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# EFFECT OF COMPOST, BIO-FERTILIZER AND ACTIVE DRY YEAST ON *ORIGANUM SYRIACUM,* L. PLANTS UNDER SINAI CONDITIONS

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## ABSTRACT

*This experiment was conducted at El-Maghara Research Station (North Sinai), Desert Research Center, during the two successive seasons of 2004 and 2005 to study the effect of compost, bio-fertilizer and yeast on growth , oil production and chemical composition of Origanum syriacum L. cv. Sinaicum (Boiss).*

*The plants were fertilized with compost at the rates 5, 10 and 20 $m^3$/feddan, bio-fertilizer (Azotobacter chroococcum, Azospirillum sp., Bacillus cirulans and Bacillus megaterium var. phosphaticum) and active dry yeast at the concentrations of 0, 5 and 10 g /L.*

*The results showed that compost application at 10 and 20 $m^3$/feddan enhanced number of branches, herb fresh and dry weights, oil percentage, oil yield / plant and chemical composition (N, P, K and total carbohydrates percentage ) of oregano plants. Compost at 10 $m^3$/feddan was the most effective treatment followed by 20$m^3$/ feddan.*

*Active dry yeast, at 5 or 10 g /L led to a significant increment in vegetative growth parameters, oil percentage and oil yield / plant, as well as chemical composition ( N, P , K and total carbohydrates percentage) . Yeast at 5 g /L was the most effective treatment in most cases. Whereas Yeast at 10 g / L was the most effective treatment on oil percentage.*

*Bio-fertilizer led to a significant increase in number of branches, fresh and dry weights / plant, oil percentage, oil yield/ plant, and chemical composition (N, P, K and total carbohydrates percentages) in both two seasons.*

*Interaction had a significant effect on all parameters. Compost at 10 or 20 $m^3$ / feddan plus bio-fertilizer plus active dry yeast at 5 or 10 g /L gave the highest values of vegetative growth parameters, oil percentage, oil yield / plant and N, P , K and total carbohydrates percentage.*

**Keywords:** Compost, bio-fertilizer, active dry yeast, *Origanum syriacum*, Sinai conditions.

## INTRODUCTION

Oregano plant ( *Origanum syriacum*, L. cv. Sinaicum (Boiss) belongs to family *Lamiaceae* (*Labiatae*) is considered one of the most important medicinal and aromatic plants because it contains an important and effective compounds, which contribute in the field of nourishing and other different medical usages. It has a long history as a medicinal and flavoring herb. The plant has been used in folk medicine to treat colds, coughs; gastrointestinal problems and a variety of other conditions, and the plant reportedly have antibacterial, antifungal and antimicrobial properties. Also, its thymol concentration is probably responsible for its effective application in treating tooth decay, gum infections, and coughs; oregano tea is drunk after meals to aid digestion (El-Batanouny, 2006).

fertilizers is considered today as a promising alternative - The utilization of bio for mineral fertilizers to reduce amount of applied mineral fertilizers, lower costs of production and support an effective tool for desert development under less polluted environments to obtain a clean product.

Organic fertilizers affecting the growth and chemical constituents of different aromatic plants. Chaves *et al.* (2002) on *Ocimum gratissimum* ; Khalil (2002) on rosemary ; Blank *et. al.*,(2005) on sweet basil and Anwar *et. Al.* (2005) on basil.

Bio-fertilizers affecting the growth and chemical constituents of different aromatic plants; Youssef *et al.* (2004) on sage; Hamed (2004) on *Salvia officinalis* and *Origanum syriacum* , Salman (2004) on basil and El-Leithy *et al*.( 2006) on sage plants.

Therefore, the of this study to investigate the effect of compost, bio-fertilizer and active dry yeast on *origanum syriacum,* l. plants, under North Sinai Governorate conditions

## MATERIALS AND METHODS

The present study was carried out during the two successive seasons; 2004 and 2005 at Ornamental Horticulture Department, Faculty of Agriculture, Cairo University and El-Maghara Research Station - Desert Research Center, North Sinai Governorate to investigate the effect of organic and bio-fertilizers on growth, yield of herb and chemical composition of oregano ( *Origanum syriacum*, L. cv. Sinaicum (Boiss).

