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INFLUENCE OF ADDING MINERAL OIL AND FERTILIZER ON ABAMECTIN USED IN CONTROL SPIDER MITE, *Tetranychus urticae* KOCH INFESTING CUCUMBER

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ABSTRACT: The aim of the present study was to investigate the following aspects; efficiency of abamectin alone or in binary mixtures with mineral oil and fertilizer against spider mite, *Tetranychus urticae* individuals, effect of adding mineral oil and fertilizer on physico-chemical properties of abamectin, residues determination of abamectin in cucumber fruits and effect of abamectin on yield of cucumber. The results show there were significant differences between treatments during two successive seasons, also, the results clear that adding fertilizer to mineral oil increasing efficiency. Regarding the results in case of 2017 summer season, the results with initial effect cleared that, mineral oil mixed with fertilizer recorded 62.0% reduction in individuals of *Tetranychus urticae* followed by abamectin alone, abamectin with mineral oil, mineral oil, abamectin with fertilizer and fertilizer. The same trend occurs in state of residual effect. The initial effect after 2nd spray during 2017, summer season, outcomes clear that adding mineral oil to abamectin cause increasing efficiency to (67.5%) compared with abamectin alone (63%), while, the other treatments ranged between 25 to 52%. The same trend occur in state of residual effect. Also, the results illustrated that abamectin has high effective recorded (95.5%) in 2018 summer season after first spray. while, in case of the residual effect, it was found that adding fertilizer to abamectin reduce abamectin degradation, whereas recorded (96.3%) reduction. In case of yield, the treatments cause increasing in yield ranged between 5.1 to 61.9%. In case of physico-chemical properties, the results indicated that PH values ranged between 3.0 to 6.4, from high acidic to slightly acidic. Addition of fertilizer or mineral oil to abamectin cause increasing surface tension compared with abamectin alone (33.7, 40.6 compared with 31.06 dyn/cm). Also, the results showed that abamectin as acaricide completely disappeared in each treatment in the 12th day of application. The fruits of cucumber are edible in the 6th day after spray where the residues of abamectin were less than MRL (0.5)mg/kg⁻¹. The half life periods (T 1/2) were increased when addition mineral oil and fertilizer to abamectin.

Key words: Spider mite, abamectin, mineral oil, fertilizer, cucumber.

INTRODUCTION

The two spotted spider mite, *Tetranychus* sp. Acari: (Tetranychidae) attack cucumber; Red spider mites can complete their life cycle from egg to larva, nymph, and adult in one to two weeks under favorable conditions (Bolland and Valla, 2000; Biswas *et al.*, 2004). This

drastically occur the crop yield owing infestation with *T. urticae* (Hill, 1983; Visser, 2005; Bok *et al.*, 2006). The two-spotted spider mite, *Tetranychus urticae* Koch, is one of the most important pests in agriculture. Due to its short life cycle and high reproductive rate, this led to the widespread, intensive and repeated use of acaricides, which led to become resistant to most acaricides. It is developed to 6 generations

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a year. *T. urticae* infestations decreased leaf productivity per plant. Approximately 14% reductions of total leaf areas could result in significant yield loss. The decreased leaf productivity by *T. urticae* feeding caused biomass reproductions and altered the pattern of dry matter portioning in the plant; damaged plants accumulated more dry matter in the leaf, and portioning of dry matter to fruits was hindered. The economic yield of cucumber began to significantly decrease as early as 4 weeks after heavy mite infestations (**Park and Lee, 2005**).

Commercially available synthetic acaricides are usually expensive, and may be needed to be imported for use by farmers. They also tend to have detrimental effects on the environment and can be hazardous to humans by acaricide residues in cucumber fruits. These negative effects have resulted in an increasing interest for natural based pesticides which are assumed to be safer than the synthetic pesticides (**Yanar *et al.*, 2011**).

This pest cause high losses in yield so the chemical control is usually applied at their recommended rates alone and in binary mixtures with adjuvants in order to know the proper pesticide mixtures to reduce population of two spotted spider mite, the environmental pollution and reduce the effect on wild life and high efficiency against the target pest. Also, the reduction of application rates is one of the dominant trends in agronomical industry. The undesirable side effects of acaricides can minimize by monitoring the presence of the residues and determining pre-harvest safety intervals.

MATERIAL AND METHODS

Materials

1. Abamectin (Vertimec), Syngenta Company, 1.8%EC, at 18 gm. a.i/liter at a rate of 50 cm/100 Liter water).
2. KZ oil (Mineral oil), Kafr El-Zayat Company, 95%E.C, at 950 ml a.i /liter, at a rate of 1Liter oil/100 Liter water).

3. Foliar Fertilizer, King Life (NPK, 20/20/ 20 + Micro, Powder, GREEN HAS ITALIA, 250 gm/100 Liter water).

Experimental Design

The present work was conducted at El-Gamalia village, El-Husinia District, Sharkia Governorate, Egypt, at a private farm; The field experiment was conducted during 2017 and 2018 summer seasons to determine the changes of properties and residues in cucumber fruits of abamectin, mineral oil and fertilizer alone and in binary mixtures. Seeds of cucumber, *Cucumis sativus* (variety, Hail) were sown in March 15, 2017 and 2018.

