Insecticide Evaluation Study, Safford Agricultural Center, 1997

L. J. Clark and E.W. Carpenter

Abstract

Several treatments were applied to long and short staple cotton to control harmful insects. These treatments included an untreated check, an insect repellent, a pheromone, pyrethroids, organophosphates, insect growth regulators and combinations of these ingredients. The treatment containing all pyrethroids gave the best control of harmful insects and was at the same time the ›softest‹ on some of the beneficials. Pink Bollworm larvae were found in all sampled bolls in some treatments.

Introduction

Insect pressures are not as great in the high desert area of the Safford Valley as in the lower valleys in Arizona, partially because of climatic considerations and partially because of the strong IPM program that has been in place over the past 20 years. The concern is that the pink boll worm will build up resistances to the pyrethroids that are primarily used in the valley for its control and that our insect control practices are eliminating the beneficial insects that help to keep all of the harmful insects in check. This experiment was designed to look at the effects of several insect control systems and then determine their effect on beneficial as well as detrimental insects and to finally ascertain the end result in cotton yield and quality.

Materials and Methods

Eight row strips of long staple (Pima S-6) and short staple (DP 90) were set up in adjacent fields where treatments were applied to randomized replicated plots. The test materials were applied using a JD 6000 high cycle spray rig that had been modified for use in small plots. Materials were mixed in 5 gallon, pressurizable containers and expelled using CO_2 gas. Approximately 20 gallons/acre of spray solution was applied per plot through flat fan TeeJet nozzles under 20 pounds of pressure. The crop history and treatments are described below:

Crop History

Soil type: Pima clay loam
Previous crop: Cotton
Planting date: 7 April 1997 Planting rate: 25 lbs/ac Varieties: Pima S-6 and DP 90
Herbicide: Treflan preplant, Cotton Pro as a layby treatment
Fertilizer: 100 lbs/ac urea under green manure crop 2/10, 100 lbs/ac of urea side dressed 6/2 and 7/14
Irrigation: Planted into moisture + 8 furrow irrigations (ca. 32 ac inches + 6 inches of rain) Last irrigation: 8 Sep
Harvest: 1st pick: 16 October 2nd pick: 4 November

Insecticide treatments are listed below. Prior to each application an insect assessment was made on two replications of the study. Net sweeps were made and all insect species and their numbers were recorded. The fifth leaf from the top of the plant was observed to determine the presence or absence of aphids and white fly (or other species that might be present) and bolls were cracked to determine the presence of pink boll worms (or other species).

At harvest two plants were pulled from each plot and mapped to determine the effect of treatment on plant physiology.

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Results and Discussion

Table 1 describes the treatments applied to the long staple and short staple experimental plots. Treatments were applied five times from August 13th to September 10th. Approximate per acre costs are listed in the last column, varying from no cost on the untreated check plots to $87.08 for Insect Growth Regulator treatment. Treatments were applied on a weekly basis irrespective of the insect counts which took place just before applications were made.

Tables 2 and 3 have yield and other agronomic data collected from the long and short staple plots, respectively. The untreated check plots produced less seedcotton for both types of cotton than did any of the treated plots. They produced approximately 60% and 75% of the yield of the best treatment. Treatment number 2, the garlic and fish oil repellent treatment yielded more than the check plots but less than the other treated plots. The best treatment from the standpoint of yield was the straight pyrethroid treatment, which was also the least costly of the chemically treated plots. Treatment #3, the pheromone treatment, was perhaps flawed in its concept because the protocol didn=t allow the use of chemicals other than NoMate for the first two cycles of spraying. This left other detrimental insects unchecked, potentially lowering yield during this period of time. Tank mixes were then used to remove the aphid and whitefly, causing increased cost of control. Treatment # 5, the organophosphate/pyrethroid rotation, which we have encouraged for years as a mechanism to prevent resistance build up in insect populations, didn=t yield as well as the straight pyrethroid treatment and cost more to implement. We haven=t given up our position on this treatment, yet, waiting to see if resistance is indeed building in insect populations in the area. The IGR treatment (#6) was flawed in the same way as the pheromone treatment, in that no chemicals other than the IGR=s were applied to the experimental plots for the first four cycles of sprayings. The IGR=s only affected the whitefly, leaving other detrimental insects to do their work for the first four weeks of treatments. Yields in all the plots were very low due to high insect pressure, but it was interesting that treatments 3 and 6 with reduced applications of toxic materials didn=t yield much below the best treatments. Percent first pick and first fruiting branch values were not apparently affected by the insect control treatments. Insect damage was determined by counting damaged bolls on plants and comparing those numbers with the total number of bolls on the plant. The damage was much higher on long staple cotton than on the short staple, but abort values were just the reverse. Insect damage was higher in the check plots than in any of the others, even though the CV (coefficient of variability) was too high to allow many statistical inferences. Even so, treatment #4, the pyrethroid treatment, had the lowest insect damage values. CV=s on the percent fruit retention were also high, but statistical differences were seen between some of the treatments, particularly between the check plots and the other treatments. The percent aborts from our evaluations, either indicate that aborts were not tied closely with the treatments or that our observations were inadequate to evaluate them. The number of non-productive upper nodes tended to be higher with treatments 1 and 2, indicating that late pink bollworm pressure reduced the top crop.

Tables 4 and 5 list the detrimental insects observed in long and short staple plots by treatment and by date of observation. Pink Bollworm (PBW#) presence in 10 bolls sampled per plot were recorded in columns 2-5, with the numbers indicating the date when the samples were taken. Other harmful insects (OTHB#) were the number found in 20 sweeps through the plots. Whitefly nymphs and adults (WFN#) and (WFA#) and Aphids (APH#) were the presence of these insects on 10 leaves sampled. This information is shown graphically in Figures 1 through 4. Pink Bollworm and other detrimental insect incidence was much higher late in the season in the check (#1) and garlic (#2) treatments on both types of cotton. It is interesting, though, that these treatments started out with the lowest numbers of harmful insects. The pheromone treatment (#3) started out with high numbers of detrimental insects and stayed quite flat during the season, ending up with fewer harmfull insects than for many of the treatments. Perhaps the late season numbers were small because of the expensive, yet effective, tank mixes used to control insects. The straight pyrethroid treatment seemed to control harmful insects quite well in the long staple cotton, dropping the counts to zero in early September. The counts did, however, come up a week later. In the short staple plots the pyrethroids did the best job of controlling harmful insects, but were not able to lower the pink bollworm count below 40% at the end of the season. The other treatments fell between the check and the pyrethroid treatments.

The other part of the study was to evaluate the effect of the various treatments on beneficial insects. They were lumped into three categories, lady bugs (LB#), lacewings (LW#) and other good insects (OTHG#). Among those classed in the other good category were