Seedlings of oregano were obtained from El-Sheikh Zowayed Research Station-Desert Research Center, North Sinai Governorate. Homogenous seedlings of 12-15 cm height were transplanted in the field on 26$^{th}$ April 2004 and 30$^{th}$ April 2005 at distances of 40 cm between hills (one plant /hill) and 75 cm between rows. Drip irrigation system was applied in the whole experiment using droppers (4 L /h) every 3 days, using a moderate salinity water (2600 ppm.).

**Table ( A):Chemical analysis of the soil:**

| pH | E.C mmhos /cm | Soluble cations mg /L | | | | Soluble anions mg /L | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{--}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{--}$ |
| 7.70 | 3.20 | 114.10 | 36.77 | 440 | 12 | 0 | 34.07 | 728.7 | 34.07 |
| **Total Dissolved Solids ( mg /L)** | | **Total nitrogen (%)** | | | | **Phosphate, µg /L** | | | |
| 1716 | | 0.42 | | | | 85.5 | | | |

**Fertilization treatments:**

The fertilization treatments included the following:

***1 – Organic fertilization treatments:***

Organic fertilizer (compost) was added at the rates of 5, 10 or 20 $m^3$ per feddan, added 7 days before transplanting date.

**Table (B) :The chemical properties of compost .**

| Humidity | Ash | O.M. | O.C | C/N | N | P | K |
|---|---|---|---|---|---|---|---|
| 26 % | 9 % | 65 % | 36.1% | 16:1 | 2.15 % | 1.5 % | 1.26 % |
| **pH** | **Trace elements (ppm)** | | | | **Water capacity** | **Na Cl** | **Humus acids** |
| | $Fe^{++}$ | $Mn^{++}$ | $Cu^{++}$ | $Zn^{++}$ | | | |
| 5.8 | 1025 | 115 | 180 | 28 | 250% | 1.21% | 13% |

**O.M**. = Organic matter **O.C**. = Organic carbon

***2 – bio-fertilization treatment:***

The bio-fertilizer provided from the unit of Bio-fertilizers, Faculty of Agriculture, Ain Shams University, Egypt. The bio-fertilizer (2 L mixtures of 4 strains of bacteria + 20 L of water) was added two weeks after transplanting and repeated after the first cut as a soil drench.

The strains of the bio-fertilizer used in this study were:

1 – *Azotobacter chroococcum* ($15*10^7$ /ml)

2 – *Azospirillum sp*. ($25\text{-}55 *10^8$/ml)

3 – *Bacillus cirulans* ($30*10^{14}$/ml)

4 – *Bacillus megaterium* var. Phosphaticum ($25\text{-}30*10^{14}$/ml)

***3 – Yeast treatments:***

Active dry yeast (*Saccharomyces cerevisiae*) was used at three concentration (0, 5 and 10 g /L (tap water)) as foliar spray + drench in the soil. Four times at two weeks intervals starting after one week from application of bio-fertilizer and repeated four times at two weeks intervals after the first cut.

The treatments were as follows:

| Treatments | | | |
|---|---|---|---|
| **5 $m^3$ compost©** | **10 $m^3$ compost©** | **20 $m^3$ compost©** | **Description** |
| $C_1 B_0 Y_0$ | $C_2 B_0 Y_0$ | $C_3 B_0 Y_0$ | without bio-fertilizer and 0 g /L yeast. |
| $C_1 B_0 Y_1$ | $C_2 B_0 Y_1$ | $C_3 B_0 Y_1$ | without bio-fertilizer and 5 g /L yeast |
| $C_1 B_0 Y_2$ | $C_2 B_0 Y_2$ | $C_3 B_0 Y_2$ | without bio-fertilizer and 10 g /L yeast |
| $C_1 B_1 Y_0$ | $C_2 B_1 Y_0$ | $C_3 B_1 Y_0$ | bio-fertilizer and 0 g /L yeast |
| $C_1 B_1 Y_1$ | $C_2 B_1 Y_1$ | $C_3 B_1 Y_1$ | bio-fertilizer and 5g /L yeast |
| $C_1 B_1 Y_2$ | $C_2 B_1 Y_2$ | $C_3 B_1 Y_2$ | bio-fertilizer and 10 g /L yeast |