Experimental area (882 m²) was divided into 21 plots, each plot area represents 1/100 from feddan (42m²), the treatment distributed on three replicates. The treatments were distributed in complete randomized block design; Seven treatments include control were used; Control was sprayed with water. Experimental area was sprayed twice when infestation beginning and the nodes and formation.

Efficiency of abamectin alone or in binary mixtures with mineral oil and fertilizer against spider mite, *Tetranychus urticae* individuals

Firstly, seedlings of cucumber were prepared as follow: the seeds were soaking in wet clothes with water for 36 hours period, thenceforth the normal seedling practices were carried out in the field. Experimental area 882 m² was divided into 21 plots, each plot area 42 m². The experimental divided into rows, the distance between two rows was 1.00 m and plant distance 40 cm. The treatments were distributed in complete randomized block design, seven treatments include control were used; Control was sprayed with water. Each treatment repeated three times on experimental area. Taken randomized leaf sample from experimental area to make sure that red spider mites are present; When red spider mite number arrived to economic threshold, the application was started calibration was executed to determine quantity of necessary spray solution to each treatments, application beginning after planting about 30th day, the leaf samples included 10th leaves randomized selective from 10 plants per plot, before spraying and after 1, 3, 5, 7 days from spraying, during two spray per season. Leaf

samples were put in paper bags and transferred to examination. The leaf samples were examined under a stereo-microscope; spider mite individuals of all moving stages were count and recorded. The results were expressed as mean populations/10 leaves/plot. All agriculture practices were carried out according to recommendation of Ministry of agriculture in Egypt. The data from the field experiments were statistically analyzed for comparing treatments following analysis of variance technique (ANOVA) and the results were interpreted at 5% level of significance. To compare the efficacy of different chemicals, reduction percentage in mite populations (active stages) was calculated according to the equation of **Henderson and Tilton (1955)** as follow:

Reduction (%) =

$$\frac{\text{No in check plot before spraying} \times \text{No in treatment plot after spraying}}{\text{No in check plot after spraying} \times \text{No in treatment plot before spraying}} \times 100$$

No in check plot after spraying × No in treatment plot before spraying

Effect of adding mineral oil and fertilizer on physico-chemical properties of vertimec

Emulsification stability and foaming were evaluated; surface tension (dyne/cm) and PH value was measured using Tensiometer and PH meter Orion model 410 A, these experimental was carried out at Qaha, plant protection research station, Qaliobia Governorate, according to **WHO (1973)**.

Residues determination of abamectin alone and in binary mixtures with mineral oil and fertilizer in cucumber fruits

Sampling

After the second spray using knapsack sprayer in case abamectin alone and in binary mixtures during 2018 summer season, random samples of about 3 kg cucumber fruits were collected from three plots of each treatment after one hour, 1, 3, 6, 9 and 12 days of spraying and well mixed. Fruit samples were divided into three sub samples (1 kg/sample), the first was left unwashed, the second was washed using running tap water and left for air till dryness and the third sample soaked in acetic acid 5% concentrate for 10 minutes and change in every treatment. Each sub sample was cut into small pieces using food chopper, then subjected to extraction and clean- up procedures.

Extraction procedures

Residues of abamectin were extracted from fruit samples according to the method of **Macneel**

et al. (1975), with simple modification in sample weight and solvent. A quantity of 20 gm of chopped fruit samples plus 10 gm. of anhydrous sodium sulphate were blended for 5 minutes with 80 ml of acetonitrile which was a suitable solvent for extracting the parent compounds and gave the highest rate of recovery. Then, the mixture was filtered through filter paper whatman No. 1 containing anhydrous sodium sulphate (5 gm). Each sample was reextracted twice with another suitable portion of the same solvent (80 and 80 ml). The solvent was collected and evaporated to near dryness on room temperature. The residues were then transferred quantitatively into a small glass vial by 10 ml of acetone. The solvent was evaporated to dryness on water bath at 35- 40°C and the residues were dissolved in two ml acetone and subjected to the clean- up step.

Clean- up procedures

Glass plates (20 x 20 cm) were coated with silica gel GF 254. After the silica gel was dispersed in distilled water at 1:2 W/V fribos applicator was used for coating the glass plates with a thin layer (0.25 mm thickness), glass plate coated with silica gel was activated inter oven at 110°C for 1 hour . An aliquot of the concentration extract was spotted on the plate at a distance of 3 cm from the lower edge. The standard active ingredient from each miticide sample was also spotted on the same plate in order to define the RF values. The plates were developed in hexane: acetone (7:3 V/V) then exposed to UV light in order to detect the spots of the authentic sample to calculate the RF values of the tested acaricide alone and in its binary mixtures. RF values of abamectin were 0.4 and the spots were scared from the plate. The acaricide residue was extracted by acetone using a centrifuge. The solvent was then decanted and evaporated to dryness. The residue was determined using HPLC at laboratory of chemical analysis in 10th of Ramadan city.

