

EFFECT OF BIO AND ORGANIC FERTILIZATION AS PARTIAL SUBSTITUTE FOR MINERAL FERTILIZATION ON SOME VEGETATIVE GROWTH, NUTRIENT STATUS AND SOIL MICROBIOLOGICAL ACTIVITIES CHARACTERS OF "VALENCIA" ORANGE SEEDLINGS GROWN IN DESERT LAND

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ABSTRACT: *This study was conducted to observe the influence of Active dry yeast as Biofertilizer and Aminokem as organic fertilizer on the vegetative growth, nutrient status and some microbiological characters (CO₂ evolution and Dehydrogenase activity). The results of two experimental seasons 2007 and 2008 showed that combination between active dry yeast as soil application at 20g/liter and 50% from the recommended doses of NPK enhanced significantly the vegetative parameters of "Valencia" orange seedlings (% increase of seedlings height, No of spring shoots and No of summer shoots ; The results also indicated that the nutritional status of the seedlings positively increased and soil microbiological activities (CO₂ evolution and dehydrogenase activity) by the same treatment ,therefore fertilizing "Valencia" orange seedlings with active dry yeast at 20g/liter in combination with 50% from the recommended of NPK suggested to be beneficial for obtaining an economical growth and improve the nutritional status and soil microbiological activities altogether under Sadat desert lands conditions .*

Key Words: *Valencia Orange, yeast, Aminokem, Dehydrogenase, CO₂, vegetative growth.*

INTRODUCTION

Citrus are considered one of the most important fruit crops grown in the whole world and Egypt. The origin of citrus is tropical and subtropical zones of Asia. The world annual production according to (FAO, 2008) reached (101, 4200 million metric . tons), with leading producers being Brazil, China, USA, Spain and Mexico. Citrus is the backbone of fruit cultivated in Egypt so that During the last few years; citrus area has increased demands of local consumption and exports, which is expected to boom in the future. In Egypt production of citrus has been developed year after year with approximately (3,200 million metric. tons) of fruit produced annually. In 2007, Egypt ranked the ninth citrus production in the world hence ,intensive efforts have been

made to increase the productivity of citrus trees by improving the cultural practices in citrus orchards such as , fertilization . Nowadays the use of bio and organic fertilizers especially for the exportation potential to both European and Arabian markets .So that, both of bio and organic fertilizers had take the attention of researches to become apposite alternative to chemical fertilizers (Ahmed *et al.*, 1997) to obtain high growth ,productivity and quality to be marked for high prices (El-Kobbia, 1999) .Therefore this study was carried out to put highlight on the effect of two concentration of applying each of Bio Yeast fungi and organic Aminokem fertilizer on "Valencia" orange seedlings alone or in combination with 1/2, Mineral fertilizers NPK (standard formula) compared with using full Mineral fertilization alone. on vegetative growth parameters, physiological and microbiological activities of the soil of "Valencia" orange seedlings grown under desert soil conditions.

MATERIALS AND METHODS

This study was carried out during seasons 2007 and 2008 on 2 years old Valencia orange seedlings(*Citrus Sinensis, L*) budded on sour orange and spaced at 5x5 Meters . The experimental soil was sandy loamy soil . Analysis of the tested soil was carried out according to cottine et al., (1982) and the data are given in Tables (1 and 2).

Table (1): Some physical analysis of the experimental soil (average of two seasons).

Location Of soils	pH KCl 1:2.5	EC dS. m ⁻¹	OM %	CaCO ₃ %	CEC mmol.Kg ⁻¹	Particle size distr. %			Texture Grade
						Sand	Silt	Clay	
El Sadat City	7.75	1.67	0.66	6.5	146.22	70.78	21.45	7.77	Sandy Loamy

Table (2): Chemical analysis of soil and materials used in the current experiment (average of two seasons).

