

EFFICACY OF EMAMECTIN BENZOATE AND METAFLOTHIZONE FOR THE CONTROL OF ONION CATERPILLAR (*Spodoptera spp.*) (LEPIDOPTERA: NOCTUIDAE)

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INTRODUCTION

Onion is an important condiment crop as well as cash crop cultivated especially in the dry zone of the Sri Lanka. Onion production is beset with serious problems caused by insect pests and diseases. Among the insect pests, thrips and onion caterpillars are identified as major pests causing considerable damage on the crop resulting in severe yield losses. Onion caterpillars (*Spodoptera spp.*) are very destructive polyphagous insects that attack a wide range of crops (Kolodny, 1997). Two species of onion caterpillars (*Spodoptera litura* and *Spodoptera exigua*) are known to damage the onion crop in Sri Lanka, of which, *Spodoptera exigua* was endemic to Northern area whereas *Spodoptera litura* is common to other areas of the country. However, during *yala* 2006, onion caterpillar (*Spodoptera exigua*) was identified as the most prevalent species of insect pest associated with the onion cultivation in the Matale District. According to our observations, damage caused by this pest was around 60–75%. However, in certain localities of the Matale district 100% crop loss has also been observed. Adult moths are grayish and lay eggs on the foliage where larvae feed on the leaf surface and remain concealed inside the tubular leaves. When feeding is complete, caterpillars pupate in the soil (Parker *et al.*, 1995). Onion caterpillar also poses a severe damage to onion bulbs. None of the recommended insecticides (Table 1) including pyrethroids provided an effective control of the pest because farmers do not follow recommended dose, correct application method and application timing. This situation created an urgent need to identify effective insecticides against onion caterpillars as onion is a cash crop grown by the majority of farmers in the Matale district. Therefore, experiments were conducted in farmers' field at Dambulla area during *yala* 2006 and *yala* 2007 to identify effective insecticides to control *Spodoptera spp.*

Table 1. Insecticides recommended for the control of onion caterpillar in Sri Lanka.

<i>Insecticide name and formulation</i>	<i>Recommended rate of application (ml/ha)</i>
Diazinon 50EC	1600 - 2000
Chlorfluazuron 5EC	320 - 400
Deltamethrin 2.5EC	190 - 240
Beta Cyfluthrin 2.5EC	320 - 400
Permethrin 25EC	96 - 120
Esfenvalerate 7.5EC	96 - 120
Fenvalerate 20EC	320 - 400

(Source: Pesticide recommendations, 1997, Department of Agriculture)

MATERIALS AND METHODS

Experiments were conducted in farmers' fields in the Dambulla area during *yala* 2006 and *yala* 2007. Experiments were laid out in a Randomized Complete Block Design with three replications. The onion variety Rampure was used for the experiments. Nursery establishment was done by farmers using the recommended method. Seedlings were transplanted at the age of 5 weeks at a spacing of 10 x 10 cm on plots measuring 3x1 m. Three plots were used as one treatment. All the cultural practices were followed as recommended by the Department of Agriculture. The following insecticides were tested at the given rates (Table 2).

Table 2. Tested insecticides during *yala* 2006 and *yala* 2007 and their dilution rates and rate of application.

<i>Insecticides</i>	<i>Season tested</i>		<i>Dilution rate</i>	<i>Rate of application</i>
	<i>yala 2006</i>	<i>yala 2007</i>		
Chromofenozide 5SC	√	√	30 ml/10 l	600 ml/ha
Thiocyclam hydrogenoxalate 50SP	√	√	5 g/16 l	400 g/ha
Metaflumizone 24SC	√	√	25 ml/10 l	1000 ml/ha
Thiacloprid 5SC	√	-	16 ml/10 l	500 ml/ha
Cyhalothrin 5EC	√	√	5 ml/10 l	125 ml/ha
Chlorfluazuron 5EC**	√	√	10 ml/10 l	450 ml/ha
Novaluron 10EC	√	-	10 ml/10 l	500 ml/ha
Emamectin benzoate 5SG	√	√	4 g/10 l	160 g/ha
Azadirachtin	-	√	1.5 g/16 l	40 g/ha
Methoxyfenozide 24SC	-	√	10 ml/10 l	500 ml/ha
Bistrifluron 10EC	-	√	10 ml/10 l	750 ml/ha
Spinosad 2.5SC	-	√	10 ml/10 l	600 ml/ha