The high performance liquid chromatography technique (HPLC) Beckman was used for the quantitative analysis of abamectin (Vertimec).

HPLC Conditions

Column

5 μ Equisil BDS C18 (4.6-mm x 150-mm)

Detector : UV at λ max= 230-nm

Injection volume : 5 μ l

Flow rate : 1 ml/min

Mobile phase

Filtered and degassed mixture of 0.1% ortho-phosphoric acid in water (PH 3.5 by TEA and acetonitrile with ratio of (30:70% v/v)

Recoveries of abamectin from different samples through the extraction and clean-up procedures

The recoveries of abamectin from different plant samples through the extraction and clean-up procedures were estimated. Untreated plant materials were fortified with the tested acaricide. The fortified samples were subjected to the extraction and clean-up steps and recoveries of acaricide were determined chemically. In the standard addition method known quantities of abamectin at three different concentration levels (1 ppm, 2 ppm and 4 ppm) were supplemented to the standard solution previously analyzed. The solutions were once again analyzed by proposed method. Results of abamectin residues were corrected using its respective recovery in cucumber fruits which 88%. Recovery studies showed the proposed method to be adequately accurate and suitable for the determination of the abamectin.

Effect of abamectin applied either alone or in binary mixture with mineral oil and fertilizer on yield of cucumber

For determination the cucumber yield, fruits were collected every 3 days from each plot and weighted immediately in the field. This procedure was used during the two tested seasons. The yield of each treatment expressed as Kg of fruits per plot. Data obtained were statistically analyzed according to the method of **Steal and Torrie (1960)**.

Statistical Analysis

All data were expressed as mean \pm standard deviation. All the grouped data were statistically evaluated with **Co Stat 6.303 software (2004)**. Hypothesis testing methods included Randomized Complete Block Design (RCBD) variance technique (ANOVA). P values of less than 0.05 were considered to indicate statistical significance.

RESULTS AND DISCUSSIONS

Efficiency of Abamectin Alone or in Binary Mixtures with Mineral Oil and Fertilizer Against Spider Mite, *Tetranychus urticae* Individuals and Reduction Percentage

The results tabulated in Table 1, show efficiency of abamectin spray alone or in binary mixtures with mineral oil and fertilizer on reduction percentages to spider mite infesting cucumber plants during two successive summer seasons 2017 and 2018. From statistical analysis the results illustrated that there were significant differences between treatments during two successive seasons (Table 1).

Regarding the results in Table 1, in case of initial effect, mineral oil mixed with fertilizer recorded 62.0% reduction in individuals of *Tetranychus urticae* followed by abamectin alone, abamectin with mineral oil, mineral oil, abamectin with fertilizer and fertilizer cause 30, 22, 20, 9 and 8% reduction, respectively. These results clear that adding fertilizer to mineral oil

Table 1. Mean No. and reduction percentages of *Tetranychus urticae* individuals infesting cucumber during 2017 and 2018 summer season

Treatment	No. and Reduction %	Average No. and reduction percentage of individuals after days from application during 2017 and 2018 summer seasons							
		First spray 2017		Second spray 2017		First spray 2018		Second spray 2018	
		Initial effect	Residual effect	Initial effect	Residual effect	Initial effect	Residual effect	Initial effect	Residual effect
Abamectin	No.	2.0 BC	4.26B	2.3 AB	3.26 C	7.6 G	71.0 A	9.0 A	30.1 B
	Red%	30.0 B	72.0 A	63.0 B	75.8 B	95.5 A	89.0 E	82.0 E	80.7 B
Oil	No.	3.0 A	3.33 D	2.0 BC	3.83 C	75.0 D	57.3B	6.7 C	26.9 D
	Red%	20.0 C	49.0 B	30.0 E	45.0 E	58.0 C	92.5 C	83.0 D	82.0 A
Fertilizer	No.	1.7 C	3.23E	1.5 BC	5.0 B	79.7 B	55.9 C	7.7B	32.23 A
	Red%	8.0 D	58.5 B	25.0 F	41.0 F	51.0 D	91.4 D	84.0 C	80.5 BC
Abamectin + oil	No.	2.0 BC	3.57C	3.0 A	4.53 B	78 C	64.8 B	5.0 D	28.9 C
	Red%	22.0 BC	18.3 C	67.5 A	88.3 A	49.0 E	89.5 E	85.0 B	79.3 C
Abamectin+ Frt.	No.	2.3 ABC	4.2B	1.7 BC	2.53 D	83.3 A	50.6 C	4.3 D	26.9 D
	Red%	9.0 D	24.3 C	52.0 C	70.0 C	74.0 B	96.3 A	87.0 A	75.3 D
Oil + Fertilizer	No.	2.7 AB	3.26E	1.3 C	6.2 A	63.7 E	35.8 D	2.7 E	21.9 E
	Red%	62.0 A	84.0 A	47.0 D	55.0 D	44.0 F	93.5 B	58.0 F	76.0 D
Control	No.	1.6 C	4.63A	2.0 BC	6.4 A	13.0 F	50.6 C	6.3 C	21.9 E
LSD05	NO.	0.855	0.605	0.855	0.649	0.855	6.163	0.781	0.0605
LSD05	Red%	8.5	20.2	0.668	0.845	0.668	0.696	0.939	1.182

