International Journal of Farm Sciences **1(2)** :105-110, 2011

Bio-efficacy of commercial neem products and Ha NPV against bollworms of cotton

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ABSTRACT

Field evaluation of eight commercial neem based formulations viz Neem Gold, Nimbo Bas, Multineem, Nimbex, NeemAzal, Nimbecidine, Neemarin and Achook having 0.03, 0.15, 0.03, 0.03, 1.00, 0.03, 0.15 and 0.03 per cent azadirachtin, respectively, neem seed kernel extract (NSKE) (5%) and Ha NPV was done against the bollworms of cotton. Four NPV products viz Helicide, Helinash, Biovirus and PDBC virus were also evaluated for their efficacy against the bollworms of cotton. NSKE, NeemAzal and Nimbecidine were found to be highly effective in reducing the damage to the cotton bolls. Among the four Helicoverpa NPV products, PDBC virus and Helinash were the most effective in suppressing the damage by the bollworms. All the biopesticides were superior to the standard check, endosulfan, in preventing the damage to bolls after four sprays recording significantly higher yields over untreated control. The cotton plots treated with NSKE (5%) recorded the highest yield of 11.60 q/ha followed by the plots treated with NeemAzal (11.05 q/ha), PDBC virus (10.49 q/ha), Nimbecidine (10.43q/ha), Helinash (10.12 q/ha) and Nimbo Bas (9.88 q/ha).

Keywords : Neem, bollworms , cotton, Ha NPV

INTRODUCTION

Cotton is an important cash crop playing a key role in the economy of Indian farmers. In India, cotton is grown in an area of 89.60 lakh hectares with a production of 232 lakh bales and productivity of 440 kg lint/ha as against world average production of 682 kg lint / ha (Anon 2005). About 156 species of insect pests have been reported to be associated with cotton from India of which only a few cause economic damage to the crop (Sundaramurthy 1985). In this crop, the bollworm complex viz spotted bollworms (*Earias vittella* and *E insulana*), the pink bollworm (*Pectiniphora gossypiella*), and the American bollworm (*Helicoverpa armigera)* account for a considerable yield loss to the extent of 32.6 per cent. A wide range of insecticides have been used effectively for reducing the pest population.

However, negligence of the principles in the crop protection and indiscriminate and extensive use of synthetic pesticides in cotton ecosystem has led to problems like insecticidal resistance, pest resurgence and destruction of natural enemies. Considering the above aspects, the present study was undertaken to evaluate some neem formulations and Ha NPV for the management of bollworm complex of cotton.

MATERIAL AND METHODS

The study was carried out at Zonal Agricultural Research Station, Hiriyur during 2002-2003 to study the bio-efficacy of commercial neem based formulations, neem seed kernel extract (NSKE) and Ha NPV against the bollworm complex of cotton. The recommended agronomical practices were followed as per the package of practices for cotton. The cotton variety DCH 32 was sown with a plot size of 7.0 x 2.0 m and a spacing of 150 x 120 cm was maintained.

The neem based formulations viz Neem Gold, Nimbo Bas, Multineem, Nimbex, NeemAzal, Nimbecidine, Neemarin and Achook having 0.03, 0.15, 0.03, 0.03, 1.00, 0.03, 0.15 and 0.03 per cent azadirachtin, respectively, and neem seed kernel extract (NSKE 5%) were evaluated besides four NPV products viz Helicide (1 ml/l), Helinash (1 ml/l), Biovirus (1 ml/l) and PDBC virus (1 ml/l) against bollworms with endosulfan (0.05%) (most widely used by the farmers in the study area to control bollworms in cotton) as standard check. The experiment was laid out in a Completely Randomised Block Design (CRBD) with fifteen treatments and three replications. A total of four sprays were given at ten days interval using a high volume hydraulic sprayer. The yield data were collected and the cost:benefit ratio was worked out for each treatrment. Observations on the number of bolls damaged per plant were recorded one day before, three and ten days after each spray. The data were subjected to statistical analysis using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The results on bio-efficacy of neem formulations, NSKE, NPV products and endosulfan against the bollworms of cotton are presented in Table 1. The number of damaged bolls per plant ranged from 7.00 to 9.73 before spraying. No effect of these insecticides was found up to 10 days. However, ten days after the second spray, two neem formulations namely NeemAzal, Nimbecidine NSKE, and three Helicoverpa NPV products viz Helinash, Helicide and PDBC virus appeared to be more effective in reducing the boll damage (2.20 to 4.20 damaged bolls as against 10.33 damaged bolls per plant in untreated control), being statistically on par with other treatments except endosulfan.