** - Recommended insecticide

Application of insecticides was commenced at 4 weeks after transplanting and continued for three times at 7-10 day intervals. The number of damaged plants per 3 m² area and number of larvae in 20 randomly selected onion leaves in 1 m² area were recorded. Bulb yield was recorded at harvesting stage.

RESULTS AND DISCUSSION

During *yala* 2006, the percentage damaged plants due to onion caterpillars in the plots treated with different insecticides varied from 4-21% while the damage in the untreated plot was 20% (Table 3). The lowest percentage damage was recorded in the plots treated with emamectin benzoate followed by metaflumizone. The caterpillar damage was comparatively high in *yala* 2007 and the untreated plots had 43% damaged plants and the two insecticides Emamectin benzoate and metaflumizone repeatedly exhibited an effective control of the pest reducing the damage. Another two insecticides,

methoxyfenozide and spinosad which were tested only in *yala* 2007 also had reduced the incidence of damaged plants.

Table 3. Performance of different insecticides on percentage damaged plants during *yala* 2006 and *yala* 2007 at farmers' fields.

<i>Treatment</i>	% Damaged plants (7 days after 3 rd spray)	
	<i>yala</i> 2006	<i>yala</i> 2007
Chromofenozide	12.6 abc *	23.3 bcd
Thiocyclam hydrogenoxalate	15.7 ab	26.6 bc
Metaflumizone	5.6 bc	12.0 e
Thiacloprid	14.1 abc	-
Cyhalothrin	19.4 a	28.0 cde
Chlorfluazuron	20.6 a	30.0 ab
Novaluron	17.3 ab	-
Emamectin benzoate	3.9 c	13.3 de
Azadirachtin	-	34.0 ab
Methoxyfenozide	-	16.0 de
Bistrifluron	-	32.0 ab
Spinosad	-	16.0 de
Untreated control	20.0 a	43.3 a
CV%	22	14

*Means in each column followed by the same letter are not significantly different at 5% level

Larval population was also low in metaflumizone and emamectin benzoate treated plots in both seasons over the control. During *yala* 2006, number of larvae at 7 days after third spray was significantly lower in metaflumizone and emamectin benzoate treated plots than the untreated control. During *yala* 2007, larval population was low in metaflumizone, emamectin benzoate, methoxyfenozide and spinosad treated plots compared to the untreated control (Table 4).

As far as yield data is concerned, all the treated plots except chlorfluazuron gave significantly higher yields than the untreated plots during *yala* 2006. During *yala* 2007, metaflumizone, emamectin benzoate, methoxyfenozide and spinosad treated plots gave significantly higher yields than the other treatments. Yield reduction due to onion caterpillar was reduced by 80-84% in metaflumizone and emamectin benzoate treated plots over the control in both seasons (Table 5).

When percentage damaged plants and larval population was plotted against yield, a linear regression was observed with high correlation in *yala* 2006 and *yala* 2007 (Fig. 1 and Fig. 2).

This study showed that metaflumizone at the rate of 1000 ml/ha and emamectin benzoate at the rate of 160 g/ha were effective in controlling *Spodoptera spp.* in onion.

Table 4. No. of larvae in 20 leaves in 3 m² area treated with different insecticides during *yala* 2006 and *yala* 2007 at farmers' fields.

