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EFFECT OF MULCH AND FOLIAR SPRAY WITH BIOSTIMULANTS AND CHEMICAL NUTRIENTS ON CUCUMBER PLANTS GROWN UNDER PLASTIC HOUSES II-FOLIAR SPRAY EFFECT

F.EL-AIDY, A. El-ZAWELLY, N. ABDEL-MENEIM, M. BASSIOUNY

Department of Horticulture, Faculty of Agriculture, Kafrelsheik University, Egypt

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Abstract

The experiments were carried out during successive early summer season of 2004 and 2005 years, under doublespan plastic house (5.1 x 17 x 55 m) at. Kafr El-Sheikgh Governorate. The main objective of this research was to study the effect of mulches and foliar nutrition with biostimulants (soft bread yeast plus K citrate and seaweed extracts) and chemical fertilizer (containing macro- and micro-nutrients) on growth, yield, analysis of disease infection of hybrid cucumber (Petostar). The results are summarized as follows:

Application of yeast plus K cit. gave the highest values of vegetative growth parameters (stem length and diameter no. of internodes and lateral branches), fruits yield (early, and total yields, compared with control (no spray) which had the lowest values. In contrast, the previous treatments gave the lowest values of D.S. % of downy and powdery mildews compared with whether bare soil, no spray or control which had the highest values.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is essentially a warm season crop. In Egypt cucumberis grown in open field during summer, and under plastics in winter and spring. Cucumber is considered the main protected crop in Egypt, it occupied 5404924 m^2 (52.5% from the total covered area) with an average yield of 11.52 kg/m^2. The main problems are the low temperature, salinity and fertilizers pollution. Therefore, the present research was carried out to study the effect of some mulching treatments and foliar application (soft bread yeast, seaweed extracts and chemical fertilizer containing macro-and micronutrients) on cucumber growth, yield and diseases infection during early summer season inside unheated double span plastic house under Kafrelsheikh conditions.

Effect of yeast spray on vegetative growth and yield has been studied by many workers. Hewedy *et al.* [5] studied the influence of soft bread yeast, biozyme and stimufol. They found that foliar spray with yeast (2 g/l), biozyme and stimufol (1 g/l) enhanced vegetative growth. El-Kassas and Abd El-Moulla [6] showed that foliar application of cucumber plants grown under plastic house with Fe (150 ppm), Mn (150 pm) or Zn (100 ppm) seven times significantly increased fruits yield over the control. Kolota *et al.* [10] showed that foliar fertilization with Ekolist U increased marketable fruits yield of cucumber plants by 7.3% and decreased the

level of cucumber leaf infestation by downy mildew. Other works have been done on the effect of foliar applications on reduced the incidence of downy and powdery mildew on cucumber [14, 15].

MATERIAL AND METHODS

Two experiments were carried out under unheated doublespan plastic house, during successive early summer seasons of 2004 and 2005, at Kafr El-Sheikh Governorate. The main objective of this research work was to study the influence of mulch types (black plastic and rice straw) and foliar nutrition: soft yeast seaweed extracts, and chemical nutrients on growth and yield of cucumber F_1 hybrid cv. Petostar and disease incidence, i.e., downy and powdery mildew.

Treatments were the following:

1. Black plastic film 40 mm.
2. Rice straw which was cut and spread on the soil surface about 5 cm layer.
3. Bare soil.
4. Soft bread yeast at 10 g/l + potassium citrate (38% K) at 1.5 cm/l were used. Soft bread yeast was mixed with sugar at a ratio of 1:1 and dissolved in water then left for 12 hours (at room temperature) before spraying.
5. Seaweed extract was obtained commercially as Promex, it was used at 1 cm/l.
6. Chemical fertilizer was obtained commercially as "High grow" and used at 1.7 g/l, (contains 10% N, 4% P, 36% K, 100 ppm Fe, 600 ppm Zn, 400 ppm Mn, 100 pm Cu, 300 ppm B and 50 ppm Mo, the microelements were in a chelated form).
7. Control (unmulched and non sprayed).