Materials	Total C %	Nutrients mg.kg ⁻¹						
		N	P	K	Fe	Mn (¹)	Zn	Cu
Soil Mean (avail. Nutr.)	0..33	18.85	28.69	1543	19.85	12.202	3.30	2.01

The five mineral, bio and organic fertilization treatments included in such experiment were as follows:

- 1-Control (100%NPK) (T₁)
- 2- Aminokem Foliar application at 30ml/liter (T₂)
- 3- Aminokem Foliar application at 30ml/liter+50%NPK (T₃)
- 4- Active dry yeast Soil application at 20g/liter (T₄)
- 5- Active dry yeast Soil application at 20g/liter +50%NPK (T₅)

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These treatments were arranged in a complete randomized block design with 10 replicates (one seedling per each) Clarke and Ekempson (1997) all obtain data were tabulated and statistically analyzed according to Sendecor and chochran(1980) using LSD Parameter at level of 0.05 to make all the comparison .

Fertilization Sources:

1-Bio fertilizer:

The biofertilizer used was active dry yeast at level 2% as soil application; which prepared carefully by accessory addition of the Egyptian trancel as source of sugars and nitrogen at 0.3% to activating the reproduction of yeast and then the amount of yeast dissolved in warm water (38 °) and kept for 3 hours before soil application, each seedling received 3 Liter from the active dry yeast solution .Four times on mid of March, June, July and August.

2-Organic fertilizer:

Regarding the organic fertilizer; (Amino Kem) compound was used as foliar application at level 3%, each seedling received 10 Liter from the prepared aminokem solution four times on mid of march, June, July and August. (H.P. 40detergent) was used as wetting agent at 1% concentration.

3-Mineral fertilizer:

Mineral fertilizer was added to the soil in the form of regular formula as recommended by the Ministry of Agriculture; Super phosphate-calcium P_2O_5 (15%) at 75 Kg / fed., Potassium sulphate K_2O (48%) at 75 kg; and Ammonium sulphate NH_4So_4 at (20.5%N) 300 kg/ fed.

The different treatments of the investigation which received the (NPK) four times either alone or in combination with bio and organic fertilizers during middle of March, June, July and August.

Different types of analysis were carried out, vegetative growth , chemical and soil microbiological. characters.

4- Vegetative growth:

In early March of each year of the study 8 spring shoots were selected and tagged around each seedlings .at the first week of September, for carrying out the following measurements:

4-1-% increasment of seedlings height

4-2- No. of spring shoots

4-3-No. of summer shoots.

5-Chemical analysis:

At the first week of September the following properties were samples of twenty mature leaves were selected at random from spring cycle (1st week of September), washed; dried to a constant weight and then 0.2g of the ash was digested in a mixture of 5:1 perchloric acid and sulphoric acid for estimating the percent of nitrogen, phosphorus and potassium respectively following A.O.A.C. (1985) procedures.

5- 1-Total nitrogen %:

The percentage of total nitrogen was estimated to the methods as outlined by (A.O.A.C,1985) by using microkeldahal.

5-2- Total phosphorous %:

Phosphorous percentage was determined colometrically According to method by (Murphy and Riley.,1962)

5-3- Total potassium %:

Potassium percentage was determined in the digested solution of the dried leaves following (A.O.A.C, 1985) methods by flame photometer.

5-4- Total calcium %:

Total calcium content was estimated according to(A.O.A.C, 1985)

6-Microbial activities analysis:-

6-1-Microbial respiration in soil (Co₂) evaluation

Co₂ as mg /kg dry soil was estimated according to : Jaggi (1975)

6-2-Microbial enzymatic activities in soil (dehydrogenase activity

Activities of the enzymes under study were determined according to the following methods:Dehydrogenase: calorimetrically, for the 2,3,5- triphenyl formazan (TPF) produced from the reduction of 2,3,5- triphenyl tetrazolium chloride (TTC), using acetone for extraction(Thalman.,1967).

RESULTS AND DISCUSSION

1-Vegtative growth parameters (% increasing of seedling height, No. of spring shoots and No. of summer shoots) affected by foliar aminokem and soil yeast treatments compared with chemical fertilization during seasons 2007and 2008.

