



The influence of pesticide treatment on cucumber quality under productive cultivation

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ABSTRACT

The influence of each pesticide Mikal (fungicide) & Dimethoate (insecticide) on certain components of cucumber plants Beth Alpha group F1 hybrids were studied on chlorophyll and carotenoids content in leaves, also on ascorbic acid content in fruits. Experiments were carried out in greenhouse farm at Nubaria city during winter – spring and repeated for two seasons. Three cucumber *Cucumis stavius* (L) varieties F1 hybrids (Katia, Nile and Passandra) were supplied with three rates of irrigation and three fertilization levels in equal plots of 6 m² with three replicates of each treatment. The maximum and minimum temperature and relative humidity were recorded during the experimental time.

The data showed that Katia variety of cucumber gave the highest total product yield under greenhouse conditions, half rate of fertilizer and irrigation level, however there is no significant effect of different varieties on their susceptibility to pests and diseases. Increasing of fertilizer level increase chlorophyll content, and carotenoid, However, Mikal treatment decrease chlorophyll content and carotenoid. Ascorbic acid content does not affected by irrigation level but it decreased when increase fertilization level. The residue level of dimethoate on cucumber fruits after three days of spray application was below tolerant level. There was a metabolite for dimethoate pesticide after 3 days, finally the dimethoate and its metabolites concentration become undetectable after 7 days of treatment.

INTRODUCTION

Cucumber, *Cucumis stavius*, L is a popular vegetable crop in Egypt as well as in many other countries. Cucumber is used mainly as a fresh vegetable as well as for pickling. In Egypt, cucumber can be grown as a summer, fall and winter crop. In addition, the plastic greenhouses techniques has been widely used now for cucumber production in the winter season for local consumption and exportation purposes.

Present work deals with “pest management recommendations for greenhouse cucumber” for this aim, it has been found necessary to find out the optimum fertilization level, the suitable irrigation rate which might give the maximum yield for cucumber. Spray technique for using pesticides, instead of adding pesticide to fertilizing cup to alleviate environment pollution.

MATERIALS AND METHODS

Field experiment accomplished in greenhouse farm at Nubaria city during two successive winter- spring seasons of 1992-1993 and 1993-1994. The F₁ hybrids of three cucumber varieties predominantly female flowering of Beth Alpha group, Katia, Nile and Passandra were used during this study.

Greenhouse 6X62 meter with area of 372 m², was used for cucumber plantations. The greenhouse soil was previously fertilized with 3.6 cubic meters poultry manure, one month before planting, then pasteurized by fumigation with methyl bromide at 60 gm per m² to get rid of many weed seeds, nematodes and soil fungi. Moreover, the rodent were controlled using zinc phosphide baits. The greenhouse soil has a sand texture, its physical and chemical properties were determined before and after the initial application of organic fertilization, then at the end of the season (Table: 1). The greenhouse was divided into 60 plots, with one meter between each other, 1.25 meters at both sides. Each plot measured 0.5 x 2.0 meter (one meter



square) . Eight plants in 2 ridges, with 50 cm distance between each other, were maintained per plot. The greenhouse was divided vertically into three irrigation regimes; $\frac{1}{2}$, 1, and 1 $\frac{1}{2}$ irrigation rates using drip irrigation system.(irrigation rate is 1 liter per plant for first month after planting , then 2 liter per plant through the season. Moreover, the greenhouse was divided horizontally, into three fertilization level; $\frac{1}{2}$, 1 , and two fold fertilizer (fertilizer rate 0.3 gm per plant)

Pesticide treatments by spray technique against mite and aphid populations on the cucumber in the different treatments were held using dimethoate 40% EC (150 g/100 L).. Also the effect of Mikal fungicide(50% fostylal, 25% folpet,EC (150g/L100)on downy mildew disease. Two leaves were selected random on one plant from each plot, to count mean of infestation directly before and two days after fungicide application.

Fruits were harvested frequency every three or four days, when the fruits were at market maturity i.e. 12 – 15 days after blossoming. Weight of production of each plot of treatment was recorded. Statistical analysis was carried out for data collected.

During the course of study Chlorophyll and Carotenoid content were calculated in plant leaves according to methods of Grodzinsky and Grodzinsky (1973) , Canal Villanueva et al (1985), and Ganddillere (1974). Also ascorbic acid content in fruits have been calculated according to David Person,(1970).

Table (1): Physical and chemical properties of the experimental field soil in the two growing seasons of 1992-93, 1993-94.

