J.Biol.Control, **9** (1), 34-36, 1995

Management of *Helicoverpa armigera* with Nuclear Polyhedrosis Virus on Cotton using different Spray Equipment and Adjuvants*

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ABSTRACT

Results of a field experiment on the control of *Helicoverpa armigera* Hbn. on cotton with nuclear polyhedrosis virus (NPV) at a dose of 3 x 10^{12} polyhedral occlusion bodies/ha using different spray equipment revealed that significant control of the pest and its damage to squares and bolls could be achieved in all the treatments. Seed cotton yields in plots sprayed with the virus by all the three spray equipment were significantly higher than in control and the difference between the treatments were not significant showing that for the control of *H.armigera* on cotton with NPV, any one of the spray equipment can be used. In another experiment which evaluated the efficacy of NPV applied with certain adjuvants by a mist blower, it was found that a combination of NPV with cotton seed kernel extract (2.5kg/ha) and crude sugar (2.5 kg/ha) recorded significantly lower boll damage than NPV applied alone. The seed cotton yield in the different treatments as well as in the control however did not differ significantly.

KEY WORDS : *Helicoverpa armigera,* nuclear polyhedrosis virus, spray equipment, adjuvants

The American boll worm *Helicoverpa armigera* Hbn. attacks several crops like chickpea, pigeonpea, soybean, sunflower and cotton in South India. On cotton, the pest feeds on the leaves, squares, and bolls. The estimated loss in cotton in Tamil Nadu, India alone during 1987-88 was about 20 per cent with a value of Rs.6.9 crores (Jayaraj, 1988). In recent years *H.armigera* has developed resistance to pyrethroids (Pasupathy and Regupathy, 1994) organo phosphorous insecticides (Whitten and Bull, 1970) and endosulfan (Basson *et al.*, 1979). The pest is however highly susceptible to its nuclear polyhedrosis virus (Rabindra and Subramaniam, 1974) and in field tests, the virus was found to be effective against the pest on cotton (Dhandapani *et al.*, 1987). This paper reports the results of field experiments on cotton to evaluate different spray equipment and adjuvants for the application of NPV for the control of *H.armigera*.

MATERIALS AND METHODS

The virus for this experiment was propagated in *H.armigera* by inoculating fourth instar larvae orally along with virus-contaminated food. Virosed larvae were harvested from fifth day onwards of inoculation and frozen immediately. The virus when required was processed from the cadavers by homogenizing in a blender along with distilled water, passing through a cheese cloth to remove the insect debri and differential centrifugation. Counts of polyhedral occlusion bodies (POB) were made with a haemocytometer in a phase contrast research microscope.

The experiments were conducted on M.C.U. 5 cotton crop raised by a farmer at Neringipettai during the summer season of 1993. The plot size was 200 m^2 and the experiments were laid out in randomised block design

* Part of research work funded by U.S.D.A. though the U.S.I.F. (PL 480) project

with five replications. In the first experiment, the efficacy of three spray equipment *viz.*, the controlled droplet applicator (CDA-ULV), backpack hydraulic sprayer (high volume) and the mist blower (low volume) were evaluated for virus application. The controlled droplet applicator (Thompson Motronics, Ahmedabad) utilized a spray fluid volume of 12.5 l/ha, whereas the mist blower and the backpack hydraulic sprayer (both Aspee, Bombay) required a spray fluid volume of 250 and 1000 litres per ha respectively. The virus was applied three times at the rate of 3.0×10^{12} POB/ha along with 2.5 kg of cotton seed kernel and 2.5 kg of crude sugar. Care was taken to avoid spray drift to adjacent fields. Cotton seed kernels were removed from the seeds by pounding and pulverized in a blender along with the required amount of water to obtain the seed kernel extract.

In the second experiment, the efficacy of cotton seed kernel extract and chickpea flour or their combinations with crude sugar were tested as adjuvants for NPV applied by mist blower. Larval population was recorded in five randomly - selected plants leaving the border rows in each plot after the first two sprays. Similarly, damage to squares and bolls was recorded in five plants selected at random in each plot after the third spray. Seed cotton yields in different plots were recorded at each harvest and pooled.

