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EFFECT OF N-FORMS AND BIO-STIMULANTS ON PRODUCTIVITY OF CUCUMBER:
2- FLOWERING CHARACTERS, YIELD AND ITS COMPONENTS.

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ABSTRACT

To investigate the effect of nitrogen fertilization forms (ammonium sulphate and calcium nitrate) and some bio-stimulants (humic acid, fulvic acid, EM and yeast extract) under high temperature on flowering characters, yield and its components of cucumber (*Cucumis sativus* L.) cv. Prince, two field experiments were carried out in a private farm at El-Mahalla El-Kubra- Gharbia governorate during the two successive summer seasons of 2011 and 2012

Results showed that the (50%NH_4 + 50%NO_3) treatment of N-forms increase No. of female flowers, fruit setting, early and total yield significantly, while No. of male flowers and sex ratio decreased significantly.

Foliar spraying of cucumber plants with bio-stimulants significantly increased the mean values of the No. of female flowers, fruit setting early and total yield as compared with the control treatment. The best foliar application were yeast extract at 10 g/l or effective Microorganisms (EM) at 20 ml/l.

Therefore we recommend using nitrogen fertilization as (50% NH_4 +50% NO_3) combined with spraying yeast extract at 10 g/l or effective Microorganisms (EM) at 20 ml/l under high temperature conditions.

Keywords: Cucumber (*Cucumis sativus*) – sex ratio – fruit setting - yield – N-forms – bio-stimulants – humic acid – fulvic acid - effective Microorganisms (EM) – yeast extract.

INTRODUCTION

It is obvious that cucumber (*Cucumis sativus* L.) is one of the most important cucurbiteous crops grown in Egypt. The cultivated open field area reached 71932 feddan with average yield of 9.33 ton/feddan (FAO, 2012).

The most common source of nitrogen for the cultivation of crops in substrate systems is nitrate, which promotes plant growth and considered to be more preferable than ammonium (Borgognonea *et al.*, 2013).

Natural products, which contain phytohormones or exhibit hormone-like activity, have received increasing attention for use as nutrients supplements in agriculture and horticulture. Humic acid and fulvic acid are in common use as major components of vegetable and crop bio-stimulant formulations. Fulvic acid molecules have to be extracted from the humate material in order to create a fulvic acid solution. They have a role in promoting plant growth, flowering and yield. The importance of fulvic acid is

due to its ability to promote hormonal activity in plant. Effective Microorganisms (EM) is a mixture of beneficial and effective Micro-organism that can be used by two ways; watering into the soil or foliar spray. EM contains selected species of microorganisms, including predominant populations of lactic acid bacteria, yeasts, smaller numbers of photosynthetic bacteria, actinomycetes and other types of organisms. All of these are claimed to be mutually compatible with one another and are able to coexist in culture. Yeast treatment plays a beneficial role in improving the formation of flower initiation due to its effect on carbohydrates accumulation. Also it has a stimulatory effect on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (Swelam, 2012).

The aim of this study was to evaluate the flowering characters, yield and its components of cucumber in response to different N-forms and some bio-stimulants treatments and their interactions under high temperature.

MATERIALS AND METHODS

Two field experiments were carried out at a private farm near El-Mahalla El-Kubra city, Gharbiya Governorate during the two successive summer seasons of 2011 and 2012, to investigate the effect of nitrogen forms and some bio-stimulants at high temperature on flowering characters, yield and its components of Cucumber (*Cucumis sativus* L.) cv. prince. Split plot design with three replicates in the both seasons was used in this study. Five treatments of N-forms combinations (NH_4^+ : NO_3^-) and five bio-stimulants (control, humic acid, fulvic acid, effective microorganisms (EM) and active dry yeast) were used in foliar way. Thus the experiment included 25 treatments as follows:

I. First factor (N-forms):

1- N1= 100% NH_4^+ + 0% NO_3^-.
2- N2= 75% NH_4^+ + 25% NO_3^-.
3- N3= 50% NH_4^+ + 50% NO_3^-.
4 -N4= 25% NH_4^+ + 75% NO_3^-.
5- N5= 0% NH_4^+ + 100% NO_3^-.

II. Second factor (Bio-stimulants treatments):

1-Control (tap water).
2-Humic acid 20 m/l.
3-Fulvic acid 20 m/l.
4-EM 20 m/l.
5-Active dry yeast 10 g/l.