LSD 0.05 Means in column followed by the same letter are not significantly different at 0.05% level according to **Co Stat 6.303 software (2004)**.

increasing efficiency. The same trend occur in state of residual effect, mineral oil with fertilizer come in the first order (84%), thenceforth followed it abamectin alone (72%), fertilizer (58.5%), mineral oil (49%), abamectin with fertilizer (24.3%) and abamectin with mineral oil (18.3%), respectively.

In the same Table 1, regarding by initial effect after 2nd spray during 2017 summer season, outcomes clear that adding mineral oil to abamectin cause increasing efficiency to (67.5%) compared with abamectin alone cause reduction percentage (63%), while, the other treatments were ensure as follows: abamectin mixed with fertilizer (52%), mineral oil with fertilizer (47%), mineral oil (30%), but fertilizer recorded fewer reduction percentage (25%).

The same trend occur in state of residual effect whereas, adding mineral oil to abamectin recorded reduce in individuals of *T. urticae* (88.3%), abamectin alone (75.8%), also, adding fertilizer to abamectin cause reduction percentage (60%), mineral oil with fertilizer (55.0%), mineral oil (45%) and (41%) in case of fertilizer spray alone.

In 2018 summer season after first spray, in case of initial effect, the results in Table 1 show that abamectin has high effective recorded (95.5%), thenceforth abamectin with fertilizer (74%) come to the second group but fertilizer with mineral oil recorded fewer efficiency (44%), other treatments showed less effect. But, in case of the residual effect, founded that adding fertilizer to abamectin reduce abamectin degradation, whereas recorded (96.3%) reduction, also, adding fertilizer to mineral oil cause (93.5%) reduction to spider mite individuals, other treatments were in descending order as follows: mineral oil (92.5%), fertilizer (91.4%), abamectin with mineral oil (89.5%) and abamectin alone cause (89%) reduction percent.

Regarding the second spray cleared in Table 1 it was found that there were significant differences on the basis of initial effect between treatments. The tested compounds alone and their binary mixtures could be divided into six groups. The first group includes abamectin with fertilizer (87.0%), abamectin with mineral oil (85%), abamectin (82.0%) and mineral oil with

fertilizer (58%). These results may be due to climatic change during two successive seasons.

Concerning the residual effect after the second spray in the same table, it is obvious that mineral oil cause the highest residual effect against spider mite, *T. urticae* population (82%), while abamectin with fertilizer treatment gave the lowest residual effect (75.3%), and the other treatments occupied an intermediate position.

The present results concerning the relative potency of the tested compounds alone or in binary mixtures with certain materials (mineral oil and fertilizer) against spider mite, *T. urticae* on cucumber plants are in agreement with those recorded by **Ruiter et al. (2016)** who found that addition of an emulsifiable and esterified canola oil (Hasten NNP) to abamectin resulted in 90% control of mites at 14 days after the third treatment. Without the adjuvant, control was 8% on average. Analysis of the foliar absorbed abamectin demonstrated that the oil adjuvant increased the foliar uptake of abamectin 10-fold on average. Analysis of the abamectin present on and in the cucumber fruits demonstrated that the maximum residue limit (MRL) was not exceeded by the addition of the oil adjuvant. Addition of the adjuvant did not result in any phytotoxicity symptoms or in visible spray residues on the leaves. We believe that the oil adjuvant (Hasten NNP) substantially improves the robustness of abamectin performance against spider mites in cucumbers. **Barbara (2015)** showed that active ingredient applied in combination with the adjuvant did not display any better level of control than when applied alone (efficacy 77–95%). The results obtained with the reference product (pyridaben) were similar or slightly lower (average > 80%) than those obtained with the test products. Greenhouse experiment results also indicated highest mortality of the mite on spraying agricultural spray oil + azadirachtin (0.5%) throughout the period, however, agricultural spray oil (0.5%) resulted in highest mortality only a day after spraying during the first season (**Deka et al., 2010**). **Mahgoub et al. (2002)** showed that the highest effect was recorded by imidacloprid insecticide and the vegetable oil, while the lowest effect was showed by vegetable oil and neem oil mixture then detergent. **Gusefa (1991)** found that foliar spray with urea

markedly decreased the incidence of aphids and also reduced the seed damage caused by pea moth.

