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BIO-RESIDUAL ACTIVITY OF DIFFERENT INSECTICIDES ON THE LEAF MINERS AND YIELD COMPONENTS OF SNAP BEAN *PHASEOLUS VULGARIS* (L.)

B.A. OMAR[1] AND F.S. FARIS [2]

1 *Central Agricultural Pesticide Laboratory, Agricultural Research Centre, Dokki, Giza.*

2 *Vegetable Research Department, Horticulture Research Institute, Agricultural Research Centre, Dokki, Giza.*

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Abstract

Field trials with snap bean, varieties Paulista, Bronco, Xera and Savana were conducted at four cultivation dates (1998-1999) at Ismailia Governorate to study the impact of foliar application of insecticides, Reldan, Evisect S, Vertemic and Neemazal on the broad bean leaf miner *Liriomyza trifolii* (Berguss) and the yield components of snap bean. Results indicated that among the insecticides, Reldan was the most effective in controlling the leaf miner and produced the highest quality and quantity of green yield, it was followed by Evisect S, Vertemic and Neemazal, respectively, in different sowing dates. Considering the varieties, Paulista was more tolerant to the infestation of *L.trifolii* followed by Bronco, Xera and Savana.

Considering the date of sowing during the winter season, the lowest population density of the leaf miner was achieved when snap beans were sown in 20/10/1998.

INTRODUCTION

In Egypt, snap bean, *Phaseolus vulgaris* (L.), is cultivated in a large scale areas at Ismailia Governorate either for export or local consumption. The broad bean fly, *Lyriomyza trifolii* (Berguss) (Diptera: Agromyzidae), is one of the most important pests attacking snap bean plants.

As a matter of fact, reports on the use of insecticides against family Agromizydae in general and the genus *Liriomyza* in particular are very few. Abul-Nasr *et al.* (1975) found that Diazinon, Gardona and Dursban were effective in controlling *Pseudonapomyza spicata* on young maize plants. Kelany *et al.* (1986) stated that Pyrethroid, Rup 962 and Zolone decreased the percentage of infestation with broad bean leaf miner, *Liriomyza congesta*. Attiah (1990) reported that Fenitrothion and Pirimiphos-methyl offered a fairly good control to *Liriomya trifolii* infesting lentil. Doss *et al.* (1992) indicated that the broad bean leafminer *L.Trifolii* is dangerous to kidney beans

in protected combs, they found that infestation began with low numbers on December, then increased gradually to their maximum on March and declined by the end of April. Buxton and MacDonald (1994) found that cyromazine and abamectin were very effective against larvae of *Liriomyza huidobrensis* attacking ornamental plants.

The aim of the present work is to evaluate the foliar spray of four insecticides; Reldan, Evisect S, Vertemic and Neemazal, for their impact on *L.trifolii* and yield characteristics of four varieties of snap bean.

MATERIALS AND METHODS

The experiments were conducted in different sowing dates, 20/10/1998, 20/11/1998, 20/12/1998 and 20/1/1999. Four varieties of snap bean plants; Paulista, Bronco, Xera and Savana were planted under plastic tunnels. The experimental area was divided into equal plots of $21m^2$ for four replicates, treated and untreated plots were arranged in a complete randomized block design, receiving routine horticulture practices. The tested insecticides were Vertemic (abamectin) 1.8% EC at the rate of 120 ml/feddan, Reldan (chlorpyrifos-methyl) at the rate of 1 liter/feddan, Neemazal (azadirachtin) 5% EC at the rate of 600 ml/feddan and Evisect S (thiocyclam) 50% WP at the rate of 300 gm/feddan. The insecticides were applied after 45 days from sowing. A knapsack sprayer equiped with one nozzle was used in applying the chemical compounds as foliar treatment, diluted with water at the rate of 300 liter/feddan. To estimate the percentage of infestation with the broad bean fly *Liriomza trifolii*, Ministry of Agriculture Protocol was followed, samples of 100 leaves i.e. 25 Leaves/replicate were selected at random. Sampling was done before spray and after 2, 5, 7, 10 and 15 days of application. The population density of the larvae was carried out by transferring the plant leaves in paper bags to the laboratory for inspection by the aid of stereomicroscope.

