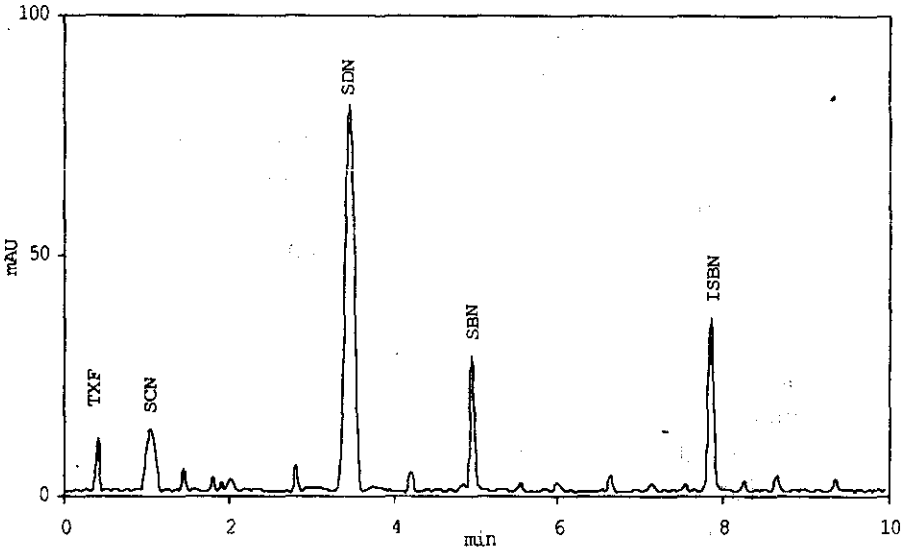

Fig. 1: Chromatogram of silymarin contents extracted from untreated plants during the second season of 2002/2003

Table 6: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D. Y.) and their interactions on total silymarin content of seeds per plant (gm) of *Silybum marianum* L. plants during the second season of 2002/2003

Chicken manure (Ch. M)	Dry yeast (D. Y)				
	2nd season				
	0	1 gm/L	2 gm/L	4 gm/L	Mean
0	0.132	0.326	0.383	0.498	0.335
5 m^3 / fed.	0.698	1.326	1.613	2.034	1.418
10 m^3 / fed.	1.892	2.088	2.210	2.681	2.218
20 m^3 / fed.	2.359	2.713	3.453	4.057	3.146
Mean	1.270	1.613	1.915	2.318	

L. S. D. of Ch. M. at 5 %	0.134
L. S. D. of D. Y. at 5 %	0.134
L. S. D. of Inter. at 5 %	0.268

or the other treatments.

Total carbohydrates and NPK contents

Regarding the effect of the interaction treatments on NPK and total carbohydrates contents per plant, data presented in Table 7 clearly show that the contents of NPK and total carbohydrates in seeds increased with increasing the level of chicken manure and dry yeast as compared with control during the two seasons.

Table 7: Effect of chicken manure (Ch. M.) levels, different concentrations of dry yeast (D. Y.) and their interactions on the NPK contents and total carbohydrates content of seeds per plant (gm) of *Silybum marianum* L. plants during the first season of 2001/2002 and the second season of 2002/2003

Treatments		Nitrogen		Phosphorus		Potassium		Total carbohydrate	
Ch. M x D.Y (m^3/fed.)	(g/l.)	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
0	0	0.36	0.39	0.04	0.04	0.38	0.45	4.95	4.94
0	1	0.92	0.96	0.12	0.11	1.00	1.19	12.21	12.56
0	2	1.05	1.04	0.13	0.12	1.51	1.34	13.56	13.30
0	4	1.27	1.29	0.15	0.14	2.08	1.64	16.03	15.68
5	0	1.29	1.28	0.18	0.14	1.65	1.91	17.35	17.09
5	1	1.48	1.51	0.20	0.18	2.00	2.27	19.24	19.74
5	2	1.63	1.65	0.22	0.20	2.55	2.45	20.77	20.74
5	4	2.24	1.94	0.27	0.23	3.03	2.82	24.69	23.10
10	0	1.37	1.55	0.20	0.21	1.71	2.44	17.71	19.92
10	1	1.60	1.59	0.23	0.22	2.09	2.57	20.16	20.52
10	2	2.06	2.12	0.25	0.23	2.32	2.77	21.28	21.22
10	4	2.54	2.53	0.31	0.29	3.04	3.23	25.21	24.33
20	0	1.78	2.08	0.26	0.24	2.83	2.35	22.19	20.77
20	1	2.14	2.45	0.30	0.28	3.11	3.00	23.85	23.02
20	2	2.93	3.11	0.38	0.36	3.91	3.76	29.56	28.35
20	4	3.06	3.38	0.42	0.41	4.02	3.97	30.41	29.90
L. S. D. at 5 %		0.13	0.22	0.02	0.03	0.21	0.27	1.54	2.34

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تأثير كل من سماد الكتكوت و الخميرة الجافة على النمو، و محصول البذور، و المواد الفعالة في شوك الجمل

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أجريت هذه الدراسة خلال موسمين متتاليين هما ٢٠٠١/٢٠٠٢ و ٢٠٠٢/٢٠٠٣ في مزرعة للتجارب بمحطة بحوث البساتين بالقصاصين، التابعة لمركز البحوث الزراعية بمحافظة الإسماعيلية، بهدف دراسة تأثير التفاعل بين مستويات مختلفة من سماد الكتكوت و تركيزات مختلفة من الخميرة الجافة على النمو، و محصول البذور، و المادة الفعالة (السيلامارين)، و بعض المكونات الكيماوية لنباتات شوك الجمل، وقد تم استخدام معاملات سماد الكتكوت بالمعدلات (صفر، ٥، ١٠، ٢٠ م^{٣} / فدان) ، و معاملات الخميرة الجافة بالمعدلات (صفر، ١، ٢، ٤ جم / لتر) ، و النتائج يمكن تلخيصها فيما يلي:-

كل المعاملات أدت إلى زيادة في كل من طول النبات ، و الوزن الجاف لكل نبات ، و كذلك محصول البذور ، و كانت أفضل معاملة (أعطت أفضل تأثير) هي سماد الكتكوت عند ٢٠م^{٣} / فدان ، و الخميرة الجافة عند ٤جم / لتر ، و كذالك معاملة التداخل (سماد كتكوت عند ٢٠م^{٣} / فدان مع الخميرة الجافة عند ٤جم / لتر) .

أيضاً كل المعاملات السابقة قد أعطت أعلى قيم لكل من النيتروجين، و الفسفور، و البوتاسيوم، و الكربوهيدرات الكلية لكل نبات، بينما نتجت أقل القيم من نباتات الكنترول ، ولقد زادت نسبة المادة الفعالة (السيلامارين) عند استخدام كل المعاملات مقارنة بالنباتات التي لم يتم معاملتها.