Properties	Per-Fertilization 1992-93	Post-Fertilization 1992-93	Per-Fertilization 1993-94	Post-Fertilization 1993-94	End of Experiment 1994
Physical					
Sand %	92		92		92
Silt %	8		8		8
Clay %	--		--		--
Texture	Sandy	sandy	sandy	Sandy	Sandy
Chemical					
pH	7.75	7.90	8.04	7.90	8.10
ECmmhos/cm	0.40	0.65	1.30	1.45	1.2
S.Cations					
Na ⁺	1.65	3.85	6.50	5.40	5.00
K ⁺	0.50	0.50	0.90	1.20	0.40
Ca ⁺⁺	1.60	0.60	0.90	1.20	0.40
Mg ⁺⁺	0.60	2.40	3.80	5.20	6.20
S. Anions					
CO ₃	--	--	--	--	Traces
HCO ₃	3.00	3.00	5.00	5.00	4.50
Cl	1.00	2.00	5.00	7.55	5.00
SO ₄	1.00	2.00	6.00	5.00	5.20
Organic matter %	0.138	1.99	0.363	0.537	0.618

RESULTS AND DISCUSSION

Fertilizer supplement, obviously affect plant growth and its susceptibility to insects and pathogens especially in condensed plantation under greenhouse conditions. The data in Table (2) illustrate that half rate of fertilization was the most proper amount to different varieties of cucumber.

Table (2): Total yield of three varieties of cucumber as affected by irrigation rates and fertilizer levels and their interactions during the two seasons of cultivation.

Treatment	Total yield of varities fruits in kg					
	Katia 92/93	Katia 93/94	Nile 92/93	Nile 93/94	Pasandra 92/93	Pasandra 93/94
½ irrigation rate ½ fertilizer level	50.0	54.8	58.8	42.5	46.5	46.4
½ irrigation rate 1 fertilizer level	35.6	45.5	42.9	40.9	45.8	40.4
1 irrigation rate 2 fertilizer level	31.9	34.9	20.7	33.7	22.4	39.1
1 irrigation rate ½ fertilizer level	63.1	51.2	57.1	45.5	63.8	54.9
1 irrigation rate 1 fertilizer level	60.2	50.1	49.6	40.5	41.5	40.0
1 irrigation rate 2 fertilizer level	33.7	32.9	32.3	41.5	21.7	36.1
1½ irrigation rate ½ fertilizer level	66.3	56.8	67.7	50.4	69.7	56.2
1½ irrigation rate 1 fertilizer level	58.4	55.9	65.1	47.4	66.3	48.1
1½ irrigation rate 2 fertilizer level	42.9	45.6	42.2	43.6	28.5	32.3
Control Without Ferti+ irriga. Rate	20.2	28.8	21.0	25.3	24.8	28.6
Total Production per each variety	459.3	256.5	457.4	411.4	431.0	422.1

Also, the data showed the more increase the fertilizer level led to more decrease in cucumber yield, which due to increase the sensitivity of the plant to attack with pest and diseases especially at the rate of irrigation. More over, cucumber varieties differed in their susceptibility to pests and diseases, under greenhouse condition, which agreed with those found by El-Habbasha (1962), Janick *et al* (1974), Koleva and Vitanov (1988), Stan and Neamtu (1988), Kaniszewski and Elkner (1990), Kim *et al* (1991), Soliman & Doss (1992), and Van Lenteren (2000).

The comparison between treatments, showed that one and half irrigation rate with half fertilization level gave the highest yield in Passandra, Nile and Katia varieties respectively during the two studied seasons. While one and half irrigation rate with two fold fertilization level produced the lowest yield. Similar findings had been reported before by Abdurkarimov and Astanakulov (1992), Goyal and Allison (1983), Desai and Patil (1985), Judah and Rushdi (1985), Kundler and Smukaliski (1988), Srinivas *et al* (1989) and Wacquant (1989) using different irrigation rates. In addition, referring to El-Habasha (1962), Janick *et al* (1974), Kim *et al* (1991), Soliman and Doss (1992) and Schreinemachers, *et al.* (2004).

reported similar results in comparison with fertilization delay maturity and fruiting of some vegetables such as cucumber caused a reduction in yield.

Table (3), Control of downey mildew disease on different cucumber varieties under greenhouse condition by using Mikal fungicide for three rates of water irrigation or three fertilization levels.