To evaluate the efficiency of the tested compounds against *L.trifolii,* the percentage reduction in the population density was calculated according to the formula given by Henderson and Tilton (1955). Data were analyzed by 1-way analysis of variance (ANOVA), means were separated by Duncan's multiple range test. Reduction percentages were calculated after 2,5,7,10,15 days after treatment and the mean reduction percentage was based on the overall mean population within 15 days.

Harvesting of green pods started after 75 days from sowing date and ended after 100 days in all experiments. Before starting of harvesting, 10 plants from each rep-

licate were randomly marked for average number of pods/10 plants, pod length (cm), pod diameter (cm) and weight of 10 pods (gm).

RESULTS AND DISCUSSION

Data in Table 1-4 indicated that *Phaseolus vulgaris* (L.) var. Savana was highly infested by the broad bean fly *Liriomyza trifolii* ranged between 40.75-60.25 larvae/ 25 plant leaves in different dates of cultivation. The lowest infestation occurred in variety Paulista (20.75 - 39.50 larvae/25 plant leaves) in different cultivation dates. The varieties Bronco and Xera showed moderate infestation of the broad bean fly.

Concerning the cultivation date, the lowest infestation occurred when snap beans were sown in 20/10/1998, Table 1 and the highest one was achieved when snap beans were sown in 20/1/1999, Table 4.

Statistical analysis of the obtained data showed significant differences in bean fly infestation between snap bean varieties. The effect of different insecticides on the number of broad bean fly infesting certain varieties of snap bean plants in different dates of sowing are presented in Tables 1-4. All insecticides significantly reduced the population density of *L.trifolii* as compared with the untreated control. The results also indicated a high and rapid reduction in insect density 2 days after spraying Reldan and the thiocyclam, Evisect S showing 95.22 and 91.95%, 96.23 and 93.22%, 95.03 and 90.23% and 94.21 and 92.61% for the varieties Paulista, Bronco, Xera and Savana, respectively. A satisfactory reduction in bean fly density was recorded 2 days after spraying the bio-pesticide, Vertemic showing 86.61, 85.18, 88.38 and 85.69% and a moderate effect was achieved by the plant extract Neemazal showing 67.54, 70.12, 75.40 and 78.60% for the varieties Paulista, Bronco, Xera and Savana, respectively, Table 1 .

The tested compounds could be arranged according to the general reduction in population density of broad bean fly in the following descending order after 15 days: Reldan, Vertemic, Evisect S and Neemazal. Statistical analysis of the obtained data indicate a significant difference between Reldan and the other tested compounds after 2 days, while there were no significant differences between Reldan, Vertemic and Evisect S after 5 days of applications. However, there were no significant differences between the effect of all insecticides used after 10 and 15 days of application, Table 1.

As shown in Tables 1-4 it is clear that Reldan was the superior compound after 2 days of application, since it gave 94.91% reduction in broad fly population infesting Sa-

Table 1. Effect of certain insecticides against the population density of *Liriomyza trifolii* (*Berguss*) on certain varieties of snap bean plants at Abou-Sultan region (Ismailia Governorate) cultivated in 20/10/1998.