The layout of the experiment was split-split plot design with three replications, the main plots were the compost, the sub plots were the bio-fertilizers and the sub-sub plots were the yeast. The plants in the two seasons were harvested twice ($26^{th}$ July and $21^{st}$ November for the first season and $17^{th}$ July and $16^{th}$ November for the second season) by cutting the herb at 15 cm above the soil surface.

Data were recorded for the following parameters: Number of branches/plant, fresh and dry weights /plant. The essential oil percentage in oregano dry herb was determined according to British Pharmacopoeia (1963). Elements contents were determined in the acid digested solution, which was prepared according to Hach *et. al*., (1985).Nitrogen content was determined by modified micro- Kjeldahl method as described by A. O. A. C. (1970). Phosphorus was estimated according to Snell and Snell (1949). Potassium was estimated using flame photometer method according to Chapman and Partt (1961). Total carbohydrates percentages in herbs were determined according to Chaplin and Kennedy (1994).

The data from this experiment were subjected to the statistical analysis of variance using Mstate Statistical Software**.** L. S .D. test at 0.05 was used to compare the average means of treatments, carried out according to Sendecor and Cochran (1982).

## RESULTS AND DISCUSSION

### Vegetative growth:

***Number of branches***

Data in Table 1 showed that, in the second cut in the first season and all cuts of the second season, the second levels of compost (10 $m^3$/feddan) led to obtain the greatest number of branches /plant. Whereas, in the first cut of the first season, the highest number of branches /plant resulted from the highest rate of compost (20 $m^3$ /feddan). Similar results were obtained by El-Gendy *et al.*(2001) on *Ocimum basilicum*; Khattab *et. al.* (2002) on *Salvia splendens* and El-Sherbeny *et. al.*(2005) on

*Sideritis montana*, found that compost application increased number of branches.

Concerning bio-fertilizer treatments, in the first cut in the first season and all cuts of the second season, the bio-fertilizer led to a significant increase in the number of branches/plant. Also, in the second cut in the first season, the bio-fertilizer caused insignificant increment in the number of branches /plant. These results are in harmony with those obtained by Mahfouz (2003) on marjoram ; Hamed (2004) on sage and *Origanum syriacum;* Salman (2004) on basil and Youssef *et. al.*, (2004) on sage, found that bio-fertilizers increased number of branches.

Regarding active dry yeast, in the first season , in the first cut, active dry yeast at 5 g / L significantly increased number of branches / plant. In the second cut, treating plants with yeast at 5 and 10 g / L led to a significant increase in number of branches/plant. In the first cut of the second season, active dry yeast at two rates had no significant effect on number of branches / plant. While in the second cut yeast at 5 g /L significantly increased number of branches / plant. Similar results were obtained by Ahmed (1998) on marjoram and Ahmed *et. Al.*(2001) on *Ambrosia maritima*, showed that yeast application increased number of branches/ plant.

Interactions had a significant effect on branching. The highest values were obtained by using compost at 20 $m^3$/ fed plus bio-fertilizer plus active dry yeast at 5 g / L in the first cut of the first season. In the second cut of the first season and in both cuts of the second season , using compost at 10 $m^3$/fed plus bio-fertilizer plus active dry yeast at 5 g /L gave the highest number of branches / plant.