Treatment	No. of larvae/20 leaves/3 m ² area			
	<i>yala</i> 2006		<i>yala</i> 2007	
	7 days after 2 nd spray	7 days after 3 rd spray	7 days after 2 nd spray	7 days after 3 rd spray
Chromofenozide	12.3 b*	26.6 bc	5.6 abc	8.3 bcde
Thiocyclam hydrogenoxalate	14.3 b	55.0 ab	5.3 abc	11.0 abcde
Metaflumizone	9.6 b	17.3 c	2.3 bc	5.6 de
Thiacloprid	12.3 b	58.3 ab	-	-
Cyhalothrin	16.6 b	70.3 a	4.0 bc	16.3 ab
Chlorfluazuron	11.6 b	66.0 a	6.6 ab	15.0 ab
Novaluron	16.3 b	59.6 ab	-	-
Emamectin benzoate	7.3 b	21.3 c	1.7 c	5.0 e
Azadirachtin	-	-	7.6 ab	13.3 abcd
Methoxyfenozide	-	-	3.3 bc	5.3 de
Bistrifluron	-	-	3.3 bc	13.3 abc
Spinosad	-	-	3.0 bc	5.6 de
Untreated control	58.6 a	68.0 a	13.3 a	18.3 a
CV%	20	19	30	21

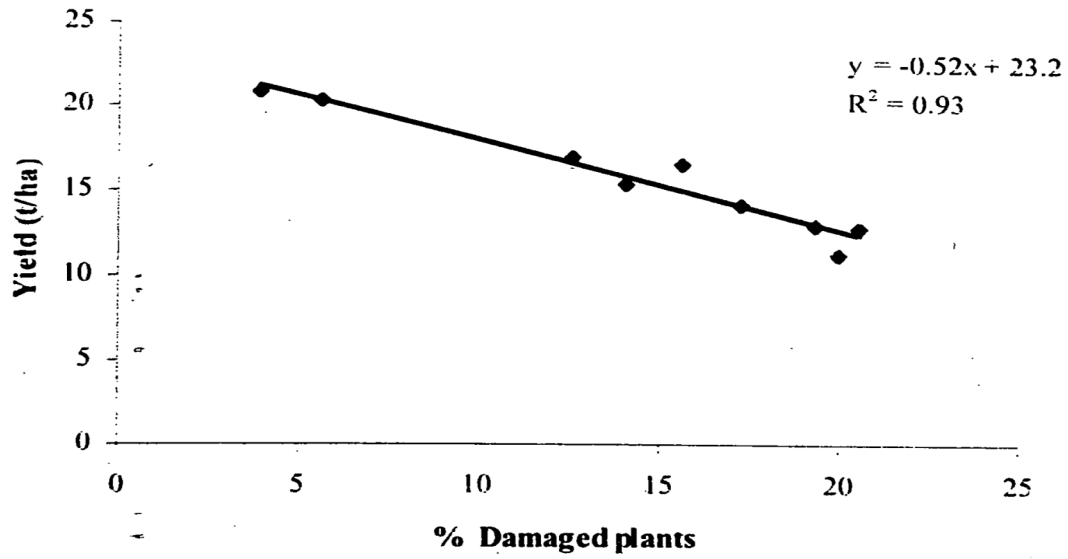
*Means in each column followed by the same letter are not significantly different at 5% level

Table 5. Performances of different insecticides on bulb yield of onion during *yala* 2006 and *yala* 2007 at farmers' fields.