All bio-stimulants were used in the foliar way.

The seeds of cucumber were sown in the fourth week of june in both seasons of the study. Cucumber seeds were sown in hills handly at 30 cm distance between seeds on ridges. The plot area was 9 m^2 (1.5m x 6m).

The physical and chemical properties of the experimental soil have presented in Table (1).

Table (1): Physical and chemical analysis of the experimental soil during 2011 and 2012 seasons.

Seasons	O.M %	$CaCO_3$ %	Coarse sand%	Fine Sand %	Silt %	Clay %
2011	2.45	1. 97	1.92	18.33	32.21	47.54
2012	2.19	2.09	2.37	18.46	33.26	45.91

Table 1: continued

S.P %	Available (ppm)			Texture class	EC** ds/m	pH*
	N	P	K			
59	58.6	5.1	328	Clay	1.03	7.83
57	53.9	4.7	315	Clay	0.98	7.96

***Soil suspension (1:2.5) ** Soil extraction (1:5)**

Nitrogen fertilizer was added in the forms of Ammonium sulphate [$(NH_4)_2SO_4$; 20.6% N] as a source of NH_4^+ and Calcium nitrate [Ca $(NO_3)_2$, 15.5% N] as a source of NO_3^-. These fertilizers were added at the level 100 kg N/fed. The given doses divided into two equal parts; the first at 21 days from planting and the other at two weeks later in both seasons.

Humic acid, fulvic acid and EM were obtained from Ministry of Agriculture, and foliarly applied at the rates of 20 ml/l for each. The control treatment was sprayed with tap water. Yeast extract: Backer's yeast was mixed with sugar at ratio of 1:1 and left for 3 hours at room temperature. Then it was frozen for disruption of yeast tissue and releasing their content. Prepration of yeast extract was done according to **El-Ghamriny *et al.* (1999)** at the rates of 10 g/l. All the treatments of bio-stimulants were foliarly applied at two stages; one after two weeks from sowing and the other 7 days later.

Five plants per each treatment were randomly chosen, labeled and the following data were recorded:

- **Number of male and female flowers:** It was determined by counting male and female flowers at two days intervals up to the end of the season.
- **Sex ratio:** The sex ratio was calculated as the ratio between male to female flowers.
- **Fruit setting(%)**= $\frac{\text{No. of fruit/plant}}{\text{No. of flowers/plant}}$ X 100.

Yield and its components:

- **No. of fruit/plant.**
- **Fruit shape index:** it was recorded as the ratio between the length and diameter (L/D) of fruit.
- **Early yield:** It was calculated as the total yield of the first five pickins (ton/fed.).
- **Total yield:** It was calculated as the total weight of fruits (ton/fed.) through the entire harvesting season.

The obtained data were subjected to statistical analysis as split plot design with three replicates in the both seasons according to Gomez and Gomez (1984).The differences between the treatments were compared using least significant differences (L.S.D) as described by Snedecor and Cochran (1967).

RESULTS

1- Flowering characters:

Concerning the effect of N forms on male, female flowers, sex ratio and fruit setting, data in Table (2) showed that all these parameters under investigation gave significant differences among the values of these parameters. As respect of the N-forms, the minimum number of the male flowers and sex ratio were executed for the treatment of N3 (50%NH_4 + 50%NO_3). On the other hand, the maximum number of female flowers and fruit setting were produced from treatments N3 (50%NH_4 + 50%NO_3). This trend was true in the two seasons of 2011 and 2012

Concerning the effect of bio-stimulants; Data of the same table also indicated that; foliar spraying of cucumber plants with some bio-stimulants (humic acid, fulvic acid, EM, yeast extract) significantly decreased the mean values of male flowers and sex ratio, While the mean values of female flowers and fruit setting were increased as compared with the untreated treatment. For bio-stimulants under study; spraying with EM gave the maximum values of female flowers & fruit setting and minimum values of male flowers & sex ratio during both seasons.

Table(2): Effect of N-forms and a bio-stimulants applications at high temperature on some flowering characters during 2011 and 2012 seasons.

