Assiut J. Agric. Sci., (47) No. (6-2) 2016 (633-648) *ISSN: 1110-0486*
Website: http://www.aun.edu.eg/faculty_agriculture *E-mail: ajas@aun.edu.eg*

Response of Cucumber to Yeast and Royal Jelly Foliar Applications

Dalia M.T. Nassef[1] and H.M. El-Aref[2]

[1]Department of Vegetable Crops, Faculty of Agriculture, Assiut University, Assiut, Egypt
[2]Department of Genetic, Faculty of Agriculture, Assiut University, Assiut, Egypt

Received on: 31/12/2016 **Accepted for publication on:** 15/1/2017

Abstract:

This investigation was carried out during two successive summer seasons in 2015 and 2016, in the Experimental Vegetable Farm, Faculty of Agriculture, Assiut University to examine the effect of yeast and royal jelly foliar applications on yield and its attributes as well as quality traits of cucumber (hybrid KUC-102). The experiment was laid out as split plot arrangement in randomized complete block design (RCBD) with three replications. The results showed that using yeast and royal jelly spray gave significant differences in most studied traits compared to the control (untreated) in favor of 20 g/l yeast and 2.4 g/l royal jelly in both seasons. Concerning the interaction between yeast and royal jelly, there were significant effects in some studied traits in both seasons. The combination of 20 g/l yeast and 2.4 g/l royal jelly recorded the highest mean values of vegetative traits, yield components, total yield and fruit quality in both seasons. Use 20 g/l yeast plus 2.4 g/l royal jelly holding a great promise since it gave fruit yield increment of 109.40% and 145.22% in the first and second seasons, respectively compared to the control (untreated plants 9.150 and 7.653 ton/feddan in the first and second seasons, respectively). Also, the results demonstrated that cucumber respond to yeast and royal jelly with distinct changes in gene expression.

Keywords*: Cucumber, Fruit quality, Gene expression, Royal jelly, Total yield, Vegetative traits, Yeast, Yield attributes.*

Introduction

Cucumber (*Cucumis sativus* L.) is clearly, one of the most imperative cucurbiteous crops grown in Egypt. It is cultivated for fresh fruits and picking which are locally expended or transferred to increase national revenue. The total cultivation area of cucumber in Egypt in 2014 was 8434 feddan and the total production reached 94948 tons with an average of 11.26 ton/feddan (Bulletin of The Agricultural Statistics), Ministry of Agriculture.

The bread yeast (*Saccharomyces cerevisiae*) is a kind of biofertilizers used in soil fertilization or as foliar application on the shoots of vegetable crops (El-Ghamriny *et al.,*1999). This is for its content of nutrient elements and existence of stimulative growth regulator compounds like auxins, gibberellins and cytokinins (Glick, 1995). Glick reported that the yeast was clever of increasing the simulative growth compounds like gibberellins, auxins and cytokinins that act in improving plant cell division and growth. The helpful effects of dry yeast application may be due to that it is considered as a natural source of cytokinins that stimulates cell division and enlargement as well as the synthesis of protein, nucleic acid and chlorophyll (Fathy and Farid, 1996). It also

contains sugar, proteins, amino acids and vitamins (Shady, 1978). Foliar application of yeast was found to increase growth, yield and quality of many vegetable crops. Many investigators stated that spraying yeast extract significantly enhanced vegetative growth performance (Abou El-Nasr *et al.,* 2001; Gomaa *et al.*, 2005, Mona *et al*., 2005; El-Tohamy and El-Greadly, 2007; Fawzy, 2007; Hussainand Khalaf, 2007; El-Tohamy *et al*., 2008; Fawzy *et al*., 2010; Ghoname *et al*., 2010). Also, many investigators found that spraying yeast extract on cucumber significantly enhanced vegetative growth performance, yield and its quality (Sarhan *et al.*, 2011; Shehata *et al.*,2012 ; Hamail *et al.,2014).*

Erratic literatures are available about the impact of royal jelly on horticultural crops. It is concealed from the heads of queen bees. It is manufactured from pollens, water and honey mixed with saliva, hormones and vitamins. It contains 65.3 % water and 34.7 % drymatter. The dry matter portion composes of 48.2 % proteins, 37.8 % carbohydrates, 10.4 % lipids and 2 % ash. It is also contains vitamins B1, B2, B5, B6, B8 and B9 as well as vitamin C. It contains at least 17 aminoacids, different nutrients (K, Mg, Ca, Fe, P, S, Mn and Si) and sex hormones (Heyl, 1951 and Nation and Robinson, 1971).

Amazing promotion on growth, nutritional status, yield and fruit quality of horticultural crops was observed using royal jelly (Townsend and Lucas, 1966; El- Maziny and Hassan, 1990 and El-Shaikh, 2010).

Molecular biological approaches including protein profile have been used to determine the variation within and between plants as well as to study gene expression (El-Aref and Hamada, 1998; El-Aref *et al*., 2014). Electrophoretic protein analysis has been used to study the genetic variations in cucumber (Ming, L. and Cao Zong-xun. 1996).

The target of this study was to assess the beneficial effects of spraying different concentrations of yeast and royal jelly on vegetative traits, yield components, total yield and quality traits of cucumber (hybrid KUC-102).

Materials and Methods:

This experiment was implemented in the Experimental Vegetable Farm, Faculty of Agriculture, Assiut University during 2015 and 2016 summer seasons using split plot arrangement in randomized complete block design (RCBD) with three replications to study the effect of yeast and royal jelly foliar applications on productivity of cucumber (hybrid KUC-102). The four yeast concentrations (5,10,15 and 20 g/l) plus control (untreated) were allocated in the main plots, while, the three royal jelly concentrations (0.8,1.6 and 2.4 g/l) plus control were arranged in the subplots. The soil texture of experimental site is clay as presented in Table (1). The seeds were sown on 15th March in both seasons on terraces width of 1m and the distance between hills was 40 cm. The experimental unit was 13.5 m^2 (4.5 × 3). The strain of yeast (*Saccharomyces cerevisiae*), was dissolved in water followed by adding sugar at a ratio of 1:1 w/w, and kept 24 hours in a warm place in

darkness for reproduction according to the methods of Morsi *et al.*(2008). Chemical analysis of activated yeast is shown in Table (2). The plants were sprayed to the drip point by yeast and royal jelly as foliar application once after 21 and 22 days from sowing, respectively using plastic sheet as a separator between treatments one meter height. Untreated plants were sprayed with tap water. Royal jelly chemical analysis is shown in Table (3). All the other agricultural practices were done as recommended for cucumber by Ministry of Agriculture.