Table1. Bio-efficacy of neem formulations and Ha NPV against bollworms in cotton during 2002-03

Treatments	Before Spray	**Mean number of damaged bolls/plant							
		I Spary		II Spary		III Spray		IV Spray	
		3 DAS	10 DAS	3 DAS	10 DAS	3 DAS	10 DAS	3 DAS	10 DAS
NSKE (5%)	7.00 (2.71^{a})	9.07(3.08^{a})	4.00 (2.10^{a})	4.20 (2.14^{a})	2.20 (1.61^{a})	1.80 (1.45^{a})	0.02 (0.83^{a})	0.00 (0.71^{ab})	0.00 (0.71^{a})
Neem Gold (0.03% aza)	9.73 (3.18^{a})	9.20 (3.09^{a})	7.40 (2.77^{a})	16.8 (3.74^{b})	4.20 (2.13^{ab})	3.20 (1.90^{ab})	1.40 (1.36^{abcd})	1.00 (1.16^{ab})	1.40 (1.29^{ab})
Nimbo Bas (0.15% aza)	9.33 (3.12^{a})	8.47 (2.98^{a})	6.40 (2.61^{a})	6.33 (2.55^{ab})	3.87 (2.05^{ab})	4.20 (2.15^{ab})	1.33 (1.32^{abcd})	1.20 (1.24^{ab})	1.00 (1.19^{ab})
Multineem (0.03% aza)	7.67 (2.84^{a})	8.00 (2.91^{a})	5.87 (2.50^{a})	6.07 (2.55^{ab})	4.80 (2.23^{ab})	4.20 (2.10^{ab})	1.80 (1.36^{abcd})	1.00 (1.17^{ab})	1.20 (1.26^{ab})
Nimbex (0.03% aza)	8.87 (3.03^{a})	8.20 (2.94^{a})	6.67 (2.63^{a})	5.40 (2.31^{ab})	4.00 (2.11^{ab})	5.20(2.37^{abc})	2.60 (1.74^{cd})	1.60 (1.40^{b})	1.40 (1.36^{b})
NeemAzal (1.0% aza)	7.53 (2.82^{a})	7.00 (2.73^{a})	4.33 (2.14^{a})	4.13 (2.13^{a})	2.47 (1.70^{a})	2.13 (1.57^{a})	0.60 (1.02^{abc})	0.00 (0.71^{ab})	0.00 (0.71^{a})
Nimbecidine (0.03% aza)	9.33 (3.10^{a})	10.33(3.27^{a})	6.27 (2.56^{a})	5.20 (2.35^{ab})	3.20 (1.91^{a})	2.93 (1.79^{ab})	1.40 (1.35^{abcd})	0.40 (0.92^{ab})	0.00 (0.71^{a})
Neemarin (0.15 % aza)	8.00 (2.91^{a})	8.00 (2.88^{a})	6.56 (2.62^{a})	6.20 (2.55^{ab})	4.93 (2.23^{ab})	3.80 (2.05^{ab})	2.27 (1.61^{bcd})	1.80 (1.42^{b})	1.20 (1.24^{ab})
Achook (0.03% aza)	8.13 (2.93^{a})	8.00 (2.91^{a})	5.20 (2.36^{a})	4.93 (2.23^{ab})	3.80 (2.06^{ab})	2.93 (1.76^{ab})	1.27 (1.30^{abcd})	1.20 (1.29^{ab})	1.00 (1.17^{ab})
Helicide NPV	8.80 (3.04^{a})	7.87 (2.86^{a})	6.00 (2.50^{a})	6.20 (2.54^{ab})	4.20 (2.13^{a})	3.47 (1.90^{ab})	1.20 (1.23^{abcd})	1.20 (1.24^{ab})	1.60 (1.36^{b})
Helinash NPV	8.20 (2.93^{a})	8.13 (2.93^{a})	5.60 (2.37^{a})	5.20 (2.33^{ab})	3.20 (1.91^{a})	2.80 (1.79^{ab})	0.40 (0.93^{ab})	0.00 (0.71^{ab})	0.00 (0.71^{a})
Biovirus NPV	9.27 (3.10^{a})	9.00 (3.02^{a})	7.07 (2.71^{a})	6.53 (2.60^{ab})	4.20 (2.15^{ab})	3.80 (2.05^{ab})	3.00 (1.85^{e})	1.40 (1.31^{ab})	2.20 (1.62^{ab})
PDBC Virus	9.00 (3.07^{a})	9.07 (3.08^{a})	4.80 (2.23^{a})	4.93 (2.27^{ab})	3.20 (1.91^{a})	2.00 (1.46^{a})	0.20 (0.82^{a})	0.00 (0.47^{a})	0.00 (0.71^{a})
Endosulfan (2ml/l)	9.20 (3.10^{a})	9.27 (3.08^{a})	8.76 (3.01^{a})	7.80 (2.87^{ab})	7.80 (2.82^{bc})	6.67 (2.64^{bc})	6.00 (2.50^{e})	5.20 (2.31^{c})	4.00 (2.07^{c})
Control	7.27 (2.77^{a})	8.20 (2.94^{a})	9.53 (3.11^{a})	9.00 (3.07^{ab})	10.33 (3.22^{c})	9.87 (3.18^{c})	10.00 (3.21^{f})	10.80 (3.31^{d})	10.00 (3.23^{d})
F-test	NS	NS	NS	*	*	*	*	*	*

DAS : Days After Spray NSKE : Neem Seed Kernel Extract

NS : Non Significant *Significant at p = 0.05 by DMRT

Values followed by letters along the columns are not significantly different

Values in parentheses are square root transformed values (“x + 0.5) **Mean of three replications