Varieties	Insecticides	Rate/ Feddan	Mean of broad bean fly larvae / 25 plant leaves and reduction percentages											Mean reduction* %
			Before spray	2 Days	Reduction %	5 Days	Reduction %	7 Days	Reduction %	10 Days	Reduction %	15 Days	Reduction %	
Paulista	Vertemic 1.8%EC	120 ml	23.00	4.25	86.61	3.50	89.39	2.75	93.04	2.75	93.68	1.75	98.14	92.17
	Reldan 50% EC	1 Liter	22.75	1.50	95.22	2.00	93.87	1.50	96.16	2.25	94.80	2.25	95.50	95.11
	Neemazal 5% EC	600 ml	21.75	9.75	67.54	9.25	70.37	8.50	77.24	2.25	94.53	3.00	92.67	80.47
	Evisect S 50% WP	300 gm	22.50	2.50	91.95	1.50	95.36	2.00	94.83	2.25	94.71	3.50	92.91	93.81
	Control		23.00	31.75	-	33.00	-	39.50	-	43.50	-	50.50	-	-
Bronco	Vertemic 1.8%EC	120 ml	27.00	5.00	85.18	2.75	91.98	2.75	92.75	-	93.43	1.50	97.09	92.09
	Reldan 50% EC	1 Liter	26.50	1.25	96.23	1.25	96.29	1.50	95.97	2.75	96.32	2.25	95.56	96.07
	Neemazal 5% EC	600 ml	27.25	9.50	72.12	9.00	73.99	8.75	77.16	1.50	94.08	3.00	94.23	82.32
	Evisect S 50% WP	300 gm	26.00	2.25	93.22	2.50	92.43	1.50	95.89	2.50	93.79	2.75	94.46	93.96
	Control		27.75	34.75	-	35.25	-	39.00	-	2.50	-	53.00	-	-
Xera	Vertemic 1.8%EC	120 ml	32.50	4.00	88.38	2.50	93.82	1.50	96.74	43.00	95.11	1.25	97.68	94.35
	Reldan 50% EC	1 Liter	33.25	14.75	95.03	1.25	96.98	1.25	97.34	2.25	95.22	2.50	95.47	96.01
	Neemazal 5% EC	600 ml	35.50	9.25	75.40	8.75	80.81	8.00	84.08	2.25	97.51	1.75	97.03	86.84
	Evisect S 50% WP	300 gm	36.25	3.75	90.23	2.75	93.91	1.25	97.56	1.25	97.08	2.50	95.84	94.92
	Control		33.75	35.75	-	42.00	-	47.75	-	1.50	-	56.00	-	-
Savana	Vertemic 1.8%EC	120 ml	40.75	6.25	85.69	2.50	95.00	1.75	96.32	47.75	97.49	1.75	97.01	94.30
	Reldan 50% EC	1 Liter	41.25	2.25	94.90	1.75	96.54	1.50	96.89	1.50	97.52	1.75	97.05	96.58
	Neemazal 5% EC	600 ml	42.50	9.75	78.60	9.50	81.79	8.75	82.37	1.50	97.59	2.50	95.91	87.25
	Evisect S 50% WP	300 gm	41.00	3.25	92.61	4.00	92.05	1.50	98.87	1.50	97.92	2.75	95.33	94.96
	Control		41.75	44.75	-	51.25	-	48.75	-	1.25	-	60.00	-	-
	L.S.D. 0.05		4.81	3.62	-	5.25	-	5.91	-	4.73	-	4.74	-	-

* Reduction was calculated based on the overall mean population within 15 days.

Table 2. Effect of certain insecticides against the population density of *Liriomyza trifolii* (*Berguss*) on certain varieties of snap bean plants at Abou-Sultan region (Ismailia Governorate) cultivated in 20/11/1998.