The data were subjected to analysis of variance after suitable transformation whereever necessary and means compared with least significant differences.

RESULTS AND DISCUSSION

Data on the larval population after the first spray showed that, NPV applied by all the three equipment was equally effective in significantly reducing the larval population of *H.armigera*. Eventhough the data recorded after the second spray revealed that the virus gave significant control only when applied by the mist blower, there were no significant differences between the three sprayers. The data on damage to squares and bolls as well as yield of seed cotton showed that NPV gave significant control of the pest and there were no differences in the efficacy due to the spray equipment. These results indicate that NPV can be applied by any one of these equipment for the control of *H.armigera* on cotton. Stacey *et al.* (1980) also did not find any difference in efficacy when the virus was applied by a mist blower or a hydraulic equipment for the control of *Heliothis* on cotton. Rabindra and Jayaraj (1988a) found no differences in the efficacy of NPV against *H.armigera* on chickpea when applied by the controlled droplet applicator or the hydraulic backpack sprayer.

The field experiment with adjuvants for NPV applied by mist blower recorded low population of *H.armigera* and the differences in the number of larvae in the different treatments were not significant. However, data on the damage to squares showed that NPV applied along with crude sugar was significantly

Table 1. Evaluation of spray equipment for NPV application against *H. armigera* on cotton (MCU 5) (Summer 1993)*

Treatment ** (Equipment)	Larvae/5 plants after spray		% damage to		Yield of seed cotton kg/ha
	I	II	Squares	Bolls	
U.L.V. (C.D.A.)	0.33[a]	0.33[ab]	4.16[a]	2.86[a]	1908[a]
Backpack hydraulic sprayer	0.66[a]	0.33[ab]	4.16[a]	2.73[a]	1896[a]
Mist blower	0.33[a]	0.00[a]	3.33[a]	3.61[a]	1782[a]
Control	2.00[b]	1.00[b]	7.78[b]	8.34[b]	1292[b]

* In vertical columns, means followed by similar letters are not different statistically by L.S.D. (P=0.05)

** All treatments except control carried NPV @ 3.0×10^{12} POB + 2.5 kg cotton seed kernel + 2.5 kg crude sugar/ha

Table 2. Field evaluation of certain adjuvants for NPV spray by low volume application for *H. armigera* control on cotton (MCU 5) (Summer 1993)

Treatment @	Larvae/5 plants after spray		% damage* to		Yield of seed cotton kg/ha
	I	II	Squares	Bolls	
NPV alone	1.00	0.66	6.02^{bc}	3.23^{bc}	1647
NPV + cotton seed kernel extract 2.5 kg + crude sugar (C.S.) 2.5 kg/ha	0.66	0.33	4.18^{ab}	1.42^{a}	1381
NPV + C.S. 5 kg/ha	0.66	0.33	3.32^{a}	1.75^{ab}	1533
NPV + chickpea flour (C.F.) 2.5 kg + C.S. 2.5 kg/ha	0.33	0.00	4.28^{ab}	2.59^{abc}	1362
NPV + C.F. 5 kg/ha	0.66	0.66	4.33^{ab}	2.86^{bc}	1659
Endosulfan 700 g/ha	1.00	0.66	6.12^{bc}	4.20^{c}	1520
Control	2.00	1.33	7.81^{c}	8.52^{d}	1381

@ NPV @ 3×10^{12} POB/ha
* Means followed by similar letters are not different statistically (P=0.05) by L.S.D.

more effective than NPV applied alone. Data on the boll damage indicated that the virus was effective in reducing the damage by the pest and a combination of NPV with cotton seed kernel extract and crude sugar was significantly more effective than NPV applied alone. The differences in the cotton yield in the different treatments were not significant.

Cotton seed kernel and crude sugar were found to increase the efficacy of NPV against *H.armigera* larvae in the laboratory by acting as phagostimulants (Rabindra and Jayaraj, 1988b). The results of this field experiment with adjuvants are inconclusive and further field studies are necessary to findout the optimum concentration of the adjuvants for low volume application of virus under field conditions.

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