Characters	No. of male flowers		No. of female flowers		Sex ratio		Fruit setting %	
Treatments	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**
A: Nitrogen forms								
100%NH_4^++0%NO_3^-	37.53	38.13	12.93	12.93	2.94	3.01	65.61	69.58
75%NH_4^++25%NO_3^-	34.07	35.00	17.20	17.33	2.00	2.05	71.43	72.66
50%NH_4^++50%NO_3^-	27.27	27.00	21.00	20.93	1.31	1.31	81.61	80.97
25%NH_4^++75%NO_3^-	30.87	32.40	18.93	19.07	1.65	1.73	75.10	74.68
0%NH_4^++100%NO_3^-	34.93	35.93	15.00	14.53	2.36	2.53	68.07	70.49
LSD	**1.02**	**0.29**	**0.73**	**0.27**	**0.13**	**0.11**	**3.86**	**3.16**
B: Bio- stimulants:								
Control	37.33	38.80	15.27	14.67	2.58	2.82	63.55	64.33
Humic acid	34.00	35.53	16.53	16.27	2.15	2.28	69.34	70.21
Fulvic acid	32.80	33.47	17.20	17.27	2.01	2.04	73.27	75.23
EM	29.67	29.47	18.53	18.87	1.68	1.64	79.44	80.40
Yeast extract	30.87	31.20	17.53	17.73	1.85	1.85	76.21	78.19
LSD	0.41	0.23	0.30	0.36	0.06	0.08	3.21	2.81

The interaction effects between N forms and foliar amendments on cucumber plants during the two seasons were presented at Table (3). It was obvious that foliar spaying of humic acid, fulvic acid, EM and yeast extracts under study has corrected the bad effect of high temperature on the mean values of male, female flowers, sex ratio and fruit setting under investigation. In this respect, foliar spraying of EM combined with the levels of N3 forms was superior for increasing the values of these parameters.

Table(3):Effect of interaction between N-forms and a bio-stimulants applications at high temperature on some flowering characters during 2011and 2012 seasons.

Characters		NO. of male flowers		NO. of female flowers		Sex ratio		Fruit setting %	
Treatments		**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**
N1	Control	43.00	44.33	11.33	11.00	3.80	4.06	56.06	57.88
	Humic acid	38.33	39.33	12.67	12.67	3.03	3.11	63.25	65.81
	Fulvic acid	37.00	38.00	13.00	13.00	2.85	2.92	66.73	71.79
	EM	34.00	33.67	14.33	14.67	2.38	2.30	74.44	77.30
	Yeast extract	35.33	35.33	13.33	13.33	2.65	2.65	67.58	75.09
N2	Control	38.67	40.00	15.67	15.33	2.47	2.61	61.81	63.06
	Humic acid	34.33	37.33	16.67	16.67	2.06	2.25	68.01	68.01
	Fulvic acid	33.67	35.00	17.33	17.67	1.95	1.98	75.05	75.49
	EM	31.33	30.33	18.67	19.00	1.68	1.60	76.80	78.95
	Yeast extract	32.33	32.33	17.67	18.00	1.83	1.80	75.49	77.78
N3	Control	30.67	31.33	19.00	18.67	1.61	1.68	73.68	76.80
	Humic acid	28.33	29.00	20.33	20.00	1.40	1.45	78.73	78.33
	Fulvic acid	27.67	26.67	21.33	21.33	1.30	1.25	79.73	79.65
	EM	24.33	23.00	22.67	23.00	1.08	1.00	89.77	86.94
	Yeast extract	25.33	25.00	21.67	21.67	1.17	1.16	86.13	83.12
N4	Control	33.67	36.33	16.67	16.33	2.02	2.23	69.98	65.32
	Humic acid	32.00	34.00	18.33	18.00	1.75	1.89	70.86	72.22
	Fulvic acid	30.67	32.00	19.33	19.33	1.59	1.66	75.96	75.88
	EM	28.33	29.33	20.67	21.33	1.37	1.38	80.71	81.24
	Yeast extract	29.67	30.33	19.67	20.33	1.51	1.49	77.98	78.73
N5	Control	40.67	42.00	13.67	12.00	2.99	3.52	56.23	58.61
	Humic acid	37.00	38.00	14.67	14.00	2.53	2.71	65.87	66.67
	Fulvic acid	35.00	35.67	15.00	15.00	2.33	2.38	68.89	73.33
	EM	30.33	31.00	16.33	16.33	1.86	1.90	75.49	77.57
	Yeast extract	31.67	33.00	15.33	15.33	2.07	2.16	73.89	76.25
LSD		1.24	0.53	0.89	0.75	0.17	0.18	7.22	6.23

N1= 100% NH_4^+ + 0% NO_3^- / N2= 75% NH_4^+ + 25% NO_3^- / N3= 50% NH_4^+ + 50% NO_3^-. / N4= 25% NH_4^+ + 75% NO_3^-. / N5= 0% NH_4^+ + 100% NO_3^-.