Varieties	Insecticides	Rate/ Feddan	Mean of broad bean fly larvae / 25 plant leaves and reduction percentages											Mean reduction* %
			Before spray	2 Days	Reduction %	5 Days	Reduction %	7 Days	Reduction %	10 Days	Reduction %	15 Days	Reduction %	
Paulista	Vertemic 1.8%EC	120 ml	27.50	3.25	91.49	2.75	93.62	2.75	93.82	1.50	97.25	2.25	95.91	94.42
	Reldan 50% EC	1 Liter	26.50	1.75	95.20	1.25	96.96	1.50	96.47	1.25	97.60	3.50	93.34	95.91
	Neemazal 5% EC	600 ml	26.75	9.50	74.21	8.75	78.94	8.50	80.21	2.75	94.79	2.50	95.35	84.70
	Evisect S 50% WP	300 gm	27.00	2.75	92.61	2.50	97.03	1.25	97.12	1.50	97.17	3.25	93.93	94.97
	Control		28.50	39.25	-	44.25	-	45.75	-	56.00	-	56.50	-	-
Bronco	Vertemic 1.8%EC	120 ml	33.75	4.75	89.23	1.25	97.61	2.75	94.75	3.00	94.73	2.75	95.29	94.32
	Reldan 50% EC	1 Liter	33.00	1.50	96.52	1.25	97.21	1.25	97.56	1.25	97.75	2.50	95.62	96.93
	Neemazal 5% EC	600 ml	31.25	9.75	76.11	9.00	78.80	8.75	81.96	2.75	94.78	1.25	97.75	85.88
	Evisect S 50% WP	300 gm	32.50	3.50	91.75	2.25	94.90	2.50	95.04	1.25	97.72	2.75	95.11	94.90
	Control		33.50	43.75	-	45.50	-	52.00	-	56.50	-	58.00	-	-
Xera	Vertemic 1.8%EC	120 ml	39.25	5.50	89.18	2.75	94.98	1.25	98.02	1.75	97.37	2.50	96.59	95.23
	Reldan 50% EC	1 Liter	38.50	1.25	97.49	1.25	97.63	1.50	97.58	1.50	97.70	3.00	95.83	97.25
	Neemazal 5% EC	600 ml	40.50	9.25	82.36	9.00	83.86	8.50	86.96	3.75	94.53	1.50	98.02	89.15
	Evisect S 50% WP	300 gm	40.00	4.75	90.83	3.75	93.19	2.50	96.12	1.75	97.41	1.745	97.64	94.99
	Control		39.75	51.50	-	54.75	-	64.00	-	670.25	-	74.25	-	-
Savana	Vertemic 1.8%EC	120 ml	46.00	3.75	92.68	2.75	95.16	1.25	97.91	2.50	96.05	3.25	95.39	95.42
	Reldan 50% EC	1 Liter	47.75	1.25	97.64	2.25	96.18	3.00	95.16	1.25	98.10	1.25	98.28	97.07
	Neemazal 5% EC	600 ml	47.00	9.00	82.79	8.25	85.80	8.00	96.88	3.25	94.58	1.50	95.49	89.11
	Evisect S 50% WP	300 gm	49.50	5.25	90.47	3.50	94.28	3.25	94.94	2.75	96.33	2.25	97.03	94.61
	Control		48.75	54.25	-	60.25	-	63.25	-	67.00	-	74.75	-	-
	L.S.D. 0.05		6.63	1.12	-	1.79	-	2.95	-	3.81	-	4.96	-	-

* Reduction was calculated based on the overall mean population within 15 days.

Table 3. Effect of certain insecticides against the population density of *Liriomyza trifolii* (*Berguss*) on certain varieties of snap bean plants at Abou-Sultan region (Ismailia Governorate) cultivated in 20/12/1998.