The measurements were taken on ten guarded plants in each experimental unit and the following measurements were recorded:

***1- Vegetative characters*:**

This included Plant height (cm) and Number of branches per plant at the end of the season (105 days fromsowing in both seasons).

2- Yield component:

This included Number of fruits per plants, fruit length (cm), fruit diameter (cm), fruit yield per plant (kg).

3- Total yield (ton/feddan).

4- Quality traits:

This included, reducing sugar percentage and total soluble solids according to A.O.A.C. (1990). Number of fruits per plant was calculated from all harvested fruits for each treatment along the season. Harvest was done at intervals of 3 days. Also, ten fruits from each treatment were randomly taken to determine fruit traits. Collected data were analyzed using MSTAT-C Statistical Software Package (Michigan State University, Freed *et al.*1991) and means were tested using L.S.D at 0.05 according to Gomez and Gomes (1984).

Electrophoresis for protein patterns:

Protein patterns of soluble proteins were determined in order to study the changes in gene expression under different treatments of yeast extract and royal jelly. Soluble proteins were extracted from ~one gram fresh weight of each treated plants in addition to their control using equal volumes of extraction buffer (0.1 M Tris-HCl + 2.0mM EDTA, pH 7.8). The samples were heated at 100 ˚C for 5 min, centrifuged at 10,000 rpm for 30 min, and 50 µl of each extracted protein treatment was mixed with sample buffer by (1:1) ratio. Electrophoresis for protein analysis was carried out according to the method described by Laemmli (1970) using 12% polyacrylamide and 1% SDS (w/v) under denaturing conditions. The gels were stained for protein bands with Commassie Blue R and destained by repeated immersion in a destaining solution (1methanol: 1acetic acid: 8 water, by volume). The molecular weight of protein bands were determined against protein marker consisted of 70, 60, 50, 40, 30, 20 and 15 KD using GS 365 electrophoresis data system program version 3.01 (Microsoft Windows @ version).

Table 1. Analysis of chemical and physical characteristics of the experimental soil.

Characteristic	Values	Characteristic	Valuse
pH(1:1)	8.01	**Caly %**	48.95
EC1:1 dSm^{-1}	1.2	**Silt %**	29.37
ECe dSm^{-1}	1.85	**Sand %**	21.68
Soluble Cations, (meq/kg soil)		**Soil texture**	Clay
Ca^{2+}	9.0	**Bulk density, (g/cm^3)**	1.12
Mg^{2+}	3.0	**Field capacity, (F.C)%**	43.02
Na^{+}	6.5	**Wilting Point (W.P)%**	22.33
K^{+}	1.0	**W.Saturation %**	65.01
Soluble Anions,(meq/100 g soil)			
Cl^{-}	4.0		
$HCO_3^{-}+CO_3^{2-}$	6.5		
SO_4^{2-}	9.0		
Total nitrogen (ppm)	8.0		
Available Phosphorus ppm	11.2		
Available Potassium ppm	300		

Table 2. Chemical analysis of activated yeast (mg/100g dry weight).

Minerals		Amino acids		Vitamins	
Total N	7.23	**Arginine**	1.99	**Thiamin**	2.71
P_2O_5	51.68	**Histidine**	2.63	**Riboflavin**	4.96
K_2O	34.39	**Isoleiucine**	2.31	**Nicotinic acid**	39.88
MgO	5.76	**Leucine**	3.09	**Pantothenic acid**	19.56
CaO	3.05	**Lysine**	2.95	**Biotin**	0.09
SiO_2	1.55	**Methionine**	0.72	**Pyridoxine**	2.90
SO_2	0.49	**Phrnylalanine**	2.01	**Folic acid**	4.36
NaCl	0.30	**Theronine**	2.09	**Cobalamin**	153ug
Fe	0.92	**Tryptophan**	0.45	**Enzymes**	
Ba	157.6	**Valine**	2.19	**Oxidase**	0.350
Co	67.8	**Glutamic acid**	2.00	**Peroxidase**	0.290
Pd	438.6	**Serine**	1.59	**Catalase**	0.063
Mn	81.3	**Aspartic acid**	1.33	**Carbohydrates**	23.20
Sn	223.9	**Praline**	1.53		
Zn	335.6	**Tyrosine**	1.49		

Table 3. Chemical Analysis of royal jelly (Townsend and Lucas, 1966).

Constituents	Values mg/ 100 g F.W.
Water	65.3
Dry matter	34.7
Portents	48.2
Carbohydrate	37.8
Lipids	10.4
Ash	2.0
Sugar	23.0
Glucose	4.0
Fructose	4.0
Sucrose	5.0
K	220
Mg	105
Ca	112
Fe	50
P	118
S	44
Mn	32
Si	5
Vitamins B1	0.4
Vitamins B2	0.3
Vitamins B5	0.4
Vitamins B6	0.3
Vitamins B8	0.3
Vitamins B9	0.4
Vitamins B12	0.3
A	0.4
C	0.9
D	0.5
K	0.4
E	0.3
Essential amino acids	1100

Results and Discussion

1- Vegetative traits:

Data presented in Table (4) show the effect of yeast concentrations on plant height and number of branches per plant in the two growing seasons. Thus, the plant height was affected significantly by the foliar application of different concentrations of yeast in the first season only. The highest mean value of plant height (139.59 cm) was obtained from 20 g/l of yeast. On the other hand, number of branches per plant did not react significantly to yeast application in both seasons. The previous increas in plant height with increasing yeast concentrations suggests the role of yeast in increasing plant growth characters. Plant height could give a clear represent of size and abundance of the vegetative growth of cucumber plant which reflected in the fruit number/plant (Al-Mokhtar *et al.,* 1991). The advantage of plants growth in response to the foliar application of yeast may be ascribed to its contents of different nutrients such as P, K, Mg, Ca, Fe, Ba, Mn and Zn, higher percentage of proteins, higher values of free amino acids and vitamins (Table 2) which may play a vital role in improving growth (Bevilacqua, *et al*., 2008). These findings are in a good line with those obtained by Bowen and Rovira, (1991), Ahmed *et al.* (1995), Glick, (1995), Sarhan (2008) on potato, Kamal and Ghanem (2012) on snap bean, Shalaby and El-Ramady (2014) on garlic, Marzouk *et al*. (2014) on broad bean and shafeek *et al.* (2015) on turnip.

