Evaluation of *Ha*NPV 100 LE in different sprayers for management of pigeonpea pod borer *Helicoverpa armigera* (Hubner)

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ABSTRACT

The study was conducted to evaluate the different sprayers in the management of pod borer using *Ha*NPV 100 LE per ha at the Agricultural Research station, Gulbarga, Karnataka, for two successive years in 2011 and 2012. The results of a year 2011 revealed that lowest mean pod borer larval population (1.16) per five plants at five days after spray recorded in the plot sprayed with Taiwan sprayer, and the results of a year 2012 also revealed that, lowest mean larval population (0.66) per five plants recorded in plots sprayed with Taiwan sprayer. Yield parameters of both years recorded a lowest pod damage (17.22 %), grain damage (13.53 %) and higher grain yield (11.51 q/ha) with high B:C ratio (3.46) in the plots sprayed with Taiwan sprayer. Tractor mounted sprayer was the next best to Taiwan sprayer in the management of pod borer. The foregoing studies indicated that the performance of Taiwan sprayer and tractor mounted sprayer were superior to other sprayers in terms of time taken to cover unit area, suppression of larval population, reduction in pod damage and harnessing higher yield.

Key words: *Ha*NPV, *Helicoverpa armigera*, High volume sprayer, Pigeonpea,Taiwan sprayer

INTRODUCTION

Among the many factors responsible for low yields of pigeonpea in India, insect pests are the major ones. Though the pest spectrum of pigeonpea crop includes 200 insects and mites, the major insect causing heavy loss is the pod borer, *Helicoverpa armigera* (Hubner) and thus determining the yields of pigeonpea crop (Saxena, 2012). In integrated pest management selection of right plant protection appliances is as important as use of recommended insecticides. Several insecticides, newer molecules, botanicals and bioagents are most promising against pod borer but the efficacy has been limited due to the lack of application technology under field conditions, especially in pigeonpea ecosystem (Siddegowda *et al*., 2012). Khanapara and Kapadia (2011) reported that high volume application of NPV was effective in controlling *H. armigera* on chickpea and ULV spray was most effective. The efficacy of insecticides in the insect management is mainly influenced by the amount of chemical used in a unit area of target, deposit of the chemical on the area and percentage of the target area receiving the pesticides. the above three factors *viz*., dose, distribution and coverage are dependent on the droplet size and density of the chemical which in turn is dependent on the type of application *viz.,* high volume, low volume and ultra low volume spray application. However each method of spraying has its own merits and demerits, based on this concept the investigation was undertaken to evaluate different spraying systems *viz.,* high volume using knapsack sprayer, Taiwan sprayer, tractor mounted sprayer, gator sprayer low volume using air blast sprayer and ultra low volume using controlled droplet applicator (CDA) to suppress *H. armigera* in pigeon pea under field conditions.

MATERIAL AND METHODS

Commonly used spray equipments like knapsack sprayer, taiwan sprayer, tractor mounted sprayer, gator sprayer, air blast sprayer and ultra low volume sprayer (CDA) were evaluated for their effectiveness and uniform distribution of *Ha*NPV on plant surface. High volume sprayer particularly HTP (Hydraulic three piston) sprayer was mounted on tractor for uniform coverage and distribution. The details of the treatments are furnished in Table 1. Randomized block design (RBD) was used with seven treatments replicated three times with a plot size of 5.4 x 4.8 m. 'Maruti' (ICP 886) pigeonpea variety having duration of 150-160 days was sown in first week of July in 2011 and 2012. The crop was raised by following recommended agronomic practices (Anonymous, 2009). The treatments imposed with a spray fluid of 1000 liters per hectare (0.5 mL/L) for high volume sprayer, 250 liters per hectare for low volume sprayer and 15 liters per hectare for ultra low volume sprayer **(**ULV**)** Common adjuvant consisting of jaggery 0.5% (feeding adjuvant) and blue 0.1% (UV protectant) were

used along with *Ha*NPV. Totally two sprays of *Ha*NPV @ 100 LE/ha were taken at 20 days interval starting from when the larval count exceeded economic threshold level of 1 larva or 2 eggs per plant. Observation on larval population was made on five randomly selected plants in each plot, leaving the border rows. Pre-treatment counts were made one day prior to application and subsequently the larval population was observed at five days after each spray. At the time of harvest per cent pod damage was estimated by counting the total number of pods and the affected pods on five randomly selected plants in each treatment. Similarly, seed damage was also recorded from 100 damaged pods. At harvest, the pods from individual plots were threshed separately and the yield was recorded from the net plot area. The yield data were computed to quintals per hectare and subjected to statistical analysis. The data from two years were subjected to statistical analysis by analysis of variance method and computed to in multiple ranges by using DMRT test as suggested by Gomez and Gomez (1984). Considering the present costs of various inputs of all the treatments and the market price of pigeonpea, the B:C (Benefit cost) ratio values for each treatment are worked out and presented in the respective tables.