Varieties	Insecticides	Rate/ Feddan	Mean of broad bean fly larvae / 25 plant leaves and reduction percentages											Mean reduction* %
			Before spray	2 Days	Reduction %	5 Days	Reduction %	7 Days	Reduction %	10 Days	Reduction %	15 Days	Reduction %	
Paulista	Vertemic 1.8%EC	120 ml	31.25	3.50	89.42	1.75	96.65	1.25	98.02	1.75	97.27	4.50	94.23	95.12
	Reldan 50% EC	1 Liter	28.25	1.25	96.02	1.25	97.48	1.75	97.08	1.50	97.54	1.75	97.64	97.15
	Neemazal 5% EC	600 ml	29.50	7.00	76.24	6.25	86.05	6.50	89.36	6.00	90.29	5.25	93.69	87.13
	Evisect S 50% WP	300 gm	27.25	1.75	93.66	1.75	95.99	2.25	95.73	2.50	95.33	4.75	92.70	94.68
	Control		29.75	32.25	-	51.00	-	61.50	-	62.50	-	76.00	-	-
Bronco	Vertemic 1.8%EC	120 ml	36.75	3.75	89.99	1.75	96.18	2.00	96.14	2.75	95.52	3.25	95.96	94.76
	Reldan 50% EC	1 Liter	35.00	1.50	96.29	0.75	96.48	1.00	98.21	1.00	98.49	2.75	91.06	96.51
	Neemazal 5% EC	600 ml	38.25	9.75	75.16	8.50	80.27	3.00	95.02	3.25	95.45	2.00	97.86	88.75
	Evisect S 50% WP	300 gm	37.00	3.00	92.68	2.25	95.51	1.25	97.79	1.25	98.14	3.25	96.30	96.08
	Control		39.00	40.00	-	44.00	-	49.75	-	59.00	-	77.25	-	-
Xera	Vertemic 1.8%EC	120 ml	45.75	5.50	87.30	2.25	95.30	3.00	94.10	2.50	95.73	3.25	95.43	93.57
	Reldan 50% EC	1 Liter	47.00	1.25	99.69	0.50	98.91	0.75	98.43	1.75	98.81	1.75	97.38	98.24
	Neemazal 5% EC	600 ml	46.25	9.50	79.35	9.00	82.30	3.75	92.79	1.50	97.49	2.25	96.91	89.77
	Evisect S 50% WP	300 gm	48.50	5.00	89.91	1.25	97.53	1.25	97.67	1.25	97.98	2.50	96.67	95.95
	Control		47.75	47.50	-	52.50	-	55.75	-	64.25	-	78.00	-	-
Savana	Vertemic 1.8%EC	120 ml	54.00	4.00	92.38	2.50	95.72	2.75	95.64	1.25	98.43	4.00	95.13	95.46
	Reldan 50% EC	1 Liter	53.25	1.75	96.19	0.50	99.25	1.25	97.74	1.50	97.85	2.25	96.87	97.58
	Neemazal 5% EC	600 ml	55.50	9.50	83.41	9.25	82.37	3.50	93.28	1.25	98.10	1.25	98.16	91.06
	Evisect S 50% WP	300 gm	54.75	2.50	93.98	1.25	97.29	1.50	96.99	1.75	97.23	2.20	96.15	96.33
	Control		55.25	57.00	-	52.25	-	56.50	-	71.50	-	73.50	-	-
	L.S.D. 0.05		2.67	2.91	-	2.05	5.91	4.83	-	3.95	-	4.88	-	-

* Reduction was calculated based on the overall mean population within 15 days.

Table 4. Effect of certain insecticides against the population density of *Liriomyza trifolii* (*Berguss*) on certain varieties of snap bean plants at Abou-Sultan region (Ismailia Governorate) cultivated in 20/1/1999.