	<i>yala</i> 2006		<i>yala</i> 2007	
	Bulb yield (t/ha)	%Yield increase over the control	Bulb yield (t/ha)	%Yield increase over the control
Chromofenozide	17.0 b*	50.4	13.0 b	19.3
Thiocyclam hydrogenoxalate	16.6 b	46.9	12.7 b	16.5
Metaflumizone	20.3 a	79.6	19.8 a	81.6
Thiacloprid	15.4 bc	36.3	-	-
Cyhalothrin	13.0 d	15.0	11.9 bc	9.2
Chlorfluazuron	12.9 de	14.1	11.2 bc	2.8
Novaluron	14.2 cd	25.6	-	-
Emamectin benzoate	20.8 a	84.0	19.9 a	82.6
Azadirachtin	-	-	9.7 c	-
Methoxyfenozide	-	-	19.3 a	77.1
Bistrifluron	-	-	12.2 b	11.9
Spinosad	-	-	18.6 a	70.6
Untreated control	11.3 e	-	10.9 bc	-
CV%	6		9	

*Means in each column followed by the same letter are not significantly different at 5% level.

(A)



(B)

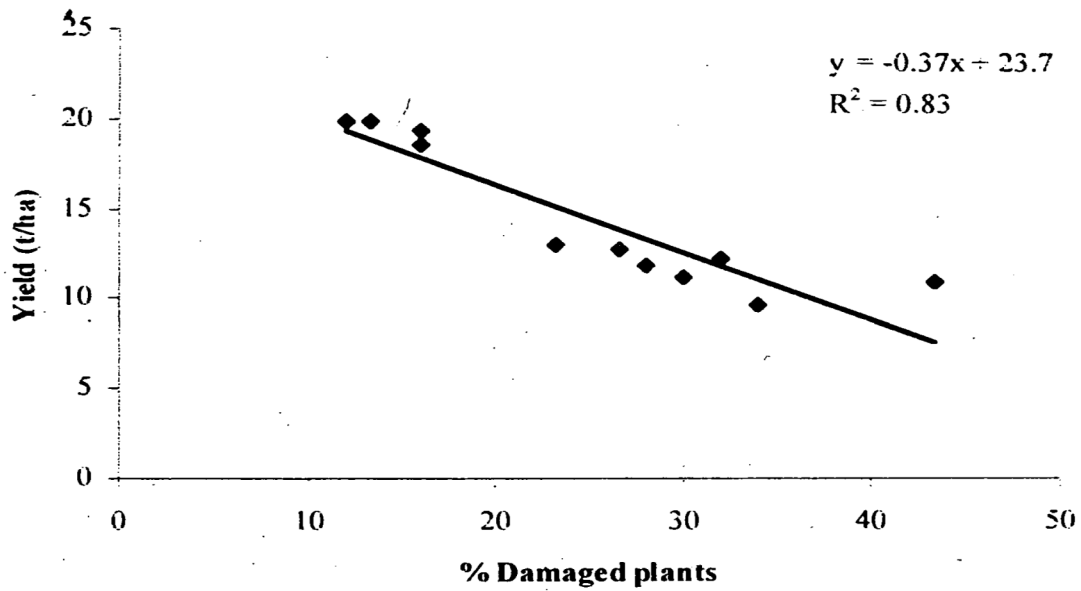
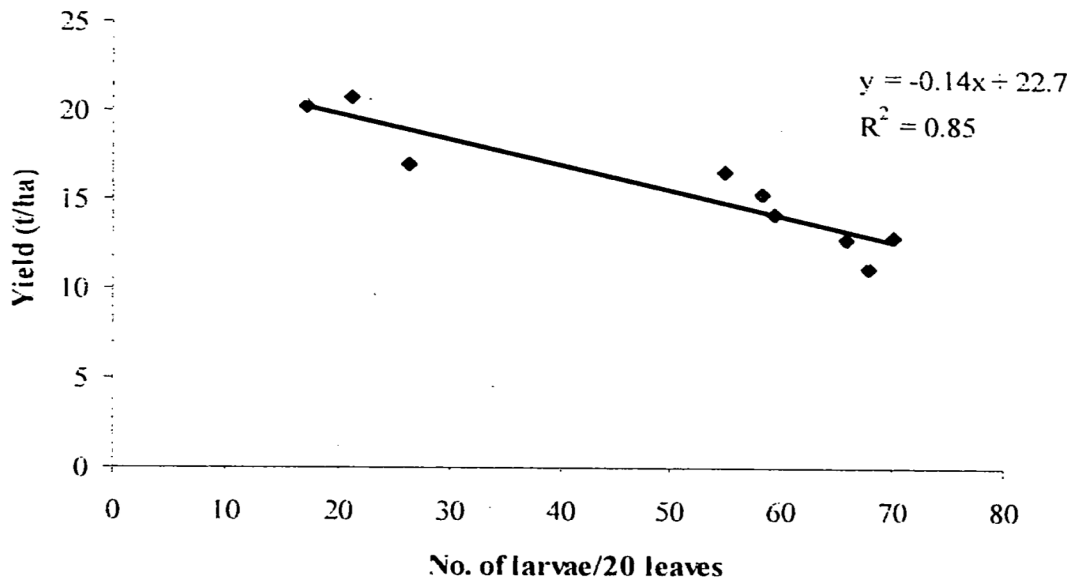