2- Yield and its components:

Concerning the effect of N forms of early, total yield, fruit shape and No. of fruits/plant, data in Table (4) indicate that N3 (50% NH_4 + 50% NO_3) gave the highest values of all characters, early and total yield 3.45 and 3.32 in the first and second season, respectively.

Regarding the effect of bio-stimulants on early, total yield, fruit shape and No. of fruits/plant, Data in the same table show that different bio-stimulants caused significant increase in all these characters. The highest values were obtained from planted sprayed with EM.

Table(4):Effect of N-forms and a bio-stimulants applications at high temperature on yield and its components during 2011 and 2012 seasons.

Characters	No. of fruits /plant		Fruit shape		Early yield ton/fed.)(		Total yield ton/fed.)(	
Treatments	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**
A: Nitrogen form								
N1	8.53	9.07	4.29	4.01	1.04	0.92	5.69	5.65
N2	12.33	12.67	4.47	4.20	2.40	2.35	7.50	7.30
N3	17.20	17.00	4.59	4.31	3.45	3.32	10.32	9.49
N4	14.27	14.33	4.53	4.23	2.93	2.80	8.15	7.78
N5	10.27	10.33	4.42	4.18	1.88	1.87	7.04	6.82
LSD	0.71	0.60	0.15	0.12	0.46	0.28	0.82	0.66
B: Bio-stimulants								
Control	9.87	9.60	4.36	4.07	1.65	1.75	6.59	6.37
Humic acid	11.60	11.53	4.43	4.16	2.34	2.18	7.70	7.35
Fulvic acid	12.73	13.07	4.47	4.21	2.42	2.27	7.83	7.53
EM	14.87	15.27	4.52	4.25	2.73	2.61	8.42	8.01
Yeast extract	13.53	13.93	4.51	4.24	2.56	2.46	8.17	7.79
LSD	0.47	0.40	0.07	0.07	0.11	0.11	0.32	0.24

N1= 100% NH_4^+ + 0% NO_3^- N2= 75% NH_4^+ + 25% NO_3^- N3= 50% NH_4^+ + 50% NO_3^-.
N4= 25% NH_4^+ + 75% NO_3^-. N5= 0% NH_4^+ + 100% NO_3^-.

Table(5):Effect of interaction between N-forms and bio-stimulants applications at high temperature on yield and its components during 2011/2012 seasons.

Characters		No. of fruits /plant		Fruit shape		Early yield ton/fed.)(		Total yield (ton/fed.)	
Treatments		**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**
N1	Control	6.33	6.33	4.05	3.78	0.47	0.47	4.71	4.80
	Humic acid	8.00	8.33	4.16	3.98	0.97	0.82	5.78	5.74
	Fulvic acid	8.67	9.33	4.31	4.08	1.05	0.86	5.92	5.79
	EM	10.67	11.33	4.46	4.11	1.47	1.39	6.03	5.99
	Yeast extract	9.00	10.00	4.45	4.10	1.23	1.08	5.98	5.90
N2	Control	9.67	9.67	4.41	4.14	1.83	1.82	6.47	6.33
	Humic acid	11.33	11.33	4.47	4.20	2.47	2.34	7.53	7.31
	Fulvic acid	13.00	13.33	4.48	4.21	2.50	2.47	7.73	7.53
	EM	14.33	15.00	4.48	4.23	2.65	2.60	7.99	7.74
	Yeast extract	13.33	14.00	4.48	4.22	2.55	2.53	7.80	7.59
N3	Control	14.00	14.33	4.57	4.18	2.60	2.69	8.65	8.06
	Humic acid	16.00	15.67	4.58	4.23	3.27	3.21	9.85	9.17
	Fulvic acid	17.00	17.00	4.59	4.30	3.53	3.31	9.95	9.42
	EM	20.33	20.00	4.61	4.44	4.08	3.77	11.93	10.65
	Yeast extract	18.67	18.00	4.58	4.39	3.78	3.64	11.22	10.15
N4	Control	11.67	10.67	4.45	4.17	2.25	2.36	7.01	6.72
	Humic acid	13.00	13.00	4.53	4.22	2.98	2.76	8.26	7.75
	Fulvic acid	14.67	14.67	4.54	4.24	3.03	2.86	8.34	8.00
	EM	16.67	17.33	4.58	4.26	3.23	3.09	8.65	8.29
	Yeast extract	15.33	16.00	4.57	4.25	3.15	2.93	8.48	8.15
N5	Control	7.67	7.00	4.33	4.10	1.11	1.40	6.09	5.93
	Humic acid	9.67	9.33	4.40	4.18	1.99	1.80	7.07	6.75
	Fulvic acid	10.33	11.00	4.42	4.19	2.00	1.88	7.19	6.89
	EM	12.33	12.67	4.47	4.22	2.21	2.17	7.51	7.36
	Yeast extract	11.33	11.67	4.45	4.20	2.09	2.10	7.34	7.18
LSD		1.13	0.95	0.19	0.17	0.49	0.34	0.99	0.77