Varieties	Insecticides	Rate/ Feddan	Mean of broad bean fly larvae / 25 plant leaves and reduction percentages											Mean reduction* %
			Before spray	2 Days	Reduction %	5 Days	Reduction %	7 Days	Reduction %	10 Days	Reduction %	15 Days	Reduction %	
Paulista	Vertemic 1.8%EC	120 ml	38.25	3.75	92.66	3.00	94.77	2.25	96.34	1.25	98.28	3.25	95.80	95.57
	Reldan 50% EC	1 Liter	37.50	1.50	97.00	1.25	97.65	1.25	97.93	2.25	96.79	2.50	96.71	97.22
	Neemazal 5% EC	600 ml	39.00	9.75	81.45	8.75	85.03	7.25	88.44	8.75	94.85	2.25	97.15	98.38
	Evisect S 50% WP	300 gm	38.75	3.00	92.40	2.00	96.56	1.25	97.99	1.50	97.93	2.50	96.81	96.34
	Control		39.50	52.75	-	59.25	-	63.50	-	73.75	-	80.00	-	-
Bronco	Vertemic 1.8%EC	120 ml	43.75	5.00	90.46	3.25	93.83	3.50	94.53	2.25	96.85	2.25	97.17	94.57
	Reldan 50% EC	1 Liter	45.75	1.25	97.72	1.50	97.46	1.50	97.76	2.50	96.65	2.25	97.30	97.38
	Neemazal 5% EC	600 ml	44.75	9.75	81.80	8.50	85.35	7.75	88.15	3.50	95.21	1.25	98.46	89.79
	Evisect S 50% WP	300 gm	46.25	2.00	96.39	2.25	96.25	1.25	98.15	1.25	98.34	2.25	97.32	97.29
	Control		45.50	54.50	-	59.00	-	66.50	-	74.25	-	82.75	-	-
Xera	Vertemic 1.8%EC	120 ml	51.50	3.75	93.28	3.50	94.59	3.25	95.45	1.50	97.95	2.50	96.90	95.63
	Reldan 50% EC	1 Liter	51.75	1.25	97.77	1.25	98.08	1.25	98.26	1.50	97.96	1.25	98.46	98.11
	Neemazal 5% EC	600 ml	52.25	9.00	84.11	8.25	97.44	8.00	88.97	3.00	95.96	1.75	97.86	90.87
	Evisect S 50% WP	300 gm	52.00	1.50	97.4	1.25	98.09	1.50	97.92	2.75	96.28	2.25	97.24	97.37
	Control		53.50	58.00	-	67.25	-	74.25	-	76.00	-	83.75	-	-
Savana	Vertemic 1.8%EC	120 ml	60.25	5.00	92.44	2.25	96.89	2.75	96.67	1.25	98.54	2.25	97.72	96.45
	Reldan 50% EC	1 Liter	57.75	1.25	98.03	1.75	97.48	1.25	98.42	1.75	97.87	2.25	97.62	97.88
	Neemazal 5% EC	600 ml	59.50	9.75	85.08	8.50	88.10	8.00	90.19	1.50	98.22	2.25	97.69	91.86
	Evisect S 50% WP	300 gm	57.25	1.50	97.61	1.25	98.18	1.50	98.09	1.50	98.15	2.50	97.33	97.87
	Control		56.00	61.50	-	67.25	-	76.75	-	79.50	-	91.75	-	-
	L.S.D. 0.05		4.11	1.75	-	1.83	-	2.89	-	3.86	-	3.07	-	-

* Reduction was calculated based on the overall mean population within 15 days.

vana variety when cultivated in 20/10/1998 (the least effect), Table 1 and 99.69% reduction in bean fly infesting Xera variety cultivated in 20/12/1998 (The highest effect), Table 3. Evisect S came next in this respect followed by Vertemic and Neemazal which showed inferior efficacy among the tested insecticides.

These results are in agreement with Prabhakar *et al.* (1994), Jyani *et al.* (1995), Khajnria and sharma (1995) and Mehta *et al.* (1995).

Considering the dates of cultivation, it is obvious that snap beans cultivated in 20/10/1998 showed the lowest rate of infestation by the broad bean fly *L.trifolii* ranged between 21.75-42.50 larvae/25 plant leaves, Table 2, while snap bean cultivated in 20/1/1999 showed the highest rate of infestation ranged between 37.50-60.25 larvae/25 plant leaves, Table 4.

Taking the results of snap bean varieties in consideration, it is evident that the variety Paulista was more tolerant to the infestation of the broad bean fly than the other varieties. However, the variety Savana was the most susceptible to the broad bean fly infestation, Tables 1-4.

The effect of insecticides on the number of pods/10 snap bean plants are shown in Table 5. The results indicated that the number of pods was not affected by the date of cultivation. There were significant differences between varieties, the variety Paulista showed the highest mean number of pods/10 snap bean plants ranged between 46.25-48.50 pods, followed by Bronco (45.25 - 48.00), Xera (44.25 - 47.25) and Savana (43.50 - 47.00).

The treatment of Reldan showed the superior effect on the mean number of pods, it showed a range of 45.50-48.50 pods/10 snap bean plants in different varieties followed by Evisect S (44.75 - 47.75), Vertemic (44.00 - 47.25) and Neemazal (43.75 - 47.25).