***Fresh weight /plant:***

Data in Table 2 showed that the second level of compost (10 $m^3$/feddan) obtained the greatest values in most cuts, followed by the third level (20 $m^3$/feddan), but the lowest values were produced with the lowest level of compost (5 $m^3$/feddan) in both two seasons, in both cuts, except in the first cut of the first season, which the heaviest fresh weight/plant resulted from the third level (20 $m^3$/feddan). The differences between values were statistically significant. These results are in agreement with those findings obtained by El-Gendy *et al.*(2001) on *Ocimum basilicum*; Edris *et al.* (2003) on marjoram plants and El-Sherbeny *et al.*(2005) on *Sideritis montana*, they found that compost application increased fresh weight of herb.

Using bio-fertilizer caused a significant increment in fresh weight /plant in all cuts of both two seasons compared with unfertilized control. Similar results on stimulatory effect of bio-fertilizer on fresh weight were obtained by Mahfouz (2003) on *Majorana hortensis*; Hamed (2004) on *Salvia officinalis* and *Origanum syriacum*; Salman (2004) on basil; Youssef *et al.*(2004) on sage; *and* Migahed *et al.*(2004) on celery.

In the first season, active dry yeast at 5 g /L significantly increased fresh weight /plant in the first and second cut. Raising level from 5 to 10 g / L led to a slight increment in the fresh weight / plant. In the second season in both two cuts using active dry yeast at 5 or 10 g /L insignificantly increased fresh weight / plant. Active dry yeast at 5 g / L was the most effective treatment in this concern. Also, Ahmed

*et al.*(2001) on *Ambrosia maritima* and Salman (2004) on basil plants, showed that active dry yeast increased herb fresh weight.

Interactions had a significant effect on fresh weight / plant. In the first cut of the first season, using compost at 20$m^3$/ fed plus bio-fertilizer plus active dry yeast at 10 g / L gave the heaviest fresh weight/ plant. In the second cut and in the first cut of the second season using compost at 10 $m^3$/ fed plus bio-fertilizer plus active dry yeast at 5 g / L gave the highest values. In the second cut of the second season using compost at 10 $m^3$/ fed plus bio-fertilizer without active dry yeast gave the heaviest fresh weight / plant.

***Dry weight / plant:***

Data on the dry weight/ plant are shown in Table 3. They pointed out that, the heaviest values resulted from the second level of compost (10 $m^3$/feddan), followed by the third level (20 $m^3$/feddan) without a significant difference between them, however, the least values were obtained with the lowest level (5 $m^3$/feddan), but, there was a significant difference between the second and third levels. Meanwhile in the first cut , first season, the heaviest dry weight /plant resulted from the third level (20 $m^3$/feddan), followed by the second level (10 $m^3$/feddan) without a significant difference between them. However, there was a significant difference between these levels and the first level of compost (5 $m^3$/feddan). El-Gendy *et al.*(2001) on *Ocimum basilicum*; Edris *et al.* (2003) on marjoram plants and El-Sherbeny *et al.* (2005) on *Sideritis montana* , showed that compost application increased dry weight of herb.

Concerning bio-fertilizer treatments, during two seasons, in both two cuts, the bio-fertilizer led to a significant increase in the dry weight of herb per plant. Similar results were obtained by Mahfouz (2003) on *Majorana hortensis*; Hamed (2004) on *Salvia officinalis* and *Origanum syriacum* ; Salman (2004) on basil; Youssef *et al.* (2004) on sage *and* Migahed *et. al.*, (2004) on celery.

Regarding active dry yeast, in both seasons, the heaviest dry weight /plant resulted from 5 g /L active dry yeast with a significant difference compared with control . In the second cut of the first and second seasons and in the first cut of the first season, the heaviest dry weight /plant resulted from the second level of yeast (5 g /L), followed by the third level (10 g / L) compared with control without a significant differences between them. Also, Ali (2001) on *Calendula officinals;* Ahmed *et. al.*,(2001) on *Ambrosia maritima* and Salman (2004) on basil plants, showed that active dry yeast increased herb dry weight.