The effect of five different treatments of this experiment were varied significant effect on the vegetative growth parameters (% increasing of seedling height, No. of spring shoots and No. of summer shoots), according to data in Table (3) which Cleary showed that treatment of active dry yeast soil application in combination with 50% from the recommended doses of NPK gave the highest values during the two seasons of the experiment (22.7, 25.6%). No of spring shoots ((44.3,46.79) and No of summer shoots (25.8, 26.9), on the other hand the lowest values were recorded by treatment of foliar aminokem at 3% alone, % increasing of seedling height (12.1, 17.1%),no of spring shoots (15.6, 27.9) and No of summer shoots (12.1, 14.7) during the two seasons 2007 and 2008 respectively .The positive effect of active dry yeast at 2% in combination with 50% from the recommended doses may be attributed to their action on enhancing cell divisions and protecting plant cells from free radicals that responsible for plant senescences. These findings are in agreement with those obtained by Mostafa and Abou Raya (2004),

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Mustafa (2004) on banana plants EL-Khafagy (2005) on Thompson seedless grapevines and Aslantas , et al (2007).on apple trees .

Table (3): Physical characters(Seedlings height %, No of spring shoots and No of summer shoots as affected by foliar aminokem and active dry yeast treatments compared with chemical fertilization during season 2007and 2008.

Physical characters	seedlings height %(cm)		No of spring shoots		No of summer shoots	
	2007	2008	2007	2008	2007	2008
Treatments	2007	2008	2007	2008	2007	2008
Control(100%)NPK	18.2	24	41.6	42	22.4	23.3
Foliar aminokem application at30ml/ liter %	12.1	17.1	15.6	27.9	12.1	14.7
Foliaraminokem application at 30ml /liter +50%NPK	19.2	24.2	23.1	39.5	19.3	23.5
Yeast at 20g/ liter	14.9	19.7	27.4	40.1	18.1	19.7
Soil yeast application at 20g /liter +50%NPK	22.7	25.6	44.3	46.7	25.8	26.9
LSD at 0.05	3.125	3.182	5.55	3.634	3.240	2.357

2-Chemical characters as affected by foliar aminokem and soil yeast treatments compared with chemical fertilization during seasons 2007and 2008.

Some of the main chemical characters (N,P,K and Ca %) were chosen to prove the effect of different levels of bio organic fertilization on seedlings mineral levels and nutrition status under desert lands conditions. The data in Table (4) showed that there was a variable significant increase in percentage of N,P,Kand Ca among all treatments , where treatment of active dry yeast at 2% in combination with 50% from the recommended doses of NPK significantly gave the highest values of all treatments during the two seasons 2007 and 2008 nitrogen (2.392,2.399%), phosphorous (0.262,0.264%) potassium (1.493,1.493%) and calcium (3.747,4.545%) compared by control treatment (100%NPK) , followed by treatment aminokem at 3% in combination with 50% from the recommended doses of NPK . On the other hand the lowest values were obtained by treatment of foliar aminokem alone during the two seasons respectively, nitrogen (2.143, 2.175%) , phosphorus (0.138,0.147%) , potassium (0.799,0.783%) and calcium (3.214,3.32%) during the two seasons respectively. According to all the results concerning N,P,K and Ca content in leaves of Valencia orange seedlings its clear that treatment of active dry yeast at 2% in combination with 50% from the recommended dose of NPK improvement the nutritional of the seedlings under the resembling conditions. The positive effect of active dry yeast at 2% yeast along with 50% NPK fertilization or supplemented by foliar aminokem play a big role in enhancing benefit microorganisms(P-solublizing, and N-fixing bacteria) throw its biological fermentation ,also it may be play a big role of production plant growth promoting such as IAA and BA which lead to

increment of root distribution in order to raise plant uptake, also throw this products it can enhancing cell elongation and cell division in order to raise the rate of photosynthesis and accumulation of chemical compounds especially ashes NPK and Ca (Ahmed, 2007) or it can low the pH of soil which release the ashes from the ores and make it available for roots by uptaking .

