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Integration of Resistant Mutants with Neem Extract in Cotton Insect Control

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ABSTRACT

The studies at Suwan Farm during 1997-98 and 1998-99 were set up to show exp.2 with the application of neem extract integrated with cotton resistant variety lines as the insect control method to give better yields than those obtained in exp.1 using resistant plant as principal control alone. AP1 and AP2, the mutant lines possessing antibiosis mechanism against some major insect pests of cotton and SR60, the recommended variety were used in the test. It was found that the average amount of jassids on the mutants and SR60 in exp.1 did not significantly differ from those in exp.2 while there are significant differences between the numbers of bollworm and cotton plant bug on each variety/line of both tests. The comparison of average seed yields also revealed highly significant increase of seed weight in AP1 and AP2 in exp.2 whereas the increase in SR60 was not that high. Concerning fiber quality parameters, fiber length of all variety/line in both experiments were in medium group with their uniformities and micronaires to be very high and desirable respectively.

Key words : integration,cotton, neem extract, mutant

INTRODUCTION

The role of plant resistance to insects in a breeding or insect management program varies with each crop and each insect. The utility of resistant varieties and the million of dollars saved by growers was documented by Luginbill (1969). Among the best examples of useful resistance in the control of cotton jassid, *Empoasca facialis*, in Africa by resistant cotton varieties.

However, insect resistance is most likely to be used as an adjunct to other control measures. One major advantage of using a resistant variety in an integral control system is the preservation of the insect natural enemies of key and secondary pests (Maxwell, 1972; Horber, 1972). van Emden (1973) gave the theory that the resistant variety or natural enemies, if each was used alone, they could not effectively control the insect pests. Yet when the two methods were integrated, the control could be of success. An outstanding case in Texas is the use of short-season cotton varieties in an integrated system designed to control the boll weevil and cotton fleahopper without inducing outbreaks of the bollworm and budworm (Maxwell and Jennings, 1980). A series of experiments has also shown that inexpensive insecticide treatments on a variety with resistance to several rice pests were almost as economical, if not more so, than costly treatments on susceptible varieties (Dyck *et al*., 1976). Walker

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and Niles (1973) described the greatest impact on the pink bollworm, *Pectinophora gossypilla* in the western United States could be realized by combining the nectariless character with varietal earliness.

The objective of the study was to show that the integration of cotton resistant varieties with other control methods to cotton insect pests will reduce more pests as well as give more good yield than when only resistant varieties used as principal control method.

MATERIALS AND METHODS

Two cotton mutant lines, AP1, and AP2, obtained from gamma-irradiated Rachada 1 (R1) and developed into M5 with antibiosis mechanism of moderate and slight resistance to the american bollworm and cotton jassid respectively along with recommended variety, SR60, were used in the two-year study conducted at Suwan Farm during 1997-98 and 1998-99. Two experiments were set . exp. 1, employing resistant variety/lines as the principal control method to cotton insects, exp. 2, integrating resistant variety/lines with the application of neem extract. RCB was used with 4 replicates per experiment, 3 variety/lines in each replication. Each variety/line was planted in 5 rows, a row of 20 meter long. Spacing of row x plant was 1.0×1.0 meter. Weeding, watering and fertilizing were similarly treated to both tests. Six plants from 3 middle rows, 2 from each one, of each variety/line, were randomly tagged after squaring. Variation among the number of major insects were then checked from tagged plants every other weeks for 4 consecutive times using an F-test. Neem extract of 250 ml/rai was applied each time when the amount of insects in exp 2 exceeded the economic theresholds as recommended by DOA (DOA, 1984). Yields of exp 1 and 2 were also checked in terms of quantity and quality.

RESULTS AND DISCUSSION

During the 2 growing seasons, both had unusual weather conditions from heavy rainfall to the hard coldiness resulting in retard growth coupling with some physical damages as broken branches which in turn affecting the amount of insects and yields.

Table 1 presents the two-year average amount of jassid found on mutant lines, AP1 and

Table 1 Average number of major insects found on tagged cotton plants of three variety/lines during 2 growing seasons (1997-98 and 1998-99) in experiment 1 and 2.

Variety/Line	Experiment	Insect		
		Jassid	Bollworm	Plant bug
AP1	1	9.2	6.0[1/]	7.6[1/]
	2	8.2	2.7	3.3
AP2	1	7.9	5.9[1/]	4.4[1/]
	2	7.7	3.7	2.1
AP60	1	14.3	5.4[1/]	5.9[1/]
	2	14.1	2.1	3.7

[1/] Average insect numbers found were significantly different ($p < 0.05$)

AP2, and the recommended variety, SR60, in exp.1 not to be significantly different from those in exp. 2, while there were significant differences between the average numbers of bollworm and cotton plant bug on each variety/line in both experiments.

The amount of jassid averaging highest and lowest of 14.3 and 7.7 were noticed on SR60 in exp. 1 and AP2 in exp. 2 respectively. Those on AP1, and AP2 were quite close to one another in number. The jassid was grouped into the one which neem extract had the least effect (Sombatsiri, 1998). Since the average numbers of the insect on AP1, AP2 as well as SR60 in exp. 2 were almost the same as those in exp. 1, this should indicated no effect of neem shown in the integration between resistant character and neem application. The lower amounts of jassid on the two mutant lines also showed their higher resistance compared to SR60.

Comparing the average number of bollworm of each variety/line in exp. 1 and 2, it could be seen that those in exp. 1 were significantly higher than exp. 2. The similar result was also encountered in case of cotton plant bug. It was found that the highest and lowest amounts of bollworm averaging 6.0 and 2.1 per 6 plants were on AP1 of exp. 1 and SR60 of exp. 2 respectively. The highest (7.6) and lowest (2.1) numbers of cotton plant bug per 6 plants were also noticed on AP1, in exp. 1 and AP2 in exp. 2 respectively.

