J. Biol. Control. 15(2): 171-175, 2001

Field evaluation of NPV with adjuvants and UV protectants against *Helicoverpa armigera* (Hübner) in chickpea crop

R. L. RAWAT and A. SHUKLA
Department of Entomology, J. N. Krishi Vishwa Vidyalaya
Jabalpur 482 004, Madhya Pradesh, India
E-mail: abhishek @ jnau.mp.nic.in

ABSTRACT: **Efficacy of nuclearpolyhedrosisvirus (NPV) with and without adjuvants and UV protectants, against *H. armigera* in chickpea crop was evaluated in a field trial. All the treatments registered significantly lower larval population and higher seed yield as compared to untreated control. Significantly higher seed yields of 1612.5 and 1550.0 kg/ha were observed in the treatments of NPV 250 LE+milk powder (1.0%) and NPV 250 LE+Ranipal (0.5%), respectively and both were on par.**

KEY WORDS: Adjuvants, *Helicoverpa armigera*, larval population, nuclearpolyhedrosisvirus, UV protectants

Production of chickpea (*Cicer arietinum*) in India is much below the expected level, mainly due to the insect damage to the crop. Gram pod borer, *Helicoverpa armigera* (Hübner) is regarded as the key pest of chickpea (Sachan *et al.*, 1992) causing severe economic losses. Several biocontrol agents have been tried against this pest to bring down the pesticidal applications. Use of nuclearpolyhedrosisvirus (NPV) has been found effective by several workers (Jayaraj *et al.*, 1991; Shukla and Goydani, 1996). Viral inactivation, however, has been reported under field conditions due to solar radiation (Maiorov *et al.*, 1984). Certain adjuvants and ultraviolet protectants are supposed to increase the persistence of NPV under environmental conditions and thereby improve its efficacy. In the present experiment, different adjuvants and ultraviolet protectants were mixed with NPV sprays and evaluated for their effect on virulence of NPV against *H. armigera* in chickpea crop.

MATERIAL AND METHODS

Studies were conducted during the *rabi* season of 2000-2001, at Maharajpur Vegetable Farm of Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. The experiment was laid out in randomized block design, with 10 treatments (Table 1) replicated thrice. Different treatments consisted of NPV application alone and in combination with adjuvants and UV protectants against *H. armigera*.

Two NPV spray applications were given to the crop, first at 50 per cent podding and second at an interval of 7 days. First application coincided with appearance of early instar larvae in the field. An adhesive Wetwell was added @ 2 ml/litre of spray solution in all the NPV treatments. Evaluation of treatments was based on larval count and seed yield. Sampling was done to record the larval population in chickpea crop, before treatment and 3 and 7 days after treatment. Each sample consisted of ½ x ½m crop canopy. Five such samples were observed in each plot/ replication. Seed yield in different treatments was recorded at harvest. The data on larval population and seed yield were subjected to the analysis of variance. Economics of different treatments was also worked out.

RESULTS AND DISCUSSION

The data on mean larval population of *H. armigera* in chickpea, recorded before treatment and 3 and 7 days after first and second sprays, are presented in Table 1.

Table 1. Evaluation of NPV with adjuvants and UV protectants against *H. armigera* in chickpea

Sl. No.	Treatment and dose/ha	Mean larval population / sample*					
		Pre-treatment	After first spray		After second spray		
			3 days	7 days	3 days	7 days	10 days
1	**NPV @ 250 LE+Robin blue 0.5%	7.93	5.93 (2.42)	5.60 (2.35)	1.26 (1.12)	0.33 (0.56)	0.66 (1.05)
2	NPV @ 250 LE+Ranipal 0.5%	7.86	5.86 (2.41)	4.93 (2.21)	0.93 (0.96)	0.26 (0.50)	0.00 (0.70)
3	NPV @ 250 LE+Milk powder 1.0%	7.33	6.00 (2.44)	5.46 (2.33)	1.00 (0.99)	0.33 (0.55)	0.33 (0.88)
4	NPV @ 250 LE+Boric acid 0.5%	7.53	6.13 (2.46)	5.53 (2.34)	1.06 (1.03)	0.46 (0.65)	0.66 (1.05)
5	NPV @ 250 LE+Crude sugar 1.0%	7.00	6.26 (2.49)	5.60 (2.36)	0.86 (0.92)	0.26 (0.50)	0.00 (0.70)
6	NPV @ 250 LE+Crude sugar 1.0% + Robin blue 0.5%	7.66	6.73 (2.58)	5.53 (2.34)	1.60 (1.08)	0.26 (0.50)	0.00 (0.70)
7	NPV @ 250 LE+Boric acid 0.5%+ Ranipal 0.5%	7.13	7.46 (2.72)	5.33 (2.30)	1.06 (1.03)	0.26 (0.50)	0.00 (0.70)
8	NPV @ 250 LE alone	7.46	7.93 (2.81)	7.00 (2.63)	2.26 (1.48)	0.86 (0.92)	2.33 (1.67)
9	Endosulfan 0.07%	7.46	6.00 (2.44)	5.46 (2.33)	1.26 (1.11)	0.26 (0.50)	1.00 (1.22)
10	Untreated control	7.26	9.40 (3.06)	9.20 (3.03)	3.86 (1.95)	1.46 (1.19)	4.33 (2.19)
	SEM±	0.35	0.06	0.05	0.07	0.07	0.10
	CD (P=0.5)	NS	0.17	0.16	0.22	0.21	0.30

* Mean of 15 samples

** 1 LE represented 6×10^9 POBs

Figures in parentheses are transformed values $\sqrt{x+0.5}$

Larval population of *H. armigera* in chickpea

Pre-treatment mean larval population ranged between 7.0 and 7.9 larvae per sample (½ x ½m crop canopy) in different plots. The differences were statistically non-significant at 5 per cent level of significance.