Interactions had a significant effect on dry weight / plant. The heaviest dry weight / plant was obtained by using compost at 20 $m^3$/fed plus bio-fertilizer plus active dry yeast at 10 or 5 gm/L in the first and second cut, respectively. In the second season, compost at 10$m^3$/ fed plus bio-fertilizer plus active dry yeast at 5 or 10 g / L gave the heaviest dry weight / plant in both two cuts, respectively.

***Oil percentage:***

Data in Table 4 showed that, in all cuts in the first season and second cut in the second season, the greatest values of oil percentage resulted from application of

the third level of compost (20 $m^3$/feddan) with a significant differences compared with other treatments. Meanwhile, in the first cut of the second season, the second level of compost (10 $m^3$/feddan) significantly obtained the highest oil percentage compared to the lowest level of compost (5 $m^3$ /fed.).

Treating the plants with bio-fertilizer caused a significant increment in oil percentage in all cuts of the two seasons.

Regarding the effect of active dry yeast on oil percentage, in the first cut of the two seasons, the highest oil percentage resulted from yeast application at (10 g /L), while in the second cut of the two seasons; the greatest values resulted from yeast at (5 g /L).

Concerning the interactions, there was a significant effect on oil percentage. The highest oil percentages were obtained from plants fertilized with compost at 20$m^3$/feddan and treated with yeast at 10 gm/ L in the first cut of the two seasons. Whereas in the second cut of both seasons, plants treated with compost at 20 $m^3$/feddan and fertilized with bio-fertilizer and yeast at 5 g / L ( in the first season) and yeast at 10 g / L ( in the second season) gave the highest oil percentages compared with untreated plants.

***Oil yield /plant:***

From the data in Table 5 it is clear that, the second levels of compost (10 $m^3$/feddan) led to obtained the greatest oil yield/plant in the second cut of the first season and all cuts of the second season, while in the first cut of the first season, the highest oil yield/plant was produced from compost treatment at (20 $m^3$/feddan). Also, El-Gendy *et al.*(2001) on *Ocimum basilicum* ; Edris *et al.*(2003) on marjoram and El-Sherbeny *et al.*(2005) on *Sideritis montana* , showed that compost or organic fertilizers increased oil percentage and oil yield.

Concerning bio-fertilizer treatments, during two seasons, the bio-fertilizer led to significant increment in the oil yield/plant. These results are in harmony with those obtained by Kandeel *et al.*(2002) on sweet basil; Hamed (2004) on *Origanum syriacum*, L. var. *aegyptiacum* and *Salvia officinalis*; Salman (2004) on sweet basil and Youssef *et al.*(2004) on sage showed that bio-fertilizers increased oil percentage and oil yield.

Regarding active dry yeast, treating plants with yeast at (5 g /L) led to obtained a significant increase in oil yield/plant compared with control or yeast at the highest rate (10 g /L). Also, Salman (2004) on sweet basil, found that yeast application increased oil percentage and oil yield.

Interactions had a significant effect on oil yield/ plant in both seasons. In the 1st cut of the first season and 2nd cut of the second season, compost at 20 $m^3$ / fed plus bio-fertilizer and yeast application at 10 gm/ L ( first season) and at 5 gm/ L ( in the second season) gave the highest oil yield / plant. Whereas in the 2nd cut of the first season and 1st cut of the second season, compost at 10 $m^3$/ feddan plus bio-fertilizer and yeast application at 5 gm/ L gave the highest oil yield / plant compared with untreated plants which gave the lowest values. These effects may be due to the effect

of compost, bio-fertilizers and yeast applications on increment of both herbage yield and essential oil percentage.

**Chemical composition:**

***Nitrogen percentage***

From Table 6 it may be noticed that, the highest N percentage was determined in the herb of the plants fertilized with compost at (10 or 20 $m^3$/feddan).Whereas the lowest N percentages were obtained with the lowest level of compost (5 $m^3$/feddan).

Concerning the effect of bio-fertilizer, the data indicated that, the highest N percentages were determined in the plants received bio-fertilizer in all cuts of both two seasons.