The lower average amount of bollworm of AP1, AP2 as well as SR60 in exp. 2 should be contributed to the moderately resistant attribute of the new mutants and recommended variety to the bollworm combining with neem application. Sombatsiri (1998) put the bollworm into the group on which neem extract had moderately adverse effect. Together, the two control methods could exert more suppression to bollworm attack than one method alone. The higher amount of the insect in exp. 1 showed that the mere resistance did not give so good result as did the integration. The number of pest reduced on a resistant variety usually decline making control with insecticide which in this test is the action of neem extract much easier (Maxwell *et al.*, 1972).

Concerning the cotton plant bug, there has not been any experiment conducted on cotton resistant to this insect. The results reported was only a by-product of the study against the bollworm and jassid since the plant bug has recently become noticeable due to its increasing number and damage each year. Further investigation on cotton resistance to the insect, hence, must be appropriaetly pursued.

The comparison of average seed yields of the three variety/lines (Table 2) revealed highly significant increase of seed weight in AP1, and AP2 when neem extract was used in exp 2, whereas the increase in SR60 was not that high. The highest and lowest average seed yields of 3685 and 1526 g were found in both AP1 of exp. 2 and exp. 1 respectively.

Seed yields of SR60 in exp. 1 not greatly

Table 2 Comparison of average seed yields (g) of three cotton variety/line between experiment 1 and 2.

Experiment	Var/line		
	AP1	AP2	SR60
1	1526	2081	1529
2	3685*	2829*	1804

* Average seed yields obtained were significantly different ($p < 0.05$)

differed from that in exp. 2 should be caused by its low resistance to jassid found in all growing season. Similar to the bollworm, AP1 and AP2 survived the j assid attack better because of their slight resistance to the jassid (Hormchan *et al.*, 1997) integrated with the action of neem extract resulting in higher yield in exp. 2 than exp. 1.

In Table 3, fiber quality parameters-fiber length, fineness and uniformity, presented, were determined by high volume instrument (HVI) testing at the Department of Textile, Ministry of Industry. Fiber length of all variety/lines tested were of medium group ranging between 1. 04- 1. 14 inch and fiber uniformity of medium fiber group above 49 was classified as very high (Youngmode, 1984). The uniformity of SR60, AP1, and AP2 were found to range from the lowest of AP1, and SR60 in exp. 2 (52) to the highest of AP2 in exp. 1 (55) which, according to the standard, were then determined to be very high. The high uniformity indicates fiber length distribution and are associated with a high quality product and with low manufacturing waste (Smith *et al.*, 1994)

As for the fiber fineness or micronaire, it is a measure of maturity and/or the fineness of cotton fiber whose values of 3.5-4.9 are determined as desirable. The fineness of the three variety/lines in exp 1 and exp 2 were found to fall in such ranges with the lowest (3.9) of AP1, in exp. 1 and the highest (4.9) of AP2 in both experiments, which designated mature, well-developed fibers (Smith *et al.*, 1994)

The results of fiber parameter did not show any difference on either character of each variety/ line between the two experiments. According to Berkley (1948), the cotton fibers are extremely long epidermal hairs of seed with thick secondary walls of almost pure cellulose. They are formed from protoderm of the ovule during flowering and continue to rise for about 10 days after anthesis (Anderson and Kerr, 1938). The elongation lasts for 15 to 20 days depending on variety of cotton.

It seemed that the insect infestation did not adversely affect the mentioned parts of cotton especially the outer pigment layer of seed which gave fiber the nutrient, hence, no physiological damage encountered. After deflowering, most bolls with physical damage by the insects would not go to maturity anyway. Only bolls with good lints were collected. The effect of insect to the variety/ lines tested, would rather be quantity to quality. Therefore, at this stage it could be concluded that the integrating of control methods did not make any difference for fiber quality.

Table 3 Comparison of average fiber qualities of three cotton variety/lines between experiment 1 and 2.

Variety/Line	Experiment	Fiber qualities		
		Length(inch)	Uniformity	Micronair
AP1	1	1.14	53	3.9
	2	1.09	52	4.5
AP2	1	1.04	55	4.9
	2	1.11	53	4.9
SR60	1	1.08	53	4.6
	2	1.08	52	4.4
CV (%)		1.9	1.2	2.8

Since no synthetic organic insecticide had been used in the experiment, various kinds of predator and parasite were observed, such as lady beetle, big-eye bug, stink bug, braconid wasp etc. Moreover, by reducing the pest population, varietal resistance enables the natural enemies to be more effective because of an improved pest natural enemy ratio (Kogan, 1975). The impact of the integration was quite evident in the numbers of insect pest and seed yields on mutant lines in exp. 2 compared to those in exp. 1

CONCLUSION

The integrating of resistant variety/lines with neem application in exp. 2 gave better results in terms of average insect numbers and seed yields on the mutant lines and the recommended variety than those in exp. 1 using resistant character in insect control alone. AP1, and AP2 with moderate resistance to the bollworm and jassid might cause insect pest suppression to low levels that were easier for neem to exert the action. Even though the plantings in the 2 growing seasons were affected by the adverse weather resulting in less yields than they should be, the difference in yields and insect quantities were still noticed between the 2 experiments. With a proper understanding of the pest, the host plant and the environmental factors that affect them, a number of suppression measures may be used to suppress a pest which provides the basis for integrated pest control

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