Evaluation of an IPM Module against the Leafhopper, *Amrasca devastans* (Distant) in Cotton

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ABSTRACT

To develop an IPM module against cotton leafhopper different tactics like, leafhopper resistant cultivar (KC 2) were integrated in different combinations and were evaluated. When the susceptible LRA 5166 was raised from imidacloprid treated seed with cluster bean intercrop and need based application of dimethoate 0.03 % leafhopper population was reduced by 79.01 per cent and seed cotton yield increased by 31.76 %. The pest reduction was 57.08 % with mere introduction of resistant cultivar *viz.,* KC 2; the yield increase was 58.82 %. The yield increase was 125.88 % when the resistant cultivar KC 2 was raised from imidacloprid treated seeds, grown with cluster bean intercrop and applied with dimethoate on need basis.

Key words: Cotton, *Amrasca devastans,* intercrop, seed treatment, imidacloprid

INTRODUCTION

Pesticide load in crop ecosystem has culminated in many undesirable effects such as resistance, resurgence, residues *etc*., disturbing the agro-ecosystem. Sprays and soil application of pesticides are costly and cumbersome to adopt. In India, 45 percent of the pesticides are applied (Chaudhary and Laroia, 2001) in cotton alone. So it is imperative to find out eco-friendlier components of integrated pest management. Eco-friendly, less costly measures such as cropping system approach, seed treatment, plant products are fitting well in Integrated Pest Management (IPM) as they are more advantageous over insecticides (Kiritani, 1979). The choice of methods in the IPM strategy depends upon the locality, insect species complex and efficiency and economics of pest control measures. There is a great potential for management of different insect pests of cotton based on IPM technology (Simwat, 1994; Gautam, 1998). Hence, a study was made with an objective of developing an IPM Module integrating resistant cultivar, cropping system approach, seed treatment, need based application of insecticides against the cotton leafhopper *Amrasca devastans* (Distant).

METHODOLOGY

Field experiments on the integration of different tactics of pest management *viz*., resistant cultivar, seed treatment, cropping system approach and need based application of insecticides were taken up during Summer 2003 at Thirupanikarisalkulam farmer's field with twelve treatments. The experiment was replicated thrice in randomized block design. The plot size was 80 m^2. In the plots with intercropping treatment a row of cluster bean was raised in between every paired row of cotton. The total population of cotton plants was maintained as that of pure crop. The treatments were: T_1-LRA 5166 – no treatment; T_2 - LRA 5166 + seed treatment with imidacloprid 17.8 SL (10 ml kg^{-1}); T_3 - LRA 5166 + cluster bean; T_4 - LRA 5166 + spraying with dimethoate 30 EC (0.03 percent) at ETL; T_5 - LRA 5166 + seed treatment with imidacloprid 17.8 SL (10 ml kg-1) + cluster bean; T_6- LRA 5166 + seed treatment with imidacloprid 17.8 SL (10 ml kg-1) + cluster bean + spraying with dimethoate 30 EC (0.03 percent) at ETL; T_7 - KC 2 – no treatment; T_8 -KC 2 + seed treatment with imidacloprid 17.8 SL (10 ml kg^{-1}); T_9 - KC 2 + clusterbean; T_{10} -KC 2 + spraying with dimethoate 30 EC (0.03 percent) at ETL; T_{11} -KC 2 + seed treatment with imidacloprid 17.8 SL (10 ml kg^{-1}) + cluster bean; and T_{12} - KC 2 + seed treatment with imidacloprid 17.8 SL (10 ml kg^{-1}) + cluster bean + spraying with dimethoate 30 EC (0.03 %) at ETL.

The acid delinted (using concentrated sulphuric acid @ 100 ml kg^{-1} of seed) seeds were used for the experiments. In case of imidacloprid seed treatment, to treat one kg of seed 0.5 g of *Acacia* gum powder and 20 ml of water were used. Gum was dissolved in water and then mixed with the 10 ml imidacloprid 17.8 SL. The seeds were thoroughly mixed with gum + insecticide mixture, dried under shade and kept for 24 hours before sowing. Untreated acid delinted seeds served as untreated check (UTC).

Statistical Analysis

The data were transformed into angular or square-root values for statistical scrutiny, wherever necessary (Gomez and Gomez, 1984). The experiments were subjected to statistical scrutiny following the method of Panse and Sukhatme (1989) and Gomez and Gomez (1984) and the means were compared with Least Significant Difference (L.S.D.).

RESULTS

The result of the field experiment conducted on thee integration of different tactics of pest management *viz*., resistant cultivar, seed treatment, cropping system approach and need based application of insecticides is presented in Table 1. Variability in the leafhopper population among the treatments was distinguishable. Mean leafhopper population ranged from 0.89 to 4.24 and 0.58 to 1.82 for LRA 5166 and KC 2 respectively. KC 2 crop grown from imidacloprid treated seeds, raised along with cluster bean and sprayed with dimethoate based on ETL (0.58/3 leaves) recorded the least incidence of leafhopper. It was followed by LRA 5166 crop grown from imidacloprid treated seeds, raised along with cluster bean and sprayed with dimethoate based on ETL (0.89/3 leaves) followed by KC 2 crop grown from imidacloprid treated seeds and raised with cluster bean intercrop (1.00/3 leaves); however the latter treatment was on a par with KC 2 crop sprayed with dimethoate (1.12/3 leaves) and KC 2 crop raised from imidacloprid treated seeds (1.28/3 leaves).