The registered data in Table (5) show that the plant height and number of branches per plant were significantly influenced by the foliar applications of royal jelly concentrations in the two growing seasons. Thus, the highest mean values of plant height (138.70 and 126.18 cm) and number of branches per plant (3.51 and 3.20 branch) in the first and second seasons, respectively, were obtained using 2.4 g/l royal jelly concentration. On the other hand, the lowest morals were obtained with corresponding untreated plants. These increments in vegetative growth traits may be due to the highly nutritional and hormonal status of royal jelly. These results are in harmony with those detected by Nation and Robinson (1971), Townsend and Lucas (1966), Hyel (1951), El-Maziny and Hassan (1990) and El-Shaikh (2010).

Data exhibited in Tables (6) and (7) reveal that plant height and number of branches per plant traits was not affected significantly by the interaction in both seasons. Whatever, the highest mean values of plant height (144.33 cm and 142.12 cm) and number of branches per plant (3.53 and 3.64 branch) in the first and second seasons, respectively were achieved from cucumber plants sprayed by 20 g/l of yeast with 2.4 g/l royal jelly concentration.

2- Yield components:

Illustrated data in Table (4) reveal that number of fruits per plant, fruit yield per plant was affected significantly by the different concentrations of yeast in the two growing seasons. While, the fruit length was affected significantly by the studied yeast concentrations in the second season only. But, the fruit diameter trait reacted significantly to the tested yeast concentrations in the first season only. Thus, the highest mean values of fruit yield per plant (1.271 and 1.252 kg per plant in the first and second seasons, respectively) were obtained when the yeast was applied at the highest concentration (20 g/l). This is to be ex-

pected since the same yeast concentration produced the highest mean values with regard to number of fruits per plant and consequently produced the highest yield per plant. The optimistic effects of spraying yeast extract was qualified to its own contents of different nutrients, high percentage of protein, large amount of vitamin B and natural plant growth regulators such as cytokines. Physiological roles of vitamins and amino acids in the yeast extract which increase the metabolic processes role and levels of endogenous hormones that may indorsed the vegetative growth parameters and reflected on enhancing yield. Related trend of results were detected by Shehata *et al.* (2012) on cucumber.

Presented data in Table (5) denote that all studied yield components traits (number of fruits per plant, fruit length, fruit diameter and fruit yield per plant) were affected significantly by the foliar application of royal jelly as compared to control treatment (without royal jelly) in both seasons. Thus, the highest mean values of number of fruit per plant (12.71 and 12.23 fruit), fruit length (15.70 and 13.61 cm), fruit diameter (3.47 and 3.39 cm) and fruit yield per plant (1.223 and 1.215 kg) in the first and second seasons, respectively, were achieved from 2.4 g/l of royal jelly concentration. The superiority of 2.4 g/l royal jelly concentration were regard to fruit yield per plant can be attributed to the superiority with the same concentration concerning number of fruit per plant, fruit length and fruit diameter traits. These findings are supported by those obtained by El-Maziny and Hassan (1990) and El-Shaikh (2010).

Data illustrated in Tables (6) and (7) show that all studied yield components traits (number of fruits per plant, fruit length, fruit diameter and fruit yield per plant) were not affected significantly by the interaction between yeast and royal jelly in both seasons except fruit yield per plant in the second season only by the interaction between foliar application of yeast and royal jelly. The highest mean values of fruits number per plant (14.55 and 14.35 fruit), fruit length (18.08 and 14.83 cm), fruit diameter (3.75 and 3.70 cm) and fruit yield per plant (1.449 and 1.420 kg/plant) were observed in both seasons, respectively from the combinationof the application of 20 g/l yeast and 2.4 g/l royal jelly.

3- Total yield (ton /feddan):

Exhibited data in Table (4) exhibit that total yield per feddan was affected significantly by the yeast treatments in the two growing seasons. All studied yeast concentrations surpassed significantly the control treatment (without yeast) in this respect. Increasing yeast concentrations from 5 to 20 g/l increased the total yield per feddan. The highest mean values of total yield (16.780 and 16.527 ton/feddan in the first and second seasons, respectively) were obtained from 20 g/l yeast concentration was applied. This is to be expected since the same yeast concentration gained the highest mean values of fruit yield per plant as shown before and consequently produced the maximum fruits yield per feddan. The positive effects of using yeast applications was attributed to increase validity of different nutrients, high percent of protein, high amounts of vitamin B and natural plant growth regulators such as cytokinins (Glick, 1995 and Fathy and Farid, 1996); physiological roles of vitamins and amino acids in the yeast extract which increased the metabolic processes part and levels of endogenous hormones i.e., IAA and GA3

(Chaliakhyan (1956), Sarhan and Abdullah (2010) and Ahmed *et al.*(2011). Similar results trend were previously reported by several scientists for many crops (e.g., tomato, cucumber, eggplant, sweet pepper, Snap bean and potato).

Data recorded in Table (5) show that the total yield per feddan affected significantly by the foliar application of royal jelly in the both seasons. Cucumber plants which sprayed at 2.4 g/l royal jelly concentration out yielded the highest mean values of total fruits yield per feddan (16.140 and 16.027 ton/feddan) in the first and second seasons, respectively. This is to be expected since the same royal jelly concentration produced the highest fruits yield per plant as mentioned before (Table 5). The positive effect of royal jelly on total fruit yield (ton/feddan) may be attributed to its contents of hormones and nutrition elements (Nation and Robinson, 1971 and Hyel, 1951). Likewise, the improvement encouraged vegetative growth traits mirrored positively on total fruit yield (ton/feddan) due to the structure and contents of royal jelly (El-Maziny and Hassan, 1990 and El-Shaikh, 2010).

Data presented in Tables (6) and (7) reveal that the total yield per feddan affected significantly by the interaction between the application of yeast and royal jelly in the second season only. Cucumber plants were treated with both 20 g/l yeast and 2.4 g/l royal jelly gave the highest total yield per feddan (19.160 and 18.767 ton/feddan) in the first and second seasons respectively. The previous interaction led to an increment in fruit yield reached about 109.40 and 145.22 % in the first and second seasons, respectively as compared to control treatment (0.00 g/l of both yeast and royal jelly). These results were expected since the same interaction gave the highest fruit yield per plant (1.449 and 1.420 kg/plant).