Average pod length as shown in Table 5 reveals that all insecticides increased the pod length of the snap bean as compared with untreated control. Among the tested insecticides, Reldan significantly increased the pod length, 14.50, 14.25, 13.75 and 12.75 cm and the untreated were 12.75, 12.50, 12.25 and 11.25 for the varieties Paulista, Bronco, Xera and Savana, respectively, when snap beans were planted at 20/10/1998. The same trend was also obtained in the other dates of cultivation and the best results were obtained when snap beans were sown in 20/11/1998.

Table 5 demonstrates the effect of the tested insecticides on the weight of snap bean pods, all insecticides slightly increased pods weight and did not show significant effect when compared with the untreated control. Reldan revealed the highest increase followed by Evisect S, Vertemic and Neemazal, in different sowing dates, respectively.

Data in Table 5 reveal that slight increases were obtained in pod diameter of snap beans after the treatments of all insecticides. This increase was not significant in the variety Paulista, but it was significant in Bronco, Xera and Savana varieties. The treatment of Reldan was superior followed Evisect S, Vertemic and Neemazal, respectively.

From the results obtained and presented in Table 5, it could be concluded that the application of insecticides had an additive effect and thereby increased the yield of snap bean. Hassan *et al.* (1985) found that the application of insecticides alone or with macroelements are effective in controlling the sucking insects and produce the highest quality and quantity of cowpea.

Table 5. The effect of insecticidal treatments on certain yield components of snap bean cutlivated in different dates at Abou-Sultan region, Ismailia Governorate.

Varieties	Insecticides	Rate/ Feddan	Mean no. of pods/10 plants				Mean pod length (cm)				Mean weight of 10 pods(cm)				Mean pod diameter (cm)			
			20/10/98	20/11/98	20/12/98	20/1/99	20/10/98	20/11/98	20/12/98	20/1/99	20/10/98	20/11/98	20/12/98	20/1/99	20/10/98	20/11/98	20/12/98	20/1/99
Paulista	Vertemic 1.8%EC	120 ml	47.00	47.50	47.00	47.25	13.75	14.25	13.25	14.00	40.50	40.75	40.25	40.75	0.65	0.67	0.66	0.67
	Reldan 50% EC	1 Liter	48.25	48.50	48.00	48.25	14.50	15.00	14.00	15.00	41.25	41.75	41.25	41.50	0.66	0.66	0.66	0.65
	Neemazal 5% EC	600 ml	46.75	47.25	46.75	46.75	13.25	13.75	13.00	13.75	39.75	40.00	39.75	40.00	0.65	0.65	0.65	0.65
	Evisect S 50% WP	300 gm	74.75	48.25	47.25	47.50	14.00	14.50	13.50	14.50	40.75	41.00	40.50	40.75	0.65	0.66	0.66	0.65
	Control		46.5	46.75	46.25	46.50	12.75	13.25	12.50	12.75	39.25	39.50	39.00	39.25	0.65	0.66	0.65	0.66
Bronco	Vertemic 1.8%EC	120 ml	46.25	47.00	46.50	46.75	13.00	13.75	12.75	13.25	39.50	39.75	39.50	39.75	0.64	0.66	0.66	0.67
	Reldan 50% EC	1 Liter	47.25	48.00	48.00	47.75	14.25	14.75	14.00	14.50	40.25	40.50	39.75	41.00	0.67	0.65	0.67	0.68
	Neemazal 5% EC	600 ml	45.50	46.75	45.75	46.00	12.75	13.00	12.50	13.00	38.75	39.00	38.75	39.25	0.63	0.65	0.64	0.63
	Evisect S 50% WP	300 gm	4.75	47.25	47.00	47.25	13.50	14.25	13.25	14.25	39.75	40.00	39.50	40.00	0.65	0.65	0.65	0.66
	Control		45.25	46.25	45.50	45.75	12.50	13.00	12.25	12.50	38.50	38.75	38.00	38.50	0.63	0.65	0.63	0.64
Xera	Vertemic 1.8%EC	120 ml	45.50	46.27	45.25	45.50	12.75	13.25	12.50	13.00	38.25	38.75	38.75	39.25	0.64	0.65	0.46	0.56
	Reldan 50% EC	1 Liter	44.75	48.00	47.00	47.25	13.75	14.25	13.50	14.25	39.50	39.75	40.25	40.75	0.66	0.67	0.66	0.67
	Neemazal 5% EC	600 ml	46.75	45.50	45.00	45.50	12.50	12.75	12.25	12.75	37.75	38.25	38.35	38.75	0.62	0.63	0.62	0.63
	Evisect S 50% WP	300 gm	46.50	46.75	45.50	46.00	13.50	14.00	13.00	14.00	38.75	39.25	39.00	39.50	0.64	0.63	0.64	0.66
	Control		44.25	45.25	44.25	44.50	12.25	12.75	12.00	12.25	37.00	37.75	37.25	37.75	0.61	0.61	0.60	0.61
Savana	Vertemic 1.8%EC	120 ml	44.00	45.25	33.75	45.25	11.75	12.25	11.50	12.00	27.25	38.25	38.25	38.75	0.63	0.64	0.64	0.65
	Reldan 50% EC	1 Liter	45.50	46.75	46.75	47.00	12.75	13.00	12.50	12.75	38.25	39.00	38.75	39.25	0.66	0.66	0.65	0.68
	Neemazal 5% EC	600 ml	43.75	44.75	44.50	45.00	11.50	12.00	11.00	11.25	37.25	37.75	37.75	38.00	0.60	0.60	0.60	0.61
	Evisect S 50% WP	300 gm	44.75	45.50	45.25	45.50	12.25	12.50	12.00	12.00	37.75	38.25	38.00	38.50	0.63	0.65	0.64	0.65
	Control		43.50	44.00	44.00	44.00	11.25	11.50	11.00	11.50	36.75	37.25	37.00	37.25	0.59	0.60	0.60	0.61
	L.S.D. 0.05		1.36	1.32	1.40	1.35	1.24	1.44	1.53	1.54	1.67	1.69	1.71	1.80	0.01	0.01	0.01	0.01