LRA 5166 grown from imidacloprid treated seeds and raised along with cluster bean (1.48/3 leaves) equaled the former treatments as well as LRA 5166 crop protected with dimethoate at ETL (1.54/3 leaves), KC 2 crop raised along with cluster bean (1.59/3 leaves) and imidacloprid seed treated LRA 5166 (1.90/3 leaves). Untreated KC 2 (1.82/3 leaves) was better than LRA 5166 with cluster bean intercrop (2.22/3 leaves) and untreated LRA 5166, but was on a par with LRA 5166 under need based protection, KC 2 raised with cluster bean and LRA 5166 crop raised from imidacloprid treated seeds. Among the treatments with LRA 5166, LRA 5166 infused with all tactics (560 kg ha^{-1}) and LRA 5166 crop under need-based protection (535 kg ha^{-1}) were able to register significantly higher yield than other treatments and untreated LRA 5166 (425 kg ha^{-1}); whereas with respect to the treatments with KC 2, all the treatments were able to register 5.19 to 42.22 percent higher yield than untreated KC 2 (675 kg ha^{-1}).

DISCUSSION

The most viable option to manage the cotton pests is the integrated pest management. Actual integration involves proper choice of compatible tactics and blending them so that each component potentates or complements the other. Probably, the earliest example of integration of techniques was the use of a combination of resistant varieties and sanitation practices as prophylactic measures combined with application of calcium arsenate at high population level in case of boll weevils on cotton in USA during first quarter of the twentieth century. In cotton, a number of cultural and mechanical practices were successfully implemented along with judicious use of insecticides for the management of bollworm under an ICAR sponsored

Table 1. Influence of Integrated pest management tactics on leafhopper population and cotton yield

Treatments	Leafhopper		Pad Kapas content		Cotton Seed Yield	
	no. / 3 leaves	Per cent over T_I.	%	Per cent over T_I	kg /ha	Percent T_I
T_1	4.24 (2.09) [h]	---	18.56 (25.52) [e]	–	425	--.
T_2	1.90 (1.43) [ef]	55.19	16.75 (24.56) [ef]	9.75	440	3.52
T_3	2.22 (1.60) [g]	47.64	14.91 (22.71) [d]	19.67	465	10.58
T_4	1.54 (1.41) [ef]	63.68	13.08 (21.20) [b]	29.53	535	25.8
T_5	1.48 (1.35) [de]	65.09	15.13 (22.89) [d]	18.48	475	11.76
T_6	0.89 (1.15) [b]	79.01	12.25 (20.48) [ab]	33.99	560	31.76
T_7	1.825 (1.46)	57.08	16.82 (24.21) [f]	9..38	675	58..82
T_8	1.28 (1.27) [cd]	69.81	15.58 (23.25) [dc]	16.06	710	67.05
T_9	1.59 (1.40) [ef]	62.50	12.41 (20.61) [ab]	33.14	690	62.35
T_{10}	1.12 (1.26) [cd]	73.59	11.58 (19.89) [a]	37.61	795	87.06
T_{11}	1.00 (1.18) [bc]	76..42	13.68	26.29	885	108.23
T_{12}	0.58 (1.01) [a]	86.32	11.55 (19.86) [a]	37.77	960	125.88
Mean	1.64 (1.38)	–	14.36 (22.21)	–	635	
Significance			0.01	---	–	9
CD (p=0.05)			0.93	–	–	

Operation Research Project (ORP) in Tamil Nadu (Sundaramurthy and Chitra, 1992). Success stories on the effect of various components of integrated pest management on cotton bollworms are available from Punjab (Sandhu *et. al*.,1978).

Simwat (1994) and Murugesan *et.al*. (2006) enumerated the different management practices *viz.,* resistant cultivar, intercropping and need based application of botanicals or systemic insecticides. However, the present study may probable the first in India to establish the utility of integration of several tactics *viz.,* resistant cultivar, seed treatment, intercropping and need based application of synthetic insecticides. When the susceptible LRA 5166 was raised from imidacloprid treated seed along with cluster bean and need-based application of dimethoate (0.03%) was able to reduce the leafhopper population by 79.01 per cent and increase the seed cotton yield by 31.76 per cent. Mere introduction of resistant cultivar *viz.,* KC 2 resulted in 57.08 percent reduction in the pest population and 58.82 per cent increase in the yield.

The yield increase was 125.88 per cent when KC 2 (resistant cultivar) was raised form imidacloprid treated seeds, grown with cluster bean intercrop and applied with dimethoate on need basis. Singh and Dhaliwal (1994) suggested location specific pest management practices with simple combinations of different methods of control, keeping in view of farmer's acceptability, which is ecologically, economically and sociologically accepted needs to be developed to have sustained crop production. Host plant resistance is a vital tool of IPM. It suppresses the pest population with least disturbance to cotton ecosystem and also reduces the dependence of insecticides. Several studies proved the worthiness of resistant variety to be used as the basement over which other strategies can be pyramided to have effective IPM (Adkisson and Dyck, 1980). The major advantage of using resistant variety is to induce a constant level of pest suppression in each generation. Moreover, the number of pests produced on a resistant variety usually decline over time, making control with insecticides much easier.

Several earlier workers also reported better growth of the plants of imidacloprid treated seeds in cotton (Dandale *et al.,* 2001; Gupta and Roshan Lal, 1998). The effectiveness of imidacloprid seed treatment gains support from earlier studies (Dandale *et al.,* 2001; Karabhantanal *et al.,* 2001; Murugesan *et al.,* 2006) in cotton.

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