Effect of Adding Mineral Oil and Fertilizer on Physico-Chemical Properties of Acaricide

Table 2 show Physico-chemical properties of abamectin, mineral oil, fertilizer alone and in binary mixtures under laboratory conditions according **WHO (1973)**. In case of PH, the results in Table 2 indicated that PH values ranged between 3.0 to 6.4, from high acidic to slightly acidic. The mineral oil recorded highly acidic followed by abamectin with mineral oil, abamectin, fertilizer, mineral oil with fertilizer and abamectin with fertilizer, where the values were 3.0, 3.4, 3.5, 5.1, 5.5 and 6.4, respectively. On the other hand, addition of fertilizer or mineral oil to abamectin cause increasing surface tension compared with abamectin alone (33.7, 40.6 compared with 31.06 dyn/cm), increasing surface tension reduce the wetting to plant leaves then efficiency of acaricide are drop, mineral oil recorded least of surface tension 27.31 dyn/cm followed by mineral oil with fertilizer 30.46 dyn/cm and 36.84 dyn/cm in case of fertilizer. In the same table, the results indicated that addition mineral oil to abamectin prevent foaming formation but fertilizer with abamectin cause increased foam 6.0, the other treatments recorded foaming ranged between 0.0 to 4.0 cm. The emulsion stability test was accomplished according to **WHO specification (1973)** mentioned that any separation, including creaming the top and sedimentation at the bottom of 100 ml of emulsion prepared with 5 ml of emulsifiable concentrate shall not exceed 2 ml. The results showed that addition of fertilizer to abamectin cause sedimentation 3.0 ml and 2 ml when addition fertilizer to mineral oil, the other treatments test passing. **Soliman (2004)** found that admixing adjuvants with tested insecticides decreased surface tension in case of Selecron complete rate with Emulgator and Selecron 1/2 R with Emulgator in Soft and Nile water . Also, the author indicated that values of PH to Selecron alone and in mixtures with adjuvants lie inter high acidic in Hard and Soft water and low acidic in Nile water while PH values to Marshal with adjuvants were slightly acidic. The results agreement with **Soliman (1998)** who found that the pH values lay between very slightly basic and very slightly

acidic media (Actellic, Malathion, and Lannate) and the foliar fertilizer solution have a very slightly basic medium. Also, the results illustrated that surface tension, conductivity and salinity values were increased in case of insecticides in binary mixture with Greenzite than that alone. **Soliman (2004)** showed that the addition adjuvants caused decreased of surface tension in case of profenofos complete rate with Emulgator in soft water and profenofos 1/2 rate. with Emulgator according to field dilution rate. Also, the addition to carbosulfan reduced surface tension in standard hard water while surface tension increased with soft water but surface tension reduced in Nile water.

Residues Determination of Abamectin Alone and in Binary Mixtures with Mineral Oil and Fertilizer in Cucumber Fruits

The results in Table 3 show that abamectin as acaricide completely disappearance in each treatments in 12th day. The fruits of cucumber are edible in 6th days after spray where the residues of abamectin were less than MRL (0.5)mg·kg⁻¹. The residues of abamectin in cucumber fruits were determined after different intervals of application. Data presented in Table 3 shows the residues dissipation of abamectin alone in unwashed and washed cucumber fruits. In case of unwashed cucumber fruits, summarized results show that initial amounts of abamectin as determined after two hours of the second spray was 7.96 ppm. Such amount decreased to be 3.6, 0.88, 0.12 and 0.012 ppm after 1, 3, 6, and 9 days from spraying, respectively recording 54.77, 88.94, 98.49 and 99.85% loss.

The effect of washing with tap water on the amounts of abamectin alone residues detected in cucumber fruits was estimated in Table 3. It is obvious that the initial amount decreased to be 7.92 ppm indicating 0.50 losses by washing. The values for total residues of abamectin in washed cucumber fruits were 3.45, 0.64 and 0.05 ppm after 1.3 and 6 days of spraying, respectively. The loss percentages of abamectin alone residues in cucumber fruits washed with tap water ranged from 56.66 to 100%. Especially, cucumber fruits polluted with abamectin alone and washed with acetic acid recorded residue amounts of 7.45 after 2 h from spray; this amount decreased to

Table 2. Physico-chemical properties of abamectin, mineral oil and fertilizer alone and in binary mixtures under laboratory conditions

Physico-chemical	Abamectin	Oil	Fertilizer	Abamectin + oil	Abamectin+ Fertilizer	Oil + Fertilizer
PH values	3.5	3.0	5.1	3.4	6.4	5.5
surface tension (dyn/cm)	31.06	27.31	36.84	40.61	33.7	30.46
Foam (cm3)	1.0	0.0	4.0	0.0	6.0	0.0
Emulsion stability (ml.)	✓	✓	✓	✓	3.0 cm. sed.	2.0 cm. sed.