4- Fruit quality:

Data exhibited in Table (4) reveal that reducing sugar percentage trait was affected significantly by the foliar applications of yeast in the first season only. On the contrary, the total soluble solids did not react significantly to the foliar applications of yeast in both seasons. Furthermore, the highest reducing sugar percentage (1.598%) was recorded from 20 g/l yeast concentration in the first season. The positive effects of applying active dry yeast was attributed to its own contents of different nutrients, high percentage of protein, large amounts of vitamin B and natural plant growth regulators. (Glick, 1995 and Fathy and Farid, 1996). The same results were found by Fathy *et al*., (2002) on tomato; Mona *et al*., (2005) on cucumber; Gomaa *et al*., (2005) on potato; El-Tohamy and El-Greadly, (2007) on Snap bean; El-Tohamy *et al*., (2008) on eggplant; Ghaoname *et al*., (2010) on sweet pepper and Fawzy *et al*., (2010) on Snap bean. Similar, Hussain and Khalaf, (2007) on potato, found that spraying yeast solution treatments significantly increased TSS.

Reducing sugar percentage and total soluble solids as shown in Table (5) were affected significantly by the royal jelly concentrations in the two growing seasons with regard to Tss and in the first season only with regard to reducing sugar percentage. Thus, the highest mean value (1.600%) of reducing sugar percentage was obtained from 2.4 g/l concentration of royal jelly application, while, the lowest mean value (1.565%) was obtained from untreated plants in this respectin the first season. Here too, the highest mean values of Tss (4.300 and 3.900 in the

first and second season, respectively) were registered from 2.4 g/l royal jelly concentration.

The interaction had a significant effect on reducing sugar percentage in the first season only (Tables 6 and 7). But, the total soluble solids were not affected significant in both seasons by the combination of foliar application of yeast and royal jelly. The maximum mean values of reducing sugar percentage were obtained from the interaction between 15 g/l yeast and 2.4 g/l royal jelly, 20 g/l of yeast with both 1.6 g/l and 2.4 g/l royal jelly (1.610 %) in the first season. But, in the second season the maximum values were obtained from the combination of 15 g/l and 20 g/l of yeast with 2.4 g/l royal jelly (Tables 6 and 7). Concerning total soluble solids, the maximum mean values were obtained from the combination of 15 g/l of yeast with 2.4 g/l royal jelly, 20 g/l of yeast with both 1.6 g/l and 2.4 g/l royal jelly in the first season. But, in the second season the highest mean value was obtained from the combination of foliar application of 20 g/l of yeast and 2.4 g/l of royal jelly (Tables 6 and 7).

Electrophoresis for protein patterns

Electrophoretic changes in protein patterns of cucumber plants treated with yeast, royal jelly and their combinations in comparison to the control are summarized in Table (8) and illustrated in Figs. (1 and 2). All tested plants manifested a maximum number of 18 protein bands, which were not necessarily being present in all tested treatments (Table 8).

Generally, the results revealed marked changes in protein patterns as a result of yeast and royal jelly treatments. In yeast and royal jelly treated plants, several polypeptides were apparently suppressed whereas others were induced, as compared to the control (Table 8). In this instance, the 27.72 KD protein band was reduced in plants treated with 5, 10 and 15 g/l yeast while, appeared in the other treatments. Whereas, one protein band at 19.17 KD was reduced in cucumber plants treated with yeast or royal jelly while it expressed in those treated with all combinations of yeast/royal jelly. However, the 18.24 and 14.32 KD proteins were reduced by all treatments. Meanwhile, the 61.62 KD band was induced only in plants treated with the high level of yeast (20 g/l) or royal jelly (2.4 g/l) and their combinations. However, the 33.55 KD was newly expressed in cucumber plants treated with 20g/l yeast or treated with all combinations of yeast/royal jelly. Two proteins at 46.38 and 31.44 KD were induced by all treatments of yeast and royal jelly. The induction of these proteins suggested that the genetic program in cucumber was altered by the tested treatments to induce the production of these proteins for specific pathways involved in the metabolism of cell growth and improving productivity of cucumber plants.

Conclusion:

The highest fruits yield was recorded using the foliar application by 20 g/l of yeast or by 2.4 g/l of royal jelly or from the combination of both treatments. We recommend spraying cucumber plants with 20 g/l yeast which surpassed the yield obtained by application of 2.4 g/ L royal jelly by about 3.55 % on average over both seasons and also safe lots of costs and achieve the highest return. But, Spraying plants with both 20 g/l yeast and 2.4 g/l royal jelly gave an increment for the fruits yield by about 13.87 % on average over both seasons from the yield obtained by 20 g/l of yeast only.

The use of combination of 20 g/l yeast and 2.4 g/l royal jelly holding a great promise since it gave fruit yield increment of 127.31 % on average over both seasons compared to control (untreated plants). Cucumber responded to yeast and royal jelly with distinct changes in gene expression. These changes in gene expression resulted from changes in gene products, including protein profiles. These proteins may play an important role in growth and yield of cucumber plants.

References:

Abou El-Nasr, M.E.; R.A. El-Shabrawy and M.M. Abd El-Rahman (2001). Effect of bread yeast application and some nutrient elements on squash (*Cucurbita pepo* L.) plant growth, yield and fruit quality under conditions of the early summer planting. J. Agric. Sci. Mansoura Univ., 26 (7): 4451-4464.

Ahmed, F.F.; M.M.A. Ragab; A.A. Gobara and A.E.M. Mansour (1995). The beneficial of supplying active dry yeast to some nutrients foliage spraying for Anna apple trees *(Malus domestica)* Symposium on Foliar fertilization a Technique to Improve Productivity and Decrease pollution. Cairo. Egypt.

Ahmed, A.A.; M.M.H. Abd El-Baky; M.F. Zaki and Faten S. Abd El-Aal (2011). Effect of foliar application of active yeast extract and zinc on growth, yield and quality of potato plant (*solanum tuberosum* L.). Journal of Applied Sciences Research, 7(12): 2479-2488.

Al-Mokhtar, F.A.; H.A. Al Zawbaee; W. raman and S. Numan, (1991). Creating and evaluating two new cucumber hybrids for protected and unprotected cultivations. Leba Journal of Agriculture Research 2(2):17-22.

A.O.A.C., 1990. Official Methods of Analysis (volume1)15th ed. Association of Official Analytical Chemists Inc., Suite 400, 2200 Wilson Boulevard. Arlington, Virginia, 22201 USA.