Cucumber plants were sprayed with the previous nutrient materials four times at 15-days interval, beginning three weeks after transplanting. In early summer season, seeds of cucumber cv. Petostar F_1 hybrid were sown on January 21st in both seasons in the nursery. The seedlings were transplanted at 2.6 plants/m^2 into an unheated plastic house on February 15th in both years. All cultural practices were carried out whenever necessary. Harvesting started on March 21st and continued until June 21st in both years. The experiment included 12 treatments which were the combinations of the three mulch treatments and four foliar nutrition treatments. The previous treatments were arranged in a split-plot using a randomized complete blocks design with four replications. Mulching treatments were assigned in the main plots where each main plot was splitted to four treatments of foliar nutrition as sub-plots. The control treatment was no spray with bare soil. The experimental sub-plot area was 9.75 m^2 (1.5 x 6.5 m) and contained of 26 plants. Data were tested by analysis of variance [11]. Duncan's multiple range test was used for comparison among treatments means [3].

Data recorded:
Vegetative growth parameters such as stem length and diameter, number of nodes, number of lateral branches were recorded at 30, 60 and 90 days after transplanting (DAT). Fruit yield: early (first 10 pickings) and total fruit yields. Downy mildew (*Pseudoperonospora cubensis*) and powdery mildew (*Erysiphe chichoracearum*) were estimated as disease severity percentage according to scale of Biswas [2] (D.S.%) after 90 days from transplanting.

RESULTS AND DISCUSSION

Vegetative growth:
Effect of foliar nutrition: Data in table 1 reveal that there were highly significant differences in all vegetables growth characteristics among the treatments of foliar nutrition at all sampling dates in both seasons. Therefore, foliar nutrition of cucumber plants with yeast + K citrate, seaweed extracts and chemical fertilizer increased the mentioned characteristics with nonsignificant differences of each other over the nonsprayed plants which had the lowest records at all tested ages of plants in both seasons. Many researchers had similar results for the effect of yeast on plant growth [13, 14 and 7].

Table 1

Effect of foliar nutrition on some stem growth characteristics of cucumber plants

Characters	Stem length (cm)			Stem D (cm)		No. of internodes/plant			No. of branches/plant		
	Days after transplanting										
Foliar nutrition	30	60	90	60	90	30	60	90	30	60	90
	2004 season										
Yeast + K citrate	52.4 a	153.2 a	289.2 a	0.89 a	1.09 a	10.2 a	25.8 a	41.3 a	2.8 a	5.8 a	7.0 a
Seaweed ext.	52.3 a	149.0 ab	291.7 a	0.89 a	1.08a	9.7 a	26.3 a	42.3 a	2.9 a	5.6 a	7.2 a
Chemical fert.	53.1 a	156.3 a	298.3 a	0.89 a	1.09 a	10.3 a	26.7 a	42.1 a	2.8 a	5.7 a	7.1 a
No spray	48.4 b	137.0 b	264.2 b	0.80 b	1.01 b	7.9 b	21.8 b	37.2 b	1.9 b	3.7 b	5.2 b
	2005 season										
Yeast + K citrate	66.4 a	169.7 a	305.9 a	0.92 a	1.16 a	13.2 a	30.8 a	48.2 a	3.1 a	8.4 a	9.2 a
Seaweed ext.	61.6 ab	162.4 ab	294.9 ab	0.91 ab	1.15 a	12.9 ab	29.8 ab	48.0 a	3.5 a	7.9 a	8.4 a
Chemical fert.	64.8ab	162.8 ab	290.7 ab	0.90 b	1.13 a	13.1 a	30.1 a	46.6 ab	3.0 ab	7.5 a	7.0 b
No spray	58.9 b	155.0 b	288.0 b	0.84 c	1.08 b	12.0 b	28.3 b	45.2 b	2.2 b	5.8 b	6.6 b

Fruit yield: Early fruit yield:
Early fruit yield: Data in table 2 reveal that all foliar nutrition treatments caused a highly significant increase in early fruit yield (as weight and number) with nonsignificant differences from each other compared with the nonsprayed treatment in both seasons. The highest early fruit yield was obtained from the

plants sprayed with soft yeast plus K citrate in both seasons. The increases (%) in weight of early yield over the no spray were 26.8 and 20.0% for yeast + K citrate, 27.0 and 12.7% for chemical fertilizer and 17.1 and 10.0% for seaweed extracts in both seasons, respectively. Similar results were obtained by El-Kassas &. Abd El-Moulla, [7].