Table 3. Addition effect of mineral oil and fertilizer on residues of abamectin in unwashed and washed cucumber fruits during 2018 summer season

Treatment	Abamectin residues after days from application											
	Initial		1 st Day		3 rd day		6 th Day		9 th Day		12 th Day	
	ppm	% loss	ppm	% loss	ppm	% loss	ppm	% loss	ppm	% loss	ppm	% loss
Abamectin unwashed	7.96	0.0	3.6	54.77	0.88	88.94	0.12	98.49	0.012	99.85	und	100
Abamectin washed by water	7.92	0.50	3.45	56.66	0.64	91.96	0.05	99.37	und	100	und	100
Abamectin washed by acetic acid	7.45	7.35	3.5	56.03	1.00	87.43	0.11	98.62	0.015	99.81	und	100
Abamectin with oil unwashed	7.76	0.0	2.6	67.33	1.05	86.81	und	100	und	100	und	100
Abamectin with oil washed by water	7.03	11.69	3.8	52.26	0.69	91.33	0.069	99.13	und	100	und	100
Abamectin with oil washed by acetic acid	7.0	12.06	3.00	62.31	0.33	95.85	0.018	99.77	und	100	und	100
Abamectin with fertilizer unwashed	7.07	0.0	3.07	61.43	0.68	91.45	0.08	98.99	und	100	und	100
Abamectin with fertilizer washed by water	7.46	6.28	3.37	57.66	0.81	89.82	0.082	98.97	und	100	und	100
Abamectin with fertilizer washed by acetic acid	7.32	8.00	2.89	63.69	0.34	95.73	0.015	99.81	und	100	und	100

ppm = Part per million, UND = undetectable

3.5, 1.0, 0.11 and 0.015 ppm after 1, 3, 6 and 9 days from spray, acetic acid cause missing 7.35% after 2h, the missing in residues increasing by time recording 56.03, 87.43, 98.62 and 99.81% at 1, 3, 6 and 9 days after application.

Data tabulated in Table 3 show the residue degradation of abamectin with mineral oil in cucumber fruits unwashed. Summarized results indicate that the initial deposits of abamectin mixed with mineral oil in unwashed cucumber after two hours were 7.76 ppm. Such amount decreased to be as follows: 2.6, 1.05 and undetectable amounts after 1, 3, 6, 9 and 12 days of application, whereas the respective values of dissipation percentages were 2.51, 67.33, 86.81, 100, 100 and 100%. Also in the same Table results show that the initial deposits of abamectin

mixed with mineral oil in washed cucumber with water was 7.03 ppm. After two hours of application which showed 3.8 fold lower than the amounts in case of abamectin alone. Such amount decreased by time as follow, 3.8, 0.69, 0.069 ppm after 1,3 and 6 days while residues of abamectin mixed with mineral oil completely disappearance in 9th and 12th days, contaminated cucumber fruits with abamectin mixed with mineral oil which washed with water cause loss in abamectin thus 11.69, 52.26, 91.33, 99.13, 100 and 100% disappearance after 2 h, 1, 3, 6, 9 and 12 day comparable abamectin alone. In case of, cucumber fruits contaminated with abamectin with mineral oil washed with acetic acid, the results recorded 7.0, 3.0, 0.33 and 0.018 ppm after 2 h, 1, 3 and 6 days from application but abamectin with mineral oil

undetectable in 9th and 12th days from spray. Disappearance% recorded 12.06 losses after two hours from application, disappearance increasing gradually by time as follow 62.31, 95.85, 99.77, 100 and 100% after 1, 3, 6, 9 and 12 day from spray. Adding mineral oil to abamectin cause depreciate residue amount of abamectin, may be due to high polarity to mineral oil which cause abamectin in binary mixture with mineral oil losses comparison with abamectin alone. Also, data in the same Table 3 show impact of adding fertilizer on residue amount of abamectin in washed and unwashed cucumber fruits. The results indicate that residues of abamectin mixed with fertilizer in unwashed cucumber fruits record 7.07, 3.07, 0.68, 0.08 after 2 h, 1,3 and 6 day, respectively from spray but the residues undetectable at 9 and 12 day, whereas dissipation percentage ranged between 11.18 to 100%. Data tabulated in Table 3 impact of washing with water and acetic acid to abamectin residues in cucumber fruits, whereas residue amounts were 7.46 and 7.32 ppm after 2 h from spray in treatments abamectin with fertilizer washed with water and abamectin with fertilizer washed with acetic acid, these residue amounts decreased to 0.082 and 0.015 ppm during 6 day but these amount dissipation at 9 and 12 days, respectively. The results summarized as follow washing process with water and acetic acid cause losses abamectin in cucumber fruits at 9th day from spray without abamectin alone polluted unwashed cucumber fruits and abamectin alone washed with acetic acid. Washing process fewer residue amounts from abamectin in cucumber fruits.

Rate of Degradation and Half-Life Period to Abamectin Alone and in Binary Mixture with Mineral Oil and Fertilizer

The calculated values of the rate of decomposition and the half-life periods of the abamectin alone and in binary mixture with mineral oil and fertilizer in cucumber fruits are presented in Table 4. Data show that disappearance of abamectin due to degradation in all treatments, however, abamectin is degradation faster in each treatment compared with abamectin alone in unwashed cucumber fruits, without abamectin with mineral oil unwashed and abamectin with fertilizer in cucumber fruits washed with water.