Bevilacqua, A.; M.R. Corbo; M. Mastromatteo and M. Sinigaglia (2008). Combined effects of pH, yeast extract, carbohydrates and di-ammonium hydrogen citrate on the biomass production and acidifying ability of a probiotic (*Lactobacillus plantarum*) strain, isolated from table olives, in a batch system. World J. Microbiol Biotechnol., 24: 1721-1729.

Bowen, G. D. and A. D. Rovira. (1991). The rhizosphere, the hidden half of the hidden half. P. 641-669. In:y. Waisel; A. Eshel; and V. Kalkaf; (cds). Plant Roots, the Hidden Half Marcel Dekker New York. Camb. 104: 99-106.

Bulletin of the Agricultural Statistics part (2) Summer and Nili Crops, 2013/2014.

Chaliakhyan, M.K., (1956). Effect of vitamins on growth and development of plants. Dokl Akad. Nauk. SSSR, III: 894-897.

El-Aref, H.M. and A.M. Hamada (1998). Genotypic differences and alterations of protein patterns of tomato explants under copper stress. Biologiaplantarum 41(4): 555-564.

El-Aref, H.M.; Adel, S. Taghian, Bahaa, E. Abd-El-Fatah and S. M. Dhuha (2014). Gene expression and *in vitro* selection for salinity tolerance in peanut. Assiut J. Agric. Sci., 45(2): 67-80.

El-Ghamriny, E.A.; H.M.E. Arisha and K.A. Nour (1999). Studies in tomato flowering fruit set yield and quality in summer seasons. 1. Spring with thiamine, ascorbic acid and yeast. Zagazig J. Agric. Res., 26(5):1345-1364.

El- Maziny, M.Y. and M.N.M.Hassan (1990). Effect of royal jelly, vitamin B complex and ethrel on the productivity of cucumber. Minia J. Agric. Res. Dev., 12(3): 1901-1909.

El-Shaikh, K.A. (2010). Growth and yield of some cucumber cultivars as affected by plant density and royal jelly application. Journal of Horticulture Science & Ornamental plants, 2(2): 131:137.

El-Tohamy, W.I.A. and N.H.M. El-Greadly (2007). Physiological responses, growth, yield and quality of snap bean in response to foliar application of yeast, vitamin e and zinc under sandy soil conditions. Australian Journal of Basic and Applied Sciences, 1(3): 294-299.

El-Tohamy, W.A., H.M. El-Abagy and N.H.M. El-Greadly (2008). Studies on the effect of putrescine, yeast and vitamin c on growth, yield and physiological responses of eggplant (*salanum melongena* L.) under sandy soil conditions. Australian Journal of Basic and Applied. Science, 2(2): 296-300.

Fathy, S.L. and S. Farid (1996). Effect of some chemical treatments, yeast preparation and royal jelly on some vegetable crops growing in late summer season to induce their ability towards better thermal tolerance. J. Agric. Sci., Mansoura Univ., 25(4): 2215-2249.

Fathy, E.S.L.; S. Farid and S.A. El-Desouky (2002). Induce cold tolerance of outdoor tomatoes during early summer season by using triphosphate (ATP), yeast, other natural and chemical treatments to improve their fruiting and yield. Agric. Sci. Mansoura Univ., 25(1): 377-401.

Fawzy, Z.F. (2007). Increasing productivity of head lettuce by foliar spraying of some bio- and organic compounds. Egypt. J. Appl. Sci., 22(10A): 237-247.

Fawzy, Z.F.; A.M. El-Bassiony; A.G. Behairy and Y.I. Helmy, (2010). Effect of foliar spraying by some bio and organic compounds on growth, yield and chemical composition of snap bean plant. Journal of Applied Science Research, 6(12): 2269-2274.

Freed R. D.; S.P. Eisensmith; E.H. Everson; M. Weber, E. Paul and E. Isleib (1991). Mstat, C: A microcomputer program for the design management and analysis of agronomic research experiments. Michigan State University, East lansing, MI, USA.

Ghoname, A.A.; M.A. El-Nemr; A.M.R. Abdel-Mawgoud and W.A. El-Tohamy (2010). Enhancement of sweet pepper crop growth and production by application of biological, organic and nutritional solutions. Research Journal of Agriculture and Biological Sciences, 6(3): 349-355.

Glick, B.R., (1995). The enhancement of plant growth by free living bacteria. Cand. J. Microbiology, 41:109-117.

Gomaa, A.M.; S.S. Moawad; I.M.A. Ebadah and H.A. Salim (2005). Application of bio-organic farming and its influence on certain pests infestation, growth and productivity of potato plants. Journal of Applied Sciences Research, 1(2): 205-211.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research. 4thEd. John Wiley & Sons Inc. New York, USA.

Hamail, A.F.; M.S. Hamada; E.A. Tartoura and M.A. Abd El-Hady (2014). Effect of n-forms and biostimulants on productivity of cucumber: 2- flowering characters, yield and its components. J. Plant Production, Mansoura Univ., Vol.5 (4): 573 – 583.

Hussain, W. and L. Khalaf (2007). Effect of foliar spraying with yeast solution on growth and yield of potato plant cv. desiree. html/www.tropentage.de/2007/abstractsg/links/khalaf. FPRAXY 90.

Hyel, H.L. (1951). An observation suggesting the presence of gonadotro-

fic hormone in royal jelly. Science, 89: 590-591.

Kamal, A.M. and K.M. Ghanem (2012). Impact of some bio-stimulants on organically cultivated snap bean plants. Egyt. J. of Appl. Sci., 27 (2);89-104.

Laemmli, U.K. (1970). Cleavage of structural proteins during the assembly of the head of bacteriophage T4. Nature 227: 680-685.

Marzouk, M. N.; M.R Shafeek; Y.I. Helmy; A.A. Ahmed and Magda, A.F.Shalaby (2014). Effect of vitamin E and yeast extract foliar application on growth, pod yield and both green pod and seed yield of broad bean (*Vicia faba* L.). Middle East Journal of Applied Sciences 4(1): 61-67.

Ming, L. and Cao Zong-xun. (1996). The floral-specific proteins of cucumber. Acta Botanica Sinica 38: 525-529.

Mona, M., S.M.A. Kabeel and M.A. Fayza (2005). Effect of organic and biofertilizer on growth, yield and fruit quality of cucumber grown under clear polyethelene low tunnels. J. Agric. Sci. Mansoura Univ., 30(5):2827-2841.