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النشاط الحيوى لمتبقيات بعض المبيدات على صانعات الأنفاق ومكونات المحصول فى الفاصوليا

بهاء الدين عبد المجيد عمر[1]، فايق ساويرس فارس [2]

١ *المعمل المركزى للمبيدات - مركز البحوث الزراعية - الدقى - الجيزة.*

٢ قسم بحوث *الخضر - معهد بحوث البساتين - مركز البحوث الزراعية - الدقى - الجيزة.*

أجريت تجارب حقلية على محصول الفاصوليا لأصناف بوليستا، برونكو، جزيرة ، سافانا خلال الموسم ١٩٩٨ - ١٩٩٩ فى أربع مواعيد مختلفة للزراعة فى محافظة الاسماعيلية لدراسة تأثير رش المجموع الخضرى بالمبيدات الحشرية: ريلدان، إيفيسكت إس ، فيرتيميك، نيمازال ضد صانعات الأنفاق وعلى المكونات المحصولية للمحصول الأخضر . وقد أوضحت النتائج أن مبيد ريلدان أظهر كفاءة عالية فى مكافحة الآفة الحشرية مما أدى إلى زيادة المحصول كما ونوعاً ، وتلاه كل من ايفيسكت إس ، فيرتيميك ، نيمازال على الترتيب وذلك فى مواعيد الزراعة المختلفة.

عند أخذ الأصناف فى الإعتبار كان الصنف بوليستا الأكثر مقاومة للإصابة بصانعات الأنفاق يليه الصنف برونكو ثم جزيرة ثم سافانا. كذلك وجد أن أفضل موعد للزراعة خلال موسم الشتاء وأقل كثافة عددية لصانعات الأنفاق كان عند زراعة الفاصوليا فى ٢٠ / ١٠ / ١٩٩٨ .