Cucumber variety	Irrigation rate	% of control									
		Fertilizer dose									
		½ level			1 level			2 level			
Katia	Control treatment 50 - 60 - 50										
	½		71.5	63	83	75	60	100	80	66.7	100
	1		70	--	85.7	71	--	83	82	70	--
	1 1/2		73.4	70	75	83.3	63.3	66.7	70	66.7	66.7
Nile	Control treatment 63 -- 65 -- 63										
	½		77	60	80	71	70	75	75	100	--
	1		73	66.7	60	71	75	80	80	80	71
	1 1/2		75	75	70	82.9	72	87.5	78	70	70
Passandra	Control treatment 60 -- 63- 60										
	½		70	66.7	66.7	--	60	60	82	75	75
	1		76	70	--	80	66.7	60	70	100	60
	1 1/2		--	75	80	66.7	66.7	67.1	75	100	75

Control treatment (Table(3)) received no fertilization and whole irrigation rate demonstrated the effects of fertilization on the total yield, thus, it gave the less yield through the two seasons, approximately the same total yield of the treatment by two fold of fertilization level. In respect to pest and disease infectiousness of cucumbers in greenhouse, the results presented the percentage of pest management against the infestation with insects or pathogens by applying different fungicides or insecticides which gave suitable management ratio.

Effect of Pesticide treatment on chlorophyll content:

Statistical analysis for the effect of pesticide application to the three cucumber varieties, the results showed that katia cucumber was the most effective variety to pesticide application.

Table (4): Effect of Mikal on chlorophyll (a,b & total) on katia cucumber pre- and post application.

Irrigation	Fertili-zer	T- value, pre vs post application of pesticide					
		Chlorophyll -a		Chlorophyll -b		Chlorophyll - total	
½	½, 1, 2	1.7557	0.7741	1.432	0.3435	1.6626	0.6527
1		*				*	
		9.1032	0.7651	2.5516	0.6742	6.8171	0.7592
1 1/2		*				*	
		3.5162	1.6526	1.7408	1.6995	3.1108	1.6971

Irrigation	Fertili-zer	T- value, pre vs post application of pesticide					
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		Chlorophyll -a		Chlorophyll -b		Chlorophyll – total	
½, 1, 1 ½	½	*		*	*	*	*
		3.6283	2.4819	3.0085	4.1299	3.4887	2.8709
	1	*		*			
		4.3837	1.4692	3.5802	1.4542	4.1748	1.5327
	2	*					
		3.0083	1.7304	1.0025	0.7635	2.3479	1.3409

* significant effect of Mikal pesticide on chlorophyll content.

In addition, the data showed a significant interaction of pesticides application on chlorophyll content in cucumber leaves under any condition of cultivation, however, Nile or Passandra varieties were less effective to pesticides application to affect chlorophyll content and the results in Table (3)& Table(4), were in agreement with the investigators cited before by Davlin et al (1978), Hogland (1980), Patrick and Jerome(1983), Zwolinska et al (1990). On the other hand , irrigation rates had no significant effect on chlorophyll content of leaves, contrarily with fertilization levels, increasing fertilization level causing increasing on chlorophyll content of cucumber leaves , agrees with which found by El-Kassas(1985) ,Melton and Dufult(1991). and Bueno.,(1999).

Effect of Pesticide treatment on carotenoid content:

The three cucumber varieties Katia, Nile and Passandra, in most cases increasing fertilization increase significantly the carotenoid content in leaves (Table (5)). Moreover, the carotenoid content on cucumber leaves decreased after application with Mikal fungicide and highest decrease was produced after the first application.

Table (5): Effect of Mikal on carotinoid levels on different cucumber varieties for two applications.

Irrigation	Fertili-zer	T- value, pre vs post application of pesticide					
		Katia		Nile		Passandra	
½	½, 1, 2			*		*	
		1.3384	0.8021	9.0481	0.7562	1.2670	1.4159
1		2.2354	1.6067	1.4047	0.0341	4.7371	1.8970
1 1/2		1.6698	1.6286	1.0553	1.4219	1.4031	0.2215
½, 1, 1 1/2	½	*	*				
		3.0745	4.2938	2.0828	1.7880	2.2908	1.0752
	1	*		*	*		
		3.7770	1.8823	3.5286	3.6675	2.5807	1.9221
	2			*			
		1.0575	1.6848	9.0481	0.6327	1.3115	1.7064

* significant effect of Mikal pesticide on carotinoid content.

Effect of Pesticide treatment on Ascorbic acid content:

The results in Table (6), obtained for the three cucumber varieties indicated that applied pesticide decreased ascorbic acid content of cucumber fruits two days after pesticide application. The results showed that , in most cases, increasing fertilization level decreased significantly the ascorbic acid content in cucumber fruits. These observations were in accordance with findings of Asenov and Matakov(1985), Muller Haslach et al (1986), kaniszewski and Elkner (1990), Uddin and Begum (1990) and Voloshin (1991). van Lenteren (2000)



Table (6): Effect of Mikal on Ascorbic acid levels on different cucumber varieties for two applications.