N1= 100% NH_4^+ + 0% NO_3^- N2= 75% NH_4^+ + 25% NO_3^- N3= 50% NH_4^+ + 50% NO_3^-.
N4= 25% NH_4^+ + 75% NO_3^-. N5= 0% NH_4^+ + 100% NO_3^-.

DISCUSSION

1- Flowering characters:

It could be concluded that hormone-like substances have been elucidated to understand the mechanism of humic acid substances in plant metabolism (Muscolo *et al.*, 1999) through their involvement in cell respiration, photosynthesis, oxidative phosphorylation, protein synthesis and various enzymatic reactions (Zhang *et al.*, 2003). This led to increase No. of flowers and yield. These results are in harmony with those of Tei *et al.* (2006) on zucchini and Arancon *et al.* (2006) on pepper.

The favorable effect of fulvic acid may be attributed to: 1- that female flower bud initiation and development may depend on hormone like activity of fulvic acid. 2- Participate directly or indirectly in plant anabolism resulting in more plant metabolites necessary for plant growth and flowering. These results are in harmony with the findings of Rauthan and Schnitzer (1981) and Abou Kamar (2012).

It is well noted from the present results that EM had a stimulative effect on female flowers during the two growing seasons. The beneficial effects of bacterization on female flowers may be attributed to N2-fixation process and/or to the production of growth promoting substances like auxin type which gave a positive effect of No. of female flowers of cucumber.

The yeast contains tryptofan (Abdel-Latif, 1987) which considered the precursor of IAA (Moor, 1979). Consequently, the application of yeast extract produced more IAA which increased plant growth during period of cultivation, also it might be encouraged the carbohydrates formation thus may inhibit the development of male flowers after differentiation leading to precocious female flowers. In this respect, Wien (1997) concluded that conditions which enhance the building up of carbohydrates tend to favour female flowers expression, whereas factors reduce carbohydrates build up, such as temperatures, also increase the tendency for male flowers production in the cucurbit vegetables. This observation agrees with the report of Wanas (2006) on squash.

2- Yield and its components:

The obtained increment of yield and its components may be due to more vigor of plant growth and strong rooting system as a result of residually acid forming and availability form of most nutrients to the plants supplied with N3 as (50% NH_4+50% NO_3) and as a result of residually neutral (acid + basic) forming and availability form of most nutrients to the plants treated with N4 (ammonium sulfate and calcium nitrate). It can concluded that female flower formation and fresh weights of fruits of cucumber plants were affected by N-forms. These results were agreeable with those reported by other workers such as Mohamed (1999), Hafiz and Mahmoud (2003) on cucumber and squash, respectively.

Humic acid led to increase the permeability of plant membranes, promote the uptake of nutrients, reduce impacts of disease and stimulate plant growth all of this led to increase yield of fruits. This observation agrees with the report of Bohme *et al.* (2003), Karuppaiah and Manivannan (2005) and Tei *et al.* (2006) on cucumber.

The stimulative effect of fulvic acid may be due to: 1- Enhancing productivity via increasing the vegetative growth parameters and female flowers which reflects on cucumber yield. 2- Enhancement of cell division and cell enlargement. These results are in conformity with the findings of Khalil *et al.* (2011) and Soliman (2011) on cucumber.