Our results in Harmony with those obtained by Hegab; et al. (1997) on Valencia orange trees, Ahmed;et al. (1997) on Roomy grapevines, El-Mogy; et al. (1998) on Thompson seedlings grapes , Laz et al.,(2000) on fig, ,El-Shammaa (2001) on banana, and El-Saida ,(2007) on Valencia orange, they stated that bio-fertilizing with active dry yeast showed remarkable improvement of leaves mineral contents

Table (4): Chemical characters as affected by foliar aminokem, soil yeast treatments compared with chemical fertilization during season 2007and 2008.

Chemical Characters	Nitrogen%		Phosphorus%		Potassium%		Calcium%	
	2007	2008	2007	2008	2007	2008	2007	2008
Control 100%NPK	2.52	2.361	0.182	0.193	0.873	1.19	3.319	4.202
Foliar aminokem application at 30ml/ liter	2.143	2.175	0.138	0.147	0.799	0.783	3.214	3.32
Foliar aminokem application at 30ml/ liter +50%NPK	2.34	2.351	0.244	0.248	1.119	1.105	3.567	3.278
Soil yeast application at 20g/liter.	2.252	2.269	0.184	0.194	1.131	1.131	3.371	3.323
Soil yeast application at 20g/ liter+50%NPK(T _s)	2.424	2.435	0.262	0.264	1.493	1.493	3.747	4.545
LSD at 0.05	0.0491	0.0461	0.0491	0.0044	0.2044	0.2029	0.0351	0.02271

3-Soil microbial activities as affected by foliar aminokem and soil yeast application treatments compared with chemical fertilization during season 2007and 2008.

Some of the important microbiological charters of "Valencia" orange seedlings sandy soil were measured such as; microbial respiration co₂ evolution, dehydrogenase activity as a indicator of microbial respiration affected by bio and organic fertilization the data in Fig 1 and 2 showed that soil microbiological activities sigificantly affected by treatment of active dry yeast at 2% in combination with 50% from the recommended doses of NPK during the two seasons 2007 and 2008 Dehydrogenatase activity (23.3, 26.6µg) co₂ evolution (70.7,81mg) while treatment of foliar aminokem at 3% was the less effective in enhancing microbiological activities dehydrogenase activity (10.6,11.8µg) co₂ evolution (17.8,14.7mg) , during the two seasons 2007 and 2008. Respectively according to the all previous data concern microbiological characters (co₂ evolution , dehydrogenase activity) as affected by bio and organic fertilization as compared with Mineral NPK it is clear that yeast at 2% in combination with Mineral fertilization or aminokem improve the microbiological activity in the soil cultivated with Valencia orange seedlings as indicator to soil fertility and moreover root distributions

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which affected the increasing microbiological communities especially in rizpspherer layer. These increasing in CO₂ evolution and dehydrogenase activity due to microorganisms activity affected by yeast fermentation which produce a lot of adequate amounts of IAA and cytokines which increased surface area per unit of root length and also ,root hair branching with an eventual increase of nutrients uptake from soil ,also foliar aminokem in along with yeast or NPK gave the same physiological characters (Soliman, *et al* ., 2003) Dehydrogenases catalyze the electron transfer yielding energy required for the anabolic processes of various microorganisms inhabiting the soil. Through such reactions, the energy source, or electron donor, is converted to a simpler form that could be utilized by other organisms (plants and microbes). Hence, such enzymes are not only responsible for oxidation-reduction processes, but are also involved in the recycling of elements in soil for the benefit of both macro- and micro flora. Our results are in the same findings of Soliman et al.,(2003) Abo Kora (2004). He et al.,(2005) and EL-Ghozoli(2007).

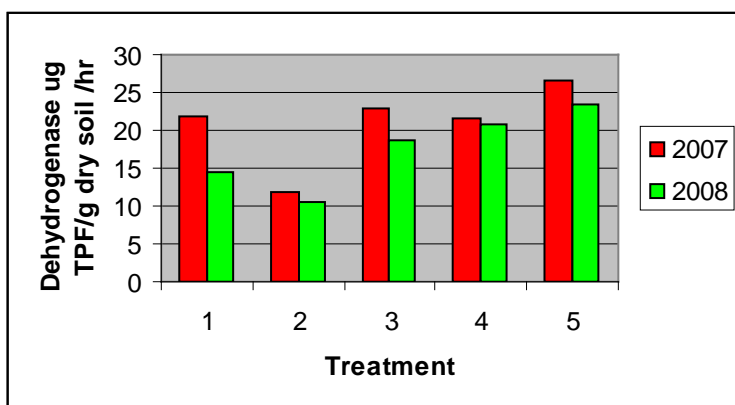


Fig (1):Dehydrogenase activity (µg TPF/g dry soil /hr) affected by foliar Aminokem and soil yeast treatments compared with chemical fertilization during season 2007and2008.