Irrigation	Fertili-zer	T- value, pre vs post application of pesticide					
		Katia		Nile		Passandra	
½	½, 1, 2	2.1763	*	19.040	1.6148	20.860	*
1		3.1873	*	23.301	8.7636	7.0709	6.1468
1 ½		2.2215	*	16.071	1.0019	7.5444	5.5280
½, 1, 1 ½	½	5.9359	*	8.0484	1.3411	22.713	14.293
	1	3.0446	*	9.3509	2.0795	3.8412	11.585
	2	10.963*	11.278*	9.2367*	4.3467*	10.188*	6.3735*

* significant effect of Mikal pesticide on ascorbic acid content

Residues of dimethoate in cucumber

Residues of dimethoate in cucumber were determined by gas chromatograph equipped with flame photometric detector, Satisfactory standard curve was obtained in range of 0 – 10 ppm using glass column (3mX3mm) packed with 1.5 %OV-17 on shimalite AW of 80/100 mesh was used. Temperature conditions for dimethoate were 280°C for column, 250°C for detector and 280°C for injection point. The flow rate of nitrogen gas was 40ml/min and chart speed was 5 mm/min. Calculations were carried out by comparing the peak heights of samples with that of the standard.

Table (7): Determination of dimethoate residues (ug/kg) by GC under greenhouse condition

Fertilizer	Pesticide application			
	0 time	3 days	5 days	7 days
½ irrigation				
½	160	870	480	350
1	150	140	0	0
2	220	860	860	100
1 irrigation level				
½	190	170	0	0
1	120	30	0	0
2	140	860	170	0
1 ½ irrigation level				
½	510	860	0	0
1	220	850	280	220
2	180	860	720	260
Control	860	60	0	0

Residues of dimethoate on cucumber fruits determined by GLC apparatus under greenhouse condition with time intervals 0, 3, 5 and 7 days after spraying. The residue level of dimethoate on cucumber fruits after three days was below tolerant level. There was a metabolite for dimethoate pesticide after 3 days but below tolerance level. It could be concluded that in each sample examined, insecticide residues decreased more rapidly after 3 days, then start to convert to its metabolites and finally the concentration become undetectable after 7 days of



treatment. Similar findings have been reported by Khan et al (1985) , and Jessup et al (1994).It should mention that the number of pesticide applications should be limited to control accumulation level of pesticide inside the greenhouse.

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الملخص العربى

اثر المعاملة بالمبيدات على الخيار المنزرع تحت الصوب

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تم دراسة اثر المعاملة بكل من مبيد الميكال (مبيد فطرى) و مبيد الدايمثويت (مبيد حشرى) على محتوى الكلورفيل و الكاروتين فى الاوراق و محتوى حمض الاسكوربيك فى ثمار محصول الخيار المنزرع من بذور الجيل الاول مهجنة نقية . تمت الدراسة تحت ظروف الزراعة تحت الصوب فى العروة الشتوى الربيع فى مدينة النوبارية و تم تكرار التجربة للعام التالى مرة اخرى . تم استخدام ثلاثة اصناف من الخيار الهجن النقى للجيل الاول وهم الصنف كاتيا و الصنف نيل و الصنف باسندرا . تم استخدام 3 معدلات للرى و كذلك 3 معدلات للتسميد و الزراعه فى مكررات كل مكررة 6متر مربع وثلاث مكررات لكل معاملة . تم تسجيل درجة الحرارة والرطوبة النسبية طوال فترة وجود التجربة .

اوضحت النتائج ان الخيار صنف كاتيا اعطى اعلى انتاج تحت ظروف الزراعة تحت الصوب باستخدام نصف معدل التسميد مع معدل الرى الطبيعى ، بينما لا يوجد تأثيرات معنوية توضح شدة حساسية اى من الاصناف تحت الدراسة للأصابة بالافات المختلفة . و اوضحت الدراسة ان معدل الرى لا يؤثر فى مكونات الاوراق او الثمار بينما زيادة درجة التسميد يزيد من محتوى الكلورفيل فى الاوراق ، و يخفض من محتوى حمض الاسكوربيك فى ثمار الخيار . المعاملة بمبيد ميكال الفطرى ينقص من محتوى كل من الكلورفيل و الكاروتين فى اوراق نبات الخيار . و بدراسة اثر المعاملة بالرش بمبيد الدايمثويت تحت الصوبة وجد انه اقل من المعدل المسموح به بعد ثلاثة ايام من المعاملة ثم يبدأ ظهور متبقياتة ويصبح تحت حد الممكن تقديره بعد 7 ايام من المعاملة .