Regarding active dry yeast, treating plants with yeast at all concentrations used (5 and 10 g /L) increased N % in the herb compared with the control. Also, it may be noticed that, the highest N percentages in herb were determined in plants treated with yeast at 5 g /L followed by the highest rate (10 gm/L).

Concerning the effect of interactions, plants receiving compost at $20m^3$ / fed plus bio-fertilizer and yeast at 5 or 10g / L gave the highest N percentages in the first season, in both cuts.

***Phosphorus percentage:***

The data presented in Table 6 revealed that, in the first cut in both seasons, the highest P % resulted from compost at 10 and 20 $m^3$/feddan with the same values. Whereas in the second cut of the first season, the highest P % resulted from compost at 20 $m^3$/feddan followed by 10 and 5 $m^3$ / feddan, respectively.

Regarding the effect of bio-fertilizer, the highest P percentage was obtained from plants treated by bio-fertilizer in the second cut of the first season and the first cut in the second season. Whereas, in the first cut of the first season and in the second cut of the second season, bio-fertilizer had no effect on P % compared with control which gave the same values.

Concerning the effect of dry yeast, in the first cut of the first season, the highest P % resulted from yeast at 5 and 10 g /L. While in the first cut of the second season, the highest P % resulted from yeast at 5 g /L. Meanwhile, in the second cut of both seasons, the highest P % resulted from yeast at 10 g / L.

**Potassium percentage**

From Table 7 the data showed that, in the first cut of the first season, the highest K % resulted from the third level of compost (20 $m^3$/feddan). However, in the second cut of the first season and all cuts in the second season, the highest percentage of K was determined in the herb of plants received the second level of compost (10 $m^3$/feddan). Herrera *et al.* (1997) on *Angelica archangelica*, *Marrubium vulgare* and *Thymus vulgaris* stated that N, P and K content increased with increasing percentage of compost in the media.

Regarding the effect of bio-fertilizer on K %, the data revealed that, in the first cut in the two seasons, the highest K percentage was determined in the plants treated with

bio-fertilizer. But, in the second cut of the two seasons, bio-fertilizer had no effect on K content. Migahed *et al.*(2004) on celery, found that bio-fertilizers increased N, P and K contents in herb.

Regarding active dry yeast, in both cuts of the first season, treating plants with yeast at10 g /L led to obtain the highest K %. But, in both two cuts of the second season, the highest K % was determined in plants received yeast at 5 and 10 g /L compared with control. Similar results, in general, were mentioned by EL-Ghadban *et al.* (2003) on *Ricinus communis* and Salman (2004) on *Ocimum basilicum*. They showed that yeast application increased N, P and K contents.

**Total carbohydrates content:**

Data in Table 7 indicated that, in the first cut in both seasons, the highest total carbohydrates percentages resulted from plants received the second level of compost ( 10$m^3$ /feddan). Whereas in the second cut in both seasons, the highest total carbohydrates percentages were obtained with the third level of compost (20 $m^3$/feddan). Similar results were presented by Khattab *et al.*(2002) on *Salvia splendens*; El-Sherbeny *et al.*(2005) on *Sideritis montana*, stated that compost applications increased total carbohydrates contents.

Moreover, treating the plants with bio-fertilizer produced the highest total carbohydrates percentage in all cuts in the two seasons compared with untreated plants. Naguib (2002) on *Cymbopogon flexuous;* Mahfouz (2003) on marjoram and Sakr (2005) on senna plants, found that bio-fertilizers increased total carbohydrates contents.

Also, in the first season and the second cut in the second season, it may be noticed that, the highest values of total carbohydrates percentage were determined in plants received yeast at the third concentration (10 g /L), but, in the first cut in the second season, the greatest values of total carbohydrates percentages were obtained with yeast at (5 g /L). Similar results were obtained by Naguib (2002) on *Cymbopogon flexuosus* and El-Leithy *et al.*(2006) on sage showed that active dry yeast increased total carbohydrates contents.