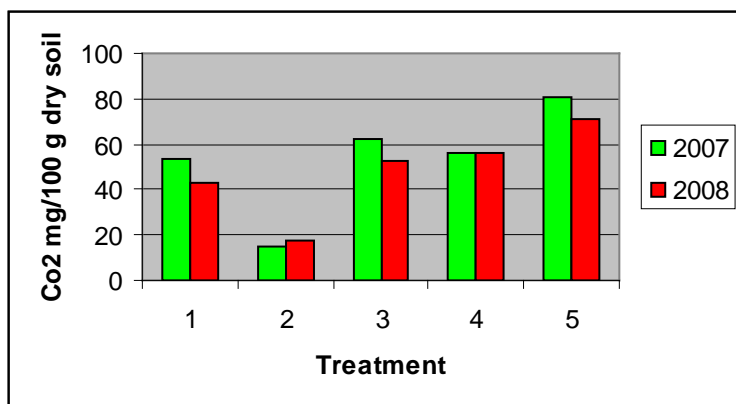


Fig (2):CO₂ evolution (co₂mg/100gdry soil) affected by foliar aminokem and soil yeast treatments compared with chemical fertilization during seasons 2007and2008

CONCLUSION

Bio and organic fertilizers an positive alternative source for plant nutrition instead of chemical fertilizers to be a limited extent not more .In order to raise seedlings growth and development especially in new reclaimed lands without any harmful effects to human, animal and environment .It can be concluded that fertilizing "Valencia "orange seedlings with the combination of active dry yeast at 2% plus 50% from the recommended doses of NPK, hence this treatment will save the high costs of chemical fertilizers as well as decrease the pollution of environment.

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تأثير استخدام التسميد الحيوي والعضوي كبديل جزئي للتسميد الكيماوى
على بعض الصفات الخضرية والغذائية و النشاط الميكروبي لشتلات
البرتقال الصيفي النامي في الأراضي الصحراوية

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المخلص العربي

اجريت هذه الدراسة لتوضيح تاثير الاضافة الارضية لفطر الخميرة الجافة النشطة والأحماض الأمينية كإضافة ورقية كبديل جزئية للتسميد الكيماوى على بعض الصفات الخضرية، الحالة الغذائية للشتلات وبعض صفات النشاط الميكروبي فى الارض لشتلات البرتقال الفالانشيا النامي في الارضى الصحراوية ، وقد اوضحت نتائج هذه التجربة خلال موسمى الدراسة ٢٠٠٧ و 2008 ان الخلط ما بين فطر الخميرة عند ٢% و نسبة ٥٠% من التسميد المعدنى NPK ادت الى زيادة معنوية واضحة فى صفات النمو الخضرى (معدل الزيادة فى طول الشتلات ، عدد افرع دورة نمو الربيع و عدد افرع دورة نمو الصيف). وقد اوضحت النتائج ايضا خلال الموسمين نسب العناصر الغذائية النتروجين، الفوسفور، البوتاسيوم والكالسيوم قد زادت ايجابيا بالإضافة إلى معدلات النشاط الميكروبي (معدل ثانى اكسيد الكربون و انزيم الديهيدروجينيز) ولهذا فانه يوصى بنسمة شتلات البرتقال الصيفي النامي فى الأرض الصحراوية بفطر الخميرة عند تركيز ٢% بجانب ٥٠% من التسميد المعدنى الموصى به NPK من اجل الحصول على الزيادة فى معدل النمو ، الحالة الغذائية للشتلات الى جانب زيادة معدل النشاط الميكروبي.