Total fruit yield: Data presented in table 2 illustrate that all foliar nutrition treatments resulted in a highly significant increase in total fruit yield (as weight and number) in comparison with the non sprayed treatment in both seasons. The highest total fruit yield was obtained from the plants sprayed with yeast plus K citrate followed by both chemical fertilizer and seaweed extracts, however the differences in between were significant in the second season only. The increase (%) in weight of total yield over the no spray were 19.9 and 33.6% for yeast + K citrate, 18.1 and 19.4% for chemical fertilizer and 17.9 and 17.6% for seaweed extracts in both seasons, receptively. Similar behavior was obtained by many researchers using foliar spray with yeast [15, 12], potassium citrate [1], K and Ca macro-and microelements [9, 10] and seaweed extracts [6]. The promotive effect of foliar spray with whether yeast plus K citrate, commercial fertilizer or seaweed extracts on total fruit yield of cucumber might be due to increased CO_2 production which lead to increasing photosynthesis and carbohydrates accumulation and in turn increased fruiting table 2 as well as decreased downy and powdery mildews incidence (figure 1) hence increased total fruit yield of cucumber.

Table 2

Effect of foliar nutrition on early and total yields of cucumber plants

Characters	Early fruits yield/m^2			Total fruits yield/m^2		
Foliar nutrition	Fruits No.	fruits (kg)	Increase in wt. %	Fruits No.	fruits (kg)	Increase in wt. %
	2004 season					
Yeast + K citrate	35.3 a	3.168 a	26.8	158.5 a	15.928 a	19.9
Seaweed ext.	32.6 ab	2.926 ab	17.1	156.1 a	15.665 a	17.9
Chemical fert.	33.7 ab	3.173 a	27.0	156.4 a	15.699 a	18.1
No spray	27.3 b	2.498 b	-	133.8 b	13.289 b	-
	2005 season					
Yeast + K citrate	50.9 a	5.119 a	20.0	163.1 a	17.210 a	33.6
Seaweed ext.	47.2 ab	4.692 ab	10.0	146.8 b	15.146 b	17.6
Chemical fert.	47.6 ab	4.807 ab	12.7	145.5 b	15.369 b	19.4
No spray	43.4 b	4.267 b	-	125.0 c	12.877 c	-

Values having the same alphabetical letter within each column are not significantly different at the 5% level, according to Duncan's test

Diseases infection

Data in figure 1 illustrate that foliar nutrition of cucumber plants with whether yeast+K citrate, chemical fertilizer or seaweed extracts induced a highly significant

reduction in D.S. % of downy and powdery mildews compared with the non sprayed plants which had the highest % in both seasons. Foliar spray of with yeast + K citrate tended to be the best treatment for reducing downy and powdery mildews infection in both seasons. In this respect, moreover, some reports showed that foliar spray with phosphate alone or in combination with potassium that reduced powdery mildew infection on cucumber plants caused an increase in peroxidase activity [12], enhanced beta-1,3 glucanase content and increased uptake of Ca in cucumber plant, in turn, increased systemic resistance against powdery mildew in cucumber plants[15]. Regarding downy mildew incidence on cucumber plants, some researchers found that foliar application of compound fertilizer Ekolist at 1.5% reduced the incidence of downy mildew on cucumber [12].

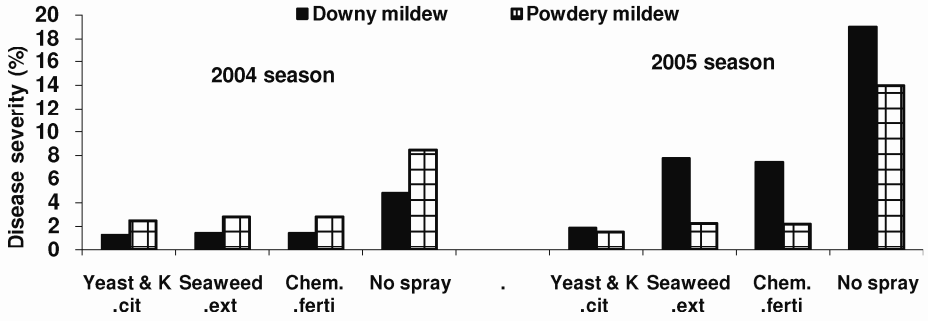

Fig. 1. Effect of foliar nutrition on disease severity (%) of downy and Powdery mildews.

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