From the data tabulated in Table 4 it is obvious that rate of degradation to abamectin washed with water was faster (0.50) followed by abamectin with fertilizer washed by acetic acid (0.47), abamectin with mineral oil washed by acetic acid (0.45), abamectin alone washed with acetic acid 0.38, abamectin alone in case of unwashed cucumber (0.35), abamectin with fertilizer in unwashed cucumber (0.35), abamectin with fertilizer in washed cucumber with water (0.15) and abamectin with mineral oil in unwashed cucumber (0.0996).

As shown in the same table, the half-life periods ($T_{1/2}$) were increased when addition mineral oil and fertilizer to abamectin as follow, in case of unwashed cucumber fruits sprayed with abamectin in binary mixture with mineral oil and fertilizer on unwashed cucumber fruits (6.95 and 4.62 days), This increase in ($T_{1/2}$) cause increasing penetration of abamectin inter plant tissues, these properties cause abamectin protective from temperature and ultra violet rays. While in other treatment, the results show that 1.98, 1.38, 1.82, 1.69, 1.54, 1.98 and 1.47 day, respectively, in case of abamectin alone in unwashed cucumber fruit, abamectin alone on washed cucumber fruits with water, abamectin alone on washed cucumber fruits with acetic acid, abamectin mixed with mineral oil on washed cucumber fruits with water, abamectin mixed with mineral oil on washed cucumber fruits with acetic acid, abamectin mixed with fertilizer on washed cucumber fruits with water and abamectin mixed with fertilizer on washed cucumber fruits with acetic acid. These results were agreement with **Bozena *et al.* (2015)**, who indicated that more than half of samples (59%) contained 29 pesticides. **Jodeh *et al.* (2016)** showed that both imidacloprid and abamectin were higher in quantity than those of residues determined by previous researchers. Also, results obtained from this study showed that the quantities of residues were higher than the maximum residue levels (MRLs) in the samples that were collected on the first, the fifth and the tenth days of spraying.

Soliman (1998) found that the initial deposits to insecticides in cucumber and squash leaves in case of spraying with pirimiphos- methyl alone were 66.20 and 80.00 ppm respectively, while in case of spraying with pirimiphos- methyl plus

Table 4. Slope, rate of degradation and half-life pesticide

Treatment	Slope	Rate of degradation (K)	T 1/2 (Days)
Abamectin alone unwashed	0.15	0.35	1.98
Abamectin washed by water	0.22	0.50	1.38
Abamectin washed by Acetic acid	0.17	0.38	1.82
Abamectin with oil unwashed	0.43	0.0996	6.95
Abamectin with oil washed by water	0.18	0.41	1.69
Abamectin with oil Washed by acetic Acid	0.19	0.45	1.54
Abamectin with fertilizer unwashed	0.15	0.35	4.62
Abamectin with fertilizer washed by water	0.067	0.15	1.98
Abamectin with fertilizer washed by acetic acid	0.20	0.47	1.47

Greenzite were 75.76 and 83.80 ppm respectively. **Soliman (2004)** found that rinsing treated fruits with tap water removed considerable amounts of Profenofos and carbosulfan residues. The loss of the pesticide residues by washing was decreased with the decrease of the residues on the fruits before washing. On contrary, vice versa results occurred when glue mixed with the two tested insecticides. **Wen et al. (2006)** found that the residual levels of avermectins (AVMs) in paprika in a field experiment from one day to seven days after the last application decreased from 18.40 to 7.59 µg/kg. The half-life (T1/2) of AVMs in paprika was 1.47 days.

Effect of Abamectin Applied Either Alone or in Binary Mixture with Mineral Oil and Fertilizer on Yield of Cucumber

Data presented in Table 5 shows the effect of tested abamectin on yield during 2017 and 2018 summer season. The statistical analysis indicated that there were significant differences between the tested treatments compared with control. The L.S.D_{0.05} was (2.758 and 6.881), the yields in 2017 summer season divided into 7 groups according to the effect on yield. The first group include abamectin with mineral oil treatment recorded (550.5 kg / treat) followed by abamectin with fertilizer (524 kg.), abamectin alone (475 kg.), mineral oil with fertilizer (468 kg.), mineral oil (461 kg.), fertilizer treatment record (396 kg.) and control (340 kg.) which come at final order. Concerning, increasing percent in yield, the treatments cause increasing in yield ranged between 5.1 to 61.9% in Table 5, whereas, adding mineral oil to abamectin cause

highly increasing (61.9%) and the second order come with adding fertilizer to abamectin (54.1%) during 2017 summer season.

Concerning yield in the second season, 2018 summer season, the results clear in the same Table 5. The results take the same trend. The statistical analysis finding significant differences between treatments, the results of statistical analysis divided the treatments to six groups, whereas, adding mineral oil to abamectin cause yield increasing to (509 kg) compared with other treatments, thenceforth adding fertilizer to abamectin recorded (427 kg.), abamectin alone, fertilizer mixed with mineral oil (407 and 407 kg), the other treatments descending order as follows: mineral oil (395 kg), fertilizer (338 kg) but control recorded (325 kg). The same trend occur 2018 summer season but increasing percent recorded fewer compared with the results during 2017 summer season, increasing% ranged between 4 to 56.6%.