Regarding the interaction, in the first cut of the first season, plants treated with compost at 20$m^3$ /feddan and yeast at 5 g / L gave the highest total carbohydrates percentages. In the second cut of the first season, compost at 20$m^3$ /feddan plus bio-fertilizer and yeast at 10 g /L gave the highest total carbohydrates percentages. In the second cut of the second season, compost at 20$m^3$/feddan plus bio-fertilizer application gave the highest total carbohydrates contents compared with untreated plants ( compost at 5 $m^3$ /feddan without bio-fertilizer or yeast) which gave the lowest values.

**Recommendation:**

To obtain the best results on both herb, oil production and chemical constituents of oregano plant in sandy soil we recommended the use of compost at 10 or 20 $m^3$/feddan plus bio-fertilizer plus active dry yeast at 5 g /L.

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# دراسة تأثير الكمبوست والسماد الحيوي والخميرة علي نبات الاوريجانو تحت ظروف سيناء

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أجري هذا البحث في محطة بحوث المغارة التابعة لمركز بحوث الصحراء – وسط شمال سيناء خلال موسمين متتالين ٢٠٠٤ /٢٠٠٥ بهدف دراسة تأثير الكمبوست والتسميد الحيوي والخميرة علي النمو والتركيب الكيميائي لنبات الاوريجانو. وقد تم إضافة الكمبوست بمعدلات ٥ و ١٠ و ٢٠ م$^3$/فدان . كما تم إضافة الخميرة بتركيزات صفر ، ٥ ، ١٠ جم/لتر . وتم إضافة السماد الحيوي الذي يحتوي علي (*Azotobacter chroococcum*, *Azospirillum sp.*, *Bacillus cirulans* and *Bacillus megaterium* var. phosphaticum). أوضحت النتائج أن التسميد بالكمبوست بمعدل ١٠ ، ٢٠ م$^3$ / فدان أعطت أفضل النتائج للنمو الخضري (عدد الأفرع، الوزن الطازج والجاف / نبات) ونسبة الزيت ومحصول الزيت/ نبات ومحتوي العشب من النتروجين والفوسفور والبوتاسيوم والكربوهيدرات الكلية. أضافة الكمبوست بمعدل ١٠ م$^3$/ فدان كانت أكثر المعاملات فعالية تليها المعاملة بالكمبوست بمعدل ٢٠ م$^3$/ فدان.

إضافة الخميرة بتركيز ٥ ، ١٠ جم/ لتر أعطت زيادة معنوية في الصفات الخضرية(عدد الأفرع، الوزن الطازج والجاف/نبات) ونسبة الزيت ومحصول الزيت/ نبات ومحتوي العشب من النتروجين والفوسفور والبوتاسيوم والكربوهيدرات الكلية. استخدام الخميرة بتركيز (٥ جم/ لتر) كانت أكثر المعاملات فاعلية في معظم الحالات. بينما الخميرة بتركيز ١٠ جم / لتر كانت أكثر فاعلية علي النسبة المئوية للزيت.

أدي التسميد الحيوي إلي زيادة معنوية في كلا من النمو الخضري(عدد الأفرع، الوزن الطازج والجاف /نبات) ونسبة الزيت ومحصول الزيت/ نبات والتركيب الكيماوي (نسبة النتروجين والفوسفور والكربوهيدرات الكلية ).

التفاعل ما بين كان له تأثير معنوي علي الصفات المدروسة.إضافة الكمبوست بمعدل ١٠ أو ٢٠ م$^3$/ فدان مع التسميد الحيوي مع الرش بالخميرة بمعدل ٥ أو ١٠ جم/لتر أدي إلي الحصول علي أعلي القيم من حيث النمو الخضري ونسبة الزيت ومحصول الزيت/نبات ومحتوي العشب من النتروجين والفوسفور والبوتاسيوم والكربوهيدرات الكلية. لذلك يوصي باستخدام الكمبوست بمعدل١٠ أو ٢٠ م$^3$ / فدان مع التسميد الحيوي مع الرش بالخميرة بتركيز ٥ جرام/ لتر في الأراضي الرملية للحصول علي أفضل النتائج.