All the treatments registered significantly lower larval population than untreated control (9.4 larvae per sample) 3 days after first application. Lowest population (5.86 larvae) was recorded in the treatment of NPV+Ranipal 0.5 per cent spray, however, it was on par with NPV+Robin blue 0.5 per cent, NPV+milk powder 1.0 per cent and Endosulfan 0.07 per cent spray treatments.

Seven days after application, all the treatments registered significantly lower larval population as compared to untreated control (9.2 larvae/sample). All other treatments, except application of NPV alone, were found statistically on par, with the larval population ranging between 4.9 and 5.6.

After second spray

All the treatments had significantly lower larval population than untreated control (3.8 larvae/sample) 3 days after application. Other treatments, except NPV application alone, were statistically on par with the population level of 0.8 to 1.2 larvae/sample.

Seven days after application, all the treatments registered significantly lower larval population than untreated control (1.46 larvae/sample). Larval population in the treatment of NPV alone was significantly higher (0.86 larva), while in remaining treatments it was on par with less than 0.46 larva/sample.

Significantly lower larval population was recorded in all treatments as compared to untreated control (4.33 larvae/sample) on 10th day. Treatments with adjuvants and UV protectants proved better as compared to the application of NPV alone.

Seed yield

Significantly higher seed yields of 1612.5 and 1550.0 kg/ha were observed in the treatments of NPV+milk powder 1.0 per cent and NPV+Ranipal 0.5 per cent, respectively and both were statistically on par (Table 2). All the treatments had significantly higher seed yield than untreated control (791.5 kg/ha). Seed yields in remaining treatments ranged between 1121.0 and 1266.5 kg/ha and were on par.

Economics of treatments

Highest return per rupee invested (1:7.38) was recorded in endosulfan treatment. Application of NPV+Ranipal 0.5 per cent registered a return of 1:5.94. Although NPV application with milk powder gave highest seed yield, the return/rupee invested was 1:5.23 due to higher cost of milk powder.

Application of NPV with adjuvants and UV protectants proved better as compared to the application of NPV alone. Treatments having different adjuvants and UV protectants did not show significant variation in larval population, however, NPV application with milk powder (1.0%) or Ranipal (0.5%) proved most effective from the yield point of view. Although the crop condition of different experimental plots was uniform in all respects, some hidden factors working behind the yield factor cannot be neglected considering the yield variation. Rabindra *et al.* (1989) also found encouraging results of NPV application against *Helicoverpa armigera* with the addition of whole milk (20%) and Ranipal (0.5%). Different adjuvants and UV protectants are being tested in the past and have been described to be effective in increasing the virulence and persistence of NPV. Chundurvar *et al.* (1990) recorded greatest larval mortality using NPV in combination with boric acid (0.5%), while Sonalker *et al.* (1997) found the addition of crude sugar (0.5%) as effective in increasing the NPV efficacy. Dhandapani *et al.* (1993) reported a higher concentration of crude sugar (15%) along with larval extract addition (4%) to NPV sprays, as effective in increasing the

Table 2. Economics of control operations

Sl. No.	Treatments and dose/ha	Seed yield (kg/ha)	Increase in yield (kg/ha) over control	Value of yield saved by treatment (Rs.)	Cost of treatment	Additional return per rupee invested
1	NPV @ 250 LE+ Robin blue 0.5%	1250.0	458.5	7107	1454	4.80
2	NPV @ 250 LE+Ranipal 0.5%	1550.0	758.5	11757	1979	5.94
3	NPV @ 250 LE+Milk powder 1.0%	1612.5	821.0	12726	2429	5.23
4	NPV @ 250 LE+ Boric acid 0.5%	1175.0	383.5	5944	1654	3.59
5	NPV @ 250 LE+Crude sugar 1.0%	1204.0	412.5	6394	1189	5.37
6	NPV @ 250 LE+ Crude sugar 1.0% + Robin blue 0.5%	1266.5	475.0	7363	1614	4.56
7	NPV @ 250 LE+ Boric acid 0.5% + Ranipal 0.5%	1204.0	412.5	6394	2604	2.45
8	NPV @ 250 LE alone	1121.0	329.5	5107	1029	4.96
9	Endosulfan 0.07%	1208.0	416.5	6456	874	7.38
10	Untreated control	791.5	-	-	-	-

persistence and activity. In the present investigation also the milk powder, Ranipal, boric acid and crude sugar addition to NPV resulted in greater larval reduction, probably due to longer persistence and thereby increased seed yield by continuously suppressing larval population for a longer period.

Study on economics of control operations indicated highest return per rupee invested (7.38) in case of endosulfan treatment. Although it has a significantly lower seed yield than other treatments, it resulted in highest return per rupee invested due to lower insecticidal cost.

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