RESULTS AND DISCUSSION

Both larval mortality and yield parameters depicted that all the three types of sprayers *viz.,* high volume (HV), low volume (LV) and ultra low volume (ULV) sprayers were significantly superior to untreated check (Table 1). Among the three types of sprayers, high volume sprayers (Knapsack sprayers, Taiwan sprayer, tractor mounted sprayer and gator sprayer) were significantly superior to rest of the sprayers in reducing the larval population and produced higher grain yield. Both air blast (LV) and ultra low volume sprayer were on par with each other in grain damage but inferior to high volume sprayers. The results of year 2011 data revealed that, population of pod borer larvae at five days after application ranged from 1.16 to 6.83 per five plants in different treatments. Significantly lower population was recorded in Taiwan sprayer followed by tractor mounted sprayer. Whereas, knapsack sprayer, gator sprayer and air blast sprayer recorded larval population of 1.83, 2.16 and 2.83 per five plants respectively. Dispersion of *Ha*NPV through ultra low volume sprayer recorded higher larval population per five plants (Table 1). This might be due to the uneven distribution of virus particles on pigeonpea crop.

Table 1. Efficacy of different sprayers for the management of *H. armigera* using *Ha*NPV @ 500 mL/ ha

Different sprayers	Spray volume (lit/ha)	Area covered (ha/day)	Larval population per five plant (Kharif, 2011)				Larval population per five plant (Kharif, 2012)			
			1DBS	Five days after spray			1DBS	Five days after spray		
				1 spray	2 spray	Mean		1 spray	2 spray	Mean
Knapsack sprayer	500	1.0	6.66	2.66	1.00	1.83	7.33	2.33	1.33	1.83
Taiwan sprayer	500	3.0	6.33	1.66	0.66	**1.16**	6.33	1.66	0.33	**0.66**
Tractor mounted sprayer	1000	6.0	6.00	2.33	0.33	**1.33**	6.00	1.00	0.33	**0.99**
Gator sprayer	500	1.8	7.00	3.00	1.33	2.16	7.00	2.66	1.33	1.99
Air blast sprayer	250	2.0	7.33	4.00	1.66	2.83	7.66	3.33	2.00	2.66
Ultra low volume sprayer (ULV)	15	2.0	7.33	4.66	2.00	3.33	8.00	3.33	2.33	2.83
Untreated check	-	-	8.66	7.33	6.33	6.83	8.66	7.66	6.66	7.16
S.E±			0.19	0.06	0.06	0.06	0.21	0.07	0.06	0.06
CD (P = 0.05)			NS	0.18	0.18	0.18	NS	0.21	0.18	0.19

DAS – Days after spray DBS – Days before spray NS – Non significant df = 12

Means followed by the same letter(s) in a coloumn are not significantly different by DMRT (P=0.05)

Table 2. Mean two years data on yield parameters and B:C ratio of pigeonpea as influenced by usage of different sprayers

Different sprayers	Pod damage (%)	Grain damage (%)	Yield (q/ha)	B:C ratio
Knapsack sprayer	22.53	16.83	1027	3.08
Taiwan sprayer	17.22	13.53	1151	3.46
Tractor mounted sprayer	19.33	14.73	1106	3.38
Gator sprayer	25.33	19.53	1004	3.07
Air blast sprayer	28.16	22.60	937	2.88
Ultra low volume sprayer	31.83	24.60	866	2.75
Untreated check	48.80	39.80	515	2.14
S.E±	1.08	0.60	0.10	-
CD (P = 0.05)	3.24	1.87	0.31	-

B:C – Benefit cost ratio, df = 12

Means followed by the same letter(s) in a column are not significantly different by DMRT (P = 0.05)

Similarly in the year 2012, Taiwan sprayer recorded mean larval population per five plants, and tractor mounted sprayer recorded 0.99 larvae per five plants. Whereas other high volume sprayer such as knapsack sprayer, gator sprayer also proven superior compare to other low volume sprayers but inferior to taiwan and tractor sprayer (Table I). The differences in the uniformity and thorough coverage accounted for discrepancies. The results of Gopali *et al.* (2009), Mundhe (1987), Rabindra *et al.* (1989) agree with the superiority of Taiwan and tractor mounted high volume sprayers, contrasted with the efficacy of low volume sprayer in pigeonpea ecosystem.

Yield parameters revealed lowest per cent of pod damage, lowest per cent grain damage and highest pigeonpea yield in the plots sprayed with Taiwan sprayer. Tractor sprayer also recorded the lowest per cent of pod damage, lowest per cent grain damage and highest pigeonpea yield and this was in conformity with the reports of Gopali *et al*. (2009) and Siddegowda *et al*. (2012). Knapsack sprayer was on par with gator sprayer in yield (Table 2). Dispersion of *Ha*NPV through Ultra low volume sprayer (ULV) resulted in lower grain yield with a B:C ratio of 2.14 compared to HV sprayers indicating uneven distribution of virus particles on pigeonpea crop. Both taiwan and tractor high volume sprayers proved to be superior in terms of time taken to over unit area, and suppressing pod borer population in pigeonpea ecosystem with a B:C ratio of 3.46 and 3.38 respectively.

The overall present study concluded that taiwan sprayer is found to be superior when compared to other sprayers for the management of pod borer (*Helicoverpa armigera*), as it recorded minimum pod borer population per five plants, at five days after spraying in all the sprays given during both years, It also recorded lowest per cent pod damage, lowest per cent grain damage and highest grain yield which was closely followed by tractor mounted sprayer. Knapsack and gator sprayer were next best in reducing pod borer population. Air-blast sprayer and Ultra low volume sprayer were inferior and recorded higher pod borer population and lower grain yield.

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