Morsi, M.K.; B. El-Magoli; N.T. Saleh; E.M. El-Hadidy and H.A. Barakat, (2008). Study of antioxidants and anticancer activity licorice *(Glycyrrhiza glabra)* extracts. Egyptian J. Nutr. and Feeds, 2(33): 177-203.

Nation, J.L. and E.AS. Robinson (1971). Concentration of some major and trace elementsin honey bee, royal jelly and pollen. J. Apic. Res. 10 (1): 35-43.

Sarhan, T.Z. (2008). Effect of biological fertilizers, animed residues, and ureaon growth and yield of potato plant c.v. desiree (*Solanum tuberosum* L.) Ph.D. Thesis Horticulture Sciences and Landscape Design (Vegetable), University of Mosul, College of Agriculture and Forestry.

Sarhan, T. and O.K. Abdullah (2010). Effect of azotobacter inoculation, dry bread yeast suspension and varying levels of urea on growth of potato cv. desiree. html/www.tropentage.de/2010/abstracts/full/628.

Sarhan T.Z.; Smira T.A. and Sanaa M.S. Rasheed (2011). Effect of bread yeast application and seaweed extract on cucumber (*Cucumis sativus* L.) plant growth, yield and fruit quality. Mesopotamia J. of Agric. (ISSN 1815-316X) Vol. (39) No. (2).

Shady, M.A. (1978). The yeasts, Adv. Cour. for Post Grand. St. In Microbiol. Agric. Bot. Dept., Fac. of Agric. Mansoura Univ., 146-247.

Shafeek M.R.; Asmaa R. Mahmoud; Aisha H. Ali, Magda M. Hafez and S.M. Singer (2015). Effect of different levels of potassium applied with foliar spraying of yeast on growth, yield and root quality of turnip under sandy soil conditions. International journal of current microbiology applied science, 4(10): 868-877.

Shalaby A. T. and H. El-Ramady (2014). Effect of foliar application of biostimulants on growth, yield, components, and storability of garlic (*Allium sativum* L.). AJCS 8 (2): 271-27.

Shehata S.A.; Z.F. Fawzy and H.R. El-ramady (2012). Response of cucumber plants to foliar application of chitosan and yeast under greenhouse conditions. Australian Journal of Basic and Applied Sciences, 6(4):63 71.

Townsend, G. and C. Lucas (1966). The chemical natural of royal jelly. Biochemical. J.34:1115-1162.

Table 4. Main effect of foliar application of active yeast on growth characters in cucumber plants in the 2015 and 2016 summer seasons.

Seasons	Treatments	Plant height (cm)	Number of branches per plant	Number of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Fruit yield per plant (Kg)	Total yield (ton/feddan)	Reducing sugar %	Total soluble solids
2015	**0 g/l**	114.51	2.77	9.76	12.92	2.90	0.810	10.637	1.568	3.854
	5 g/l	130.11	3.06	10.60	13.54	3.03	1.045	13.766	1.576	3.979
	10 g/l	133.39	3.14	11.17	13.89	3.17	1.128	14.674	1.585	4.021
	15 g/l	136.23	3.40	11.68	14.58	3.26	1.162	15.327	1.590	4.125
	20 g/l	139.59	3.57	12.58	15.63	3.50	1.271	16.780	1.598	4.229
	F value	**	NS	**	NS	*	**	**	**	NS
	L.S.D. at 5%	**5.793**	**-**	**0.927**	**-**	**0.307**	**0.198**	**2.627**	**0.0015**	**-**
2016	**0 g/l**	109.32	2.64	9.73	11.54	2.76	0.769	10.093	1.553	3.479
	5 g/l	113.66	2.78	10.37	12.07	2.99	1.025	13.498	1.558	3.521
	10 g/l	115.51	2.83	10.65	12.48	3.12	1.095	14.436	1.559	3.708
	15 g/l	117.90	2.96	11.15	12.90	3.22	1.153	15.203	1.567	3.729
	20 g/l	123.06	3.11	12.44	13.51	3.31	1.252	16.527	1.572	3.833
	F value	NS	NS	**	*	NS	**	**	NS	NS
	L.S.D. at 5%	**-**	**-**	**0.752**	**1.128**	**-**	**0.031**	**0.412**	**-**	**-**

NS, * and ** mean non-significant and significant at 0.05 and 0.01 probability, respectively.

Table 5. Main effect of foliar application of royal jelly on growth characters in cucumber plants in the 2015 and 2016 summer seasons.

Seasons	Treatments	Plant height (cm)	Number of branches per plant	Number of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Fruit yield per plant (Kg)	Total yield (ton/feddan)	Reducing sugar %	Total soluble solids
2015	**0 g/l**	123.77	2.84	9.97	12.95	2.89	0.947	12.452	1.565	3.717
	0.8 g/l	127.65	3.11	10.59	13.52	3.05	1.051	13.691	1.578	3.967
	1.6 g/l	132.94	3.29	11.35	14.28	3.28	1.112	14.664	1.590	4.183
	2.4 g/l	138.70	3.51	12.71	15.70	3.47	1.223	16.140	1.600	4.300
	F value	**	**	**	**	**	**	**	**	**
	L.S.D. at 5%	**6.961**	**0.369**	**1.206**	**1.099**	**0.268**	**0.081**	**1.060**	**0.0014**	**0.276**
2016	**0 g/l**	107.87	2.59	9.86	10.88	2.77	0.908	11.943	1.551	3.367
	0.8 g/l	113.99	2.75	10.29	12.39	2.98	1.011	13.307	1.559	3.583
	1.6 g/l	115.51	2.92	11.09	13.12	3.18	1.102	14.529	1.565	3.767
	2.4 g/l	126.18	3.20	12.23	13.61	3.39	1.215	16.027	1.573	3.900
	F value	**	**	**	**	**	**	**	NS	**
	L.S.D. at 5%	**6.692**	**0.270**	**0.601**	**1.013**	**0.265**	**0.009**	**0.121**	**-**	**0.277**

NS and ** mean non-significant and significant at 0.01 probability, respectively.

Table 6. Main effect of the interaction of foliar application of active yeast and royal jelly on growth characters in cucumber plants in the 2015 summer season.

Treatments of yeast	2015									
	Treatments of royal jelly	Plant height (cm)	Number of branches per plant	Number of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Fruit yield per plant (Kg)	Total yield (ton/feddan)	Reducing sugar %	Total soluble solids
0 g/l	**0 g/l**	108.25	2.42	9.35	12.17	2.72	0.699	9.150	1.553	3.500
	0.8 g/l	110.76	2.76	9.65	13.08	2.83	0.755	9.893	1.560	3.750
	1.6 g/l	111.51	2.81	9.85	13.17	2.95	0.876	11.510	1.570	4.000
	2.4 g/l	127.52	3.09	10.18	13.25	3.12	0.912	11.997	1.590	4.167
5 g/l	**0 g/l**	124.78	2.78	9.62	12.58	2.75	0.954	12.557	1.553	3.667
	0.8 g/l	125.52	2.64	10.22	13.25	2.95	1.052	13.853	1.580	3.917
	1.6 g/l	132.15	3.28	10.62	13.83	3.15	1.060	13.963	1.580	4.083
	2.4 g/l	138.00	3.53	11.95	14.50	3.25	1.114	14.690	1.590	4.250
10 g/l	**0 g/l**	126.40	2.78	9.95	12.75	2.92	0.985	12.957	1.570	3.750
	0.8 g/l	127.42	3.20	10.55	13.33	3.00	1.128	14.093	1.580	3.917
	1.6 g/l	137.67	3.03	10.95	14.25	3.25	1.120	14.767	1.590	4.167
	2.4 g/l	142.07	3.53	13.22	15.25	3.52	1.279	16.880	1.600	4.250
15 g/l	**0 g/l**	129.47	2.85	10.22	12.92	2.96	0.987	12.990	1.570	3.750
	0.8 g/l	134.03	3.28	10.85	13.58	3.02	1.108	14.600	1.580	4.083
	1.6 g/l	139.81	3.62	12.02	14.42	3.32	1.193	15.743	1.600	4.250
	2.4 g/l	141.61	3.87	13.65	17.42	3.73	1.361	17.973	1.610	4.417
20 g/l	**0 g/l**	129.96	3.37	10.72	14.33	3.08	1.109	14.607	1.580	3.917
	0.8 g/l	140.50	3.64	11.72	14.35	3.45	1.214	16.017	1.590	4.167
	1.6 g/l	143.55	3.75	13.32	15.75	3.72	1.313	17.337	1.610	4.417
	2.4 g/l	144.33	3.53	14.55	18.08	3.75	1.449	19.160	1.610	4.417
F value		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	******	**NS**
L.S.D. at 5%		-	-	-	-	-	-	-	**0.0030**	-

NS and ** mean non-significant and significant at 0.01 probability, respectively.

Table 7. Mean effect of the interaction of foliar application of active yeast and royal jelly on growth characters in cucumber plants in the 2016 summer season.

Treatments of yeast	2016									
	Treatments of royal jelly	Plant height (cm)	Number of branches per plant	Number of fruits per plant	Fruit length (cm)	Fruit diameter (cm)	Fruit yield per plant (Kg)	Total yield (ton/feddan)	Reducing sugar %	Total soluble solids
0 g/l	0 g/l	102.07	2.26	8.78	9.51	2.55	0.587	7.653	1.543	3.000
	0.8 g/l	108.69	2.56	9.02	11.47	2.77	0.689	9.030	1.553	3.417
	1.6 g/l	109.75	2.78	10.58	12.43	2.78	0.880	11.567	1.557	3.667
	2.4 g/l	116.79	2.98	10.52	12.75	2.95	0.922	12.123	1.560	3.833
5 g/l	0 g/l	105.90	2.59	9.55	10.70	2.75	0.913	12.007	1.553	3.083
	0.8 g/l	109.80	2.73	10.08	12.05	2.95	1.026	13.510	1.560	3.500
	1.6 g/l	115.85	2.81	10.32	12.73	3.10	1.059	13.950	1.557	3.667
	2.4 g/l	123.08	2.98	11.52	12.80	3.18	1.102	14.527	1.563	3.833
10 g/l	0 g/l	107.42	2.64	9.95	10.88	2.80	0.953	12.533	1.550	3.500
	0.8 g/l	115.51	2.73	10.22	12.17	2.98	1.051	13.840	1.557	3.583
	1.6 g/l	115.97	2.92	10.68	13.28	3.27	1.108	14.610	1.563	3.833
	2.4 g/l	123.13	3.03	11.75	13.60	3.43	1.269	16.760	1.567	3.917
15 g/l	0 g/l	111.79	2.68	10.08	11.33	2.82	1.008	13.280	1.553	3.583
	0.8 g/l	117.33	2.81	10.58	12.78	3.08	1.081	14.247	1.557	3.583
	1.6 g/l	116.66	2.98	10.92	13.40	3.30	1.162	15.327	1.570	3.833
	2.4 g/l	125.81	3.37	13.02	14.08	3.68	1.360	17.960	1.587	3.917
20 g/l	0 g/l	112.16	2.75	10.92	11.97	2.95	1.081	14.240	1.553	3.667
	0.8 g/l	118.62	2.92	11.55	13.47	3.12	1.206	15.910	1.570	3.833
	1.6 g/l	119.34	3.21	12.95	13.77	3.47	1.302	17.193	1.577	3.833
	2.4 g/l	142.12	3.64	14.35	14.83	3.70	1.420	18.767	1.587	4.000
F value		NS	NS	NS	NS	NS	**	**	NS	NS
L.S.D. at 5%		-	-	-	-	-	0.0204	0.271	-	-

NS and ** mean non-significant and significant at 0.01 probability, respectively.

Table 8. Molecular weights of protein bands detected in the cucumber plants under different treatments of yeast and royal jelly as compared with non-treated plants (control). Data were obtained by GS 365 electrophoresis data system program version 3.01.

Band No.	MW KD	Cont.	Yeast (g/l)				Royal jelly (g/l)			Yeast + Royal jelly (g/l)					
			5	10	15	20	0.8	1.6	2.4	10 Y + 1.6 R	15Y + 1.6 R	20 Y + 1.6 R	10 Y + 2.4 R	15 Y + 2.4 R	20 Y + 2.4 R
1	68.16	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	61.62	-	-	-	-	+	-	-	+	-	-	-	-	-	+
3	52.87	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	46.38	-	+	+	+	+	+	+	+	+	+	+	+	+	+
5	44.27	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	42.60	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7	39.68	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8	37.22	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	33.55	-	-	-	-	+	-	-	-	+	+	+	+	+	+
10	31.44	-	+	+	+	+	+	+	+	+	+	+	+	+	+
11	27.72	+	-	-	-	+	+	+	+	+	+	+	+	+	+
12	25.36	+	+	+	+	+	+	+	+	+	+	+	+	+	+
13	21.34	+	+	+	+	+	+	+	+	+	+	+	+	+	+
14	19.17	+	-	-	-	-	-	-	-	+	+	+	+	+	+
15	18.24	+	-	-	-	-	-	-	-	-	-	-	-	-	-
16	15.89	+	+	+	+	+	+	+	+	+	+	+	+	+	+
17	14.32	+	-	-	-	-	-	-	-	-	-	-	-	-	-
18	13.66	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Number of bands		14	12	12	12	15	13	13	14	15	15	15	15	15	16

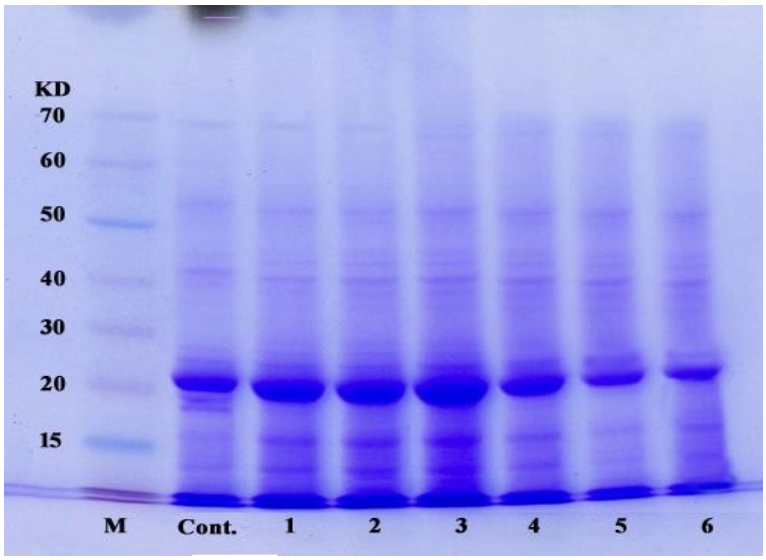

Fig. 1. Electrophoretic patterns of Protein profiles detected in the cucumber plants treated or untreated with yeast and royal jelly where: (M) = marker, Cont. = control treatment, (1), (2) and (3) 0.8, 1.6 and 2.4 (g/l) royal jelly, (4), (5) and (6) = 5, 10, 15 g/l yeast.

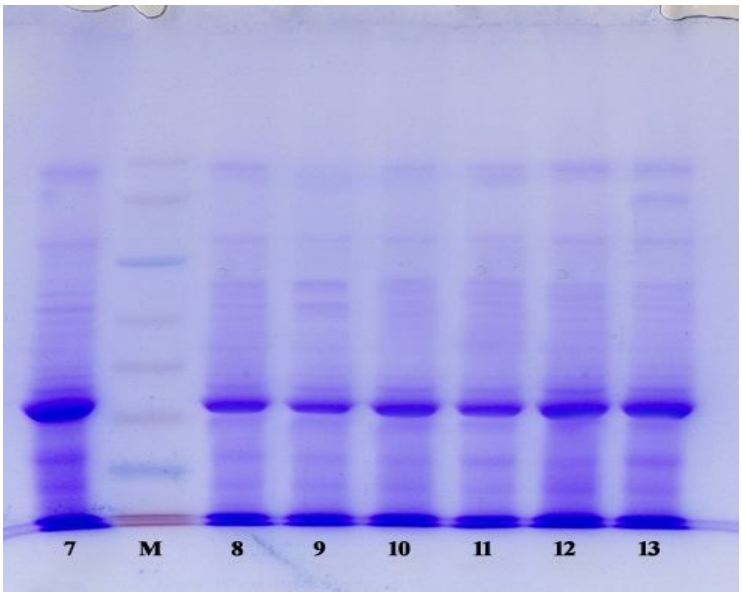

Fig. **2**. Electrophoretic patterns of Protein profiles detected in the cucumber plants treated or untreated with yeast and royal jelly where: (M) = marker, (7) = 20 g/l yeast, 8 = (10 g/l yeast +1.6 g/l royal jelly), 9 = (15 g/l yeast +1.6 g/l royal jelly), 10 = (20 g/l yeast +1.6 g/l royal jelly), 11 = (10 g/l yeast + 2.4 g/l royal jelly), 12 = (15 g/l yeast + 2.4 g/l royal jelly), and 13 = (20 g/l yeast + 2.4 g/l royal jelly).

إستجابة الخيار للرش الورقى بالخميرة والغذاء الملكي للنحل

داليا محمود طنطاوى ناصف[١] و حمدى محمد العارف[٢]

[١] قسم الخضر – كلية الزراعة – جامعة اسيوط
[٢] قسم الوراثة – كلية الزراعة – جامعة اسيوط

الملخص

أجرى هذا البحث فى مزرعة الخضر البحثية بكلية الزراعة – جامعة أسيوط فى صيف موسمى ٢٠١٥ و ٢٠١٦ لإختبار تأثير الرش الورقى بالخميرة والغذاء الملكي للنحل علي هجين الخيار (KUC-102) وتأثيره على المحصول ومكوناته وصفات الجودة. وكان تصميم هذه التجربة قطاعات كاملة العشوائية بإستخدام القطع المنشقة مرة واحدة بثلاث مكررات. أوضحت النتائج أن إستخدام الخميرة والغذاء الملكي للنحل أظهر إختلافات معنوية فى معظم الصفات المدروسة مقارنة بالكنترول حيث أعطت تركيزات ٢٠ جم/ اللتر من الخميرة و ٢,٤ جم/اللتر من الغذاء الملكي للنحل أعلى القيم فى كلا الموسمين. وأظهر الجمع بين ٢٠ جم/ اللتر من الخميرة و ٢,٤ جم /اللتر من الغذاء الملكي للنحل أعلى القيم لبعض الصفات المدروسة فى كلا الموسمين. وأيضاً أظهرت النتائج أن الرش بكلاً من ٢٠ جم/ اللتر من الخميرة مع ٢,٤ جم /اللتر من الغذاء الملكي للنحل يعتبر واعد حيث أدى لزيادة فى المحصول بلغت ١٠٩,٤ و ١٤٥,٢٢% فى كلا الموسمين على التوالى مقارنة بالكنترول. وقد أظهرت النتائج أيضاً أن الخيار إستجاب للخميرة والغذاء الملكي للنحل بتغيرات وراثية واضحة فى التعبير الجينى.