Figure 1. Yield of onion in relation to percentage damaged plants during *yala* 2006 (A) and *yala* 2007 (B) at farmers' fields.

(A)



(B)

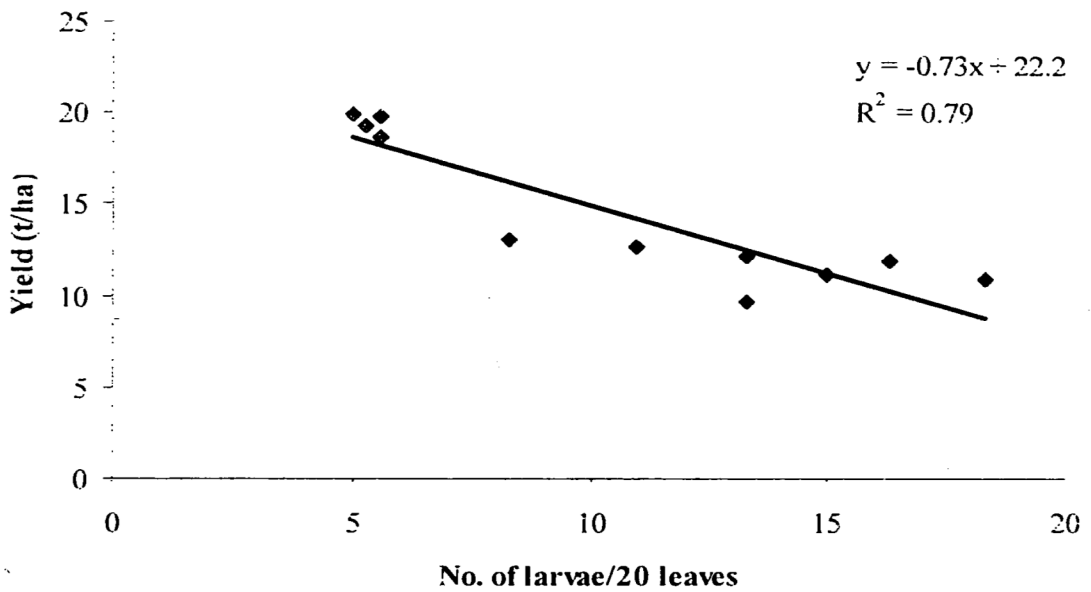


Figure 2. Yield of onion in relation to larval population during *yala* 2006 (A) and *yala* 2007 (B) at farmer's fields.

CONCLUSIONS

Two seasons results revealed that the damage caused by onion caterpillars goes up to 43% and the yield reduction is around 45% under untreated conditions. Metaflumizone 24SC (1000 ml/ha) and emamectin benzoate 5SG (160 g/ha) can be recommended for the effective control of

Spodoptera spp. in onion. The two new insecticides spinosad and methoxyfenozide which also showed effective control needs to be tested further to find out its effectiveness and feasibility of recommending for future use.

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