Ten days after the third spray, NSKE (5%) and PDBC NPV were the best products in reducing the damage to bolls, recording only 0.02 and 0.20 damaged bolls per plant as against 10.00 damaged bolls per plant, respectively, in untreated control. However, the other products namely NeemAzal , Nimbo Bas, Helinash, Nimbecidine , Neem Gold, Helicide, Achook and Multineem were equally effective and comparable with NSKE and PDBC NPV. The next best products were Nimbex (2.60) and Biovirus NPV (3.00) which were significantly different from other neem formulations, NSKE and Ha NPV, however, on par with endosulfan. All the neem formulations and Ha NPV products were either superior or on par with the standard check, endosulfan.

Ten days after the fourth spray, NSKE, NeemAzal , Nimbecidine , Helinash and PDBC virus treated plots were totally free from damage of bollworms indicating the effective suppression of the pest by these products. The other products viz Neem Gold, Nimbo Bas, Multineem, Neemarin, Achook and Helicide NPV with 1.40, 1.00, 1.20, 1.20, 1.00 and 1.60 damaged bolls/plant, respectively, were equally effective in suppressing the pest damage and all three formulations were superior over the standard check, endosulfan. The number of damaged bolls ranged from 0 to 2.20 per plant in treated plots as against 4.00 and 10.00 damaged bolls per plant in endosulfan treated and untreated control plots, respectively.

Based on the extent of damage to cotton bolls and the yield data, it is also clear that application of neem based formulation, NSKE and Ha NPV helped in protecting the cotton crop from bollworms. Among the neem formulations, NeemAzal (1.0 % aza) and Nimbecidine (0.03 % aza) and NSKE (5.0 %) were highly effective in reducing the damage to cotton bolls followed by other neem formulations. These results are in confirmation with those of Mann et al (2001a, 2001b) who also reported minimum boll damage with application of NeemAzal (1%). Similarly Dhawan and Simwat (1998) reported NeemAzal (1.0 % aza) was as effective as quinalphos (2ml/l) against young larvae. The present findings are also in agreement with Duraimurugan and Reghupathy (2005) who reported that the application of NSKE (5.0 %) in reducing the incidence of *H armigera* and damage to fruiting bodies, bolls, locules and interlocules. Also Mohapatra and Patnaik (2006) registered lower boll damage with NSKE (5%) when used as one of the components of IPM module. Among the four Ha NPV products tested, PDBC virus and Helinash were found to be most effective in suppressing the bollworms followed by Helicide (1ml/l) and Biovirus (1ml/l). The present results are more or less similar to findings of Sarode et al (1996) who reported that NPV 400 LE and 500 LE and NSKE (6%) gave minimum infestations of open bolls. All the test insecticides were superior to the standard check, endosulfan in preventing the damage

to bolls after four sprays recording significantly higher yields over untreated control.

Yield

The yield of cotton and cost:benefit ratios of different bio-pesticides and endosulfan are presented in Table 2. The cotton plots treated with NSKE (5%) recorded significantly highest yield of 11.60 q/ha and was on par with plots treated with NeemAzal (11.05 q/ha), PDBC virus (10.49 q/ha), Nimbecidine (10.43q/ha), Helinash (10.12 q/ha) and Nimbo Bas (9.88 q/ha). The present study on yield of cotton are in agreement with the findings of Sarode et al (1996) who reported maximum yield from NSKE (5.0 %) treated plots. The plot treated with endosulfan recorded significantly lower yield (4.2 q/ha) and was on par with control plot (2.44 q/ha).

Table 2. Yield and Cost:Benefit ratio for different neem formulations, NSKE and Ha NPV products against bollworms of cotton during 2002-03

Treatments	Yield(q/ha)	Additional Yield over control (q/ha)	Cost:Benifit ratio
NSKE (5%)	11.6^{a}	9.16	84.55
Neem Gold (0.03% aza)	8.52^{bcde}	6.08	22.80
Nimbo Bas(0.15% aza)	9.88^{abcd}	7.44	35.71
Multineem (0.03% aza)	8.46^{bcde}	6.02	11.20
Nimbex (0.03% aza)	7.53^{de}	5.09	6.71
NeemAzal (1.0% aza)	11.05^{ab}	8.61	3.34
Nimbecidine (0.03% aza)	10.43^{abc}	7.99	19.37
Neemarin (0.15 % aza)	7.47^{de}	5.03	12.32
Achook (0.03% aza)	8.39^{bcde}	5.95	12.00
Helicide NPV	8.02^{cde}	5.58	6.44
Helinash NPV	10.12^{abcd}	7.68	8.61
Biovirus NPV	7.04^{e}	4.60	3.69
PDBC Virus	10.49^{abc}	8.05	7.61
Endosulfan	4.2^{f}	1.76	2.87
Control	2.44^{f}	-	-
$CD_{0.05}$	2.43		

Price of cotton : Rs 1800/q

Labour cost : Rs 180/day

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Received : 17.3.2011 *Accepted : 4.4.2011*