Discussing the foregoing results, it could be seen that all tested pesticides induced significant increase in yield of cucumber fruits comparing with the untreated check. These results are in full agreement with those obtained by **Soliman (1998)** who found that adding Greenzite as foliar fertilizer to actellic, malathion and methomyl induced increase in yields of cucumber and squash in case of pesticides mixed with Greenzite than that treated with pesticides alone and **Ghatwary (2003)** who found that carbosulfan and pirimiphos-methyl alone or in binary mixtures with caple 2 increased apparently the yield of cucumber fruits comparing with the untreated control.

Table 5. Effect of abamectin, mineral oil, fertilizer alone and in their binary mixtures on yield and increasing percentage of cucumber during 2017 and 2018 summer season

Treatment	Yield (KG)	Increasing%	Yield (KG)	Increasing%
	2017 season		2018 season	
Abamectin	475 C	39.7	407 C	25.2
Oil	461 E	35.6	395 D	21.5
Fertilizer	395 F	16.2	338 E	4.0
Abamectin + Oil	550.5 A	61.9	509 A	56.6
Abamectin +Fertilizer	524 B	5.1	427 B	31.4
Oil + Fertilizer	468 D	37.6	407 C	25.2
Control	340 G	0.0	325 F	0.0
LSD 0.05	2.179	--	6.882	--

LSD 0.05 Means in column followed by the same letter are not significantly different at 0.05 level according to Co Stat 6.303 software (2004).

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تأثير إضافة الزيت المعدني والسماد علي الأباكتين المستخدم في مكافحه حلم العنكبوت الأحمر الذي يصيب الخيار

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تهدف هذه الدراسة لمعرفة كفاءة الأباكتين ضد حلم العنكبوت الأحمر وذلك منفرداً او مخلوطاً مع الزيت والسماد ومعرفة نسبة الخفض ؛ ومعرفة تأثير الأباكتين منفرداً او مخلوطاً مع الزيت والسماد علي محصول الخيار وتأثيره علي الصفات الفيزيائية والكيميائية والمتبقيات في ثمار الخيار. اظهرت النتائج وجود اختلافات معنوية بين المعاملات خلال موسمين متتاليين، كما اوضحت ايضا ان اضافة السماد الي الزيت المعدني تزيد الفاعليه. وفيما يتعلق بموسم صيف 2017 اظهرت نتائج التأثير الأولي ان خلط الزيت المعدني مع السماد سجل نسبة خفض 62% في تعداد حلم العنكبوت الأحمر يتبعه الأباكتين منفرداً ثم؛ الأباكتين مع الزيت المعدني؛ ثم الزيت المعدني؛ ثم الأباكتين مع السماد؛ ثم السماد. وحدث نفس الإتجاه في حالة التأثير المتبقي، تشير النتائج الي ان التأثير الأولي بعد الرش الأول خلال موسم صيف 2017 يظهر ان اضافة الزيت المعدني الي الأباكتين سبب زيادة في الكفاءة بنسبة (67.5%) مقارنة بالاباكتين منفرداً الذي سبب نسبة خفض (63%)، في حين ان المعاملات الاخرى كانت علي النحو التالي: الأباكتين مخلوطاً مع السماد (52%) ، الزيت المعدني مع السماد (47%)، الزيت المعدني (30%)، لكن سجل السماد اقل نسبة خفض (25%). حدث نفس الإتجاه في حالة التأثير المتبقي حيث ان اضافة الزيت المعدني للاباكتين سبب خفضاً مستمراً في تعداد افراد حلم العنكبوت الاحمر بنسبة (88.3%) ، الأباكتين منفرداً (75.8%)، ايضا سبب اضافة السماد الي الأباكتين نسبة خفض (60%) ، الزيت المعدني مع السماد (55%) ، الزيت المعدني (45%) و في حالة رش السماد منفرداً كانت (41%)، اشارت النتائج في حالة الصفات الكيميائية والفيزيائية لسائل الرش ان درجات الحموضة تقع بين 3 الي 6.4. كما ان اضافة السماد الي الأباكتين ادت الي زيادة التوتر السطحي مقارنة مع الأباكتين منفرداً وكانت النسب (33.7) ، 40.6 مقارنة مع 31.06 داين/سم)، اوضحت النتائج ايضا ان الأباكتين اخفتي كمبيد اكاروسي تماما في اليوم الثاني عشر، وان ثمار الخيار كانت صالحة للاكل في اليوم السادس وذلك بعد الرش حيث كانت متبقيات الأباكتين اقل من الحدود المسموح بها وهي (0.5) كجم/لمجم، كما سجلت المعاملات زيادة في المحصول تقع ماين 5.1 الي 61.9%.

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