The positive impact of EM that happened may due to presence of the following five families of micro-organisms: a) Lactic acid bacteria: these bacteria are differentiated by their powerful sterilizing properties. They suppress harmful micro-organisms and encourage quick breakdown of organic substances. In addition, they can suppress the reproduction of fusarium, a harmful fungus. b) Yeasts: these manufacture anti-microbial and useful substances for plant growth. Their metabolites are food for other bacteria such as the lactic acid and actinomycete groups. c) Actinomycetes: these suppress harmful fungi & bacteria and can live together with photosynthetic bacteria. d) Photosynthetic bacteria: these bacteria play the leading role in the activity of EM. They synthesize useful substances from secretions of roots, organic matter and/or harmful gases (e.g. hydrogen sulfide) by using sunlight and the heat of soil as sources of energy. They contribute to a better use of sunlight or , in other words, better photosynthesis. The metabolites developed by these micro-organisms are directly absorbed into plants. In addition, these bacteria increase the number of other bacteria and act as nitrogen binders. e) Fungi: that bring about fermentation these break down the organic substances quickly. This suppresses smell and prevents damage that could be caused by harmful insects (Xu, 2000). This is in agreement with similar observations made by Tong (1998) on watermelons, Hafiz and Mahmoud (2003) on squash and Habashi *et al.* (2007) on cucumber.

The positive effects of applying yeast extract was attributed to its own contents of different nutrients, high percentage of protein, large amount of vitamin B and natural plant growth regulators such as cytokinins. Physiological roles of vitamins and amino acids in the yeast extract which increased the metabolic processes role and levels of endogenous hormones that may promoted the vegetative growth parameters and reflected on enhancing yield. Also increasing fruits yield response to yeast extract could be attributed to the increasing of total leaf area and dry matter accumulation, photosynthetic pigments and assimilates supply under high temperature that favour femaleness and hence enhancement of fruits growth rates.

Similar trend of results were reported by Shehata *et al.* (2012) on cucumber and Wanas (2006) on squash.

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تأثير صور النيتروجين و المنشطات الحيوية على إنتاجية الخيار:-
٢- صفات الأزهار و المحصول و مكوناته

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نفذت تجربتـان حقليتـان فـى مزرعـة خاصـة بـالقرب مـن المحلـة الكبـرى خـلال موسـمى الزراعة ٢٠١١-٢٠١٢ لدراسة تأثير صور النتروجين المختلفة (سلفات النشادر و نترات الكالسيوم) وبعض المنشطات الحيوية (حمض الهيوميك ، و حمض الفالفيك ، و الكائنات الحية الدقيقة الناشطة ، ومستخلص الخميرة) تحت درجات الحرارة المرتفعة على صفات الأزهار مثل (عدد الأزهار المذكرة و عدد الأزهار المؤنثة و النسبة الجنسية و نسبة العقد) و المحصول المبكر و الكلى لنبات الخيار. و أظهرت النتائج أن المعاملة بصورة الينتروجين (٥٠% امونيوم + ٥٠% نترات) أدت لزيادة عدد الأزهار المؤنثة و نسبة العقد و المحصول المبكر و الكلى، بينما قلت عدد الأزهار المذكرة و النسبة الجنسية.

أما بالنسبة لرش نباتات الخيار بالمنشطات الحيوية فقد أعطى زيادة كبيرة فى عدد الأزهار المؤنثة و نسبة العقد و المحصول المبكر و الكلى مقارنة بمعاملة الكنترول وكانت أفضل المعاملات عند الرش بمستخلص الخميرة بتركيز ١٠ جم/لتر و الكائنات الحية الدقيقة النافعة بتركيز ٢٠ مل/لتر.

حيث يبين ذلك الأهمية الإقتصادية لكل من النيتروجين و المنشطات الحيوية من إحداث الزيادة فى صفات الأزهار و بالتالى فى المحصول و مكوناته؛ لذلك نوصى بالتسميد النيتروجينى على الصورة (٥٠% امونيوم + ٥٠% نترات) مع الرش بمستخلص الخميرة بتركيز ١٠ جم/لتر أو الكائنات الحية الدقيقة النافعة بتركيز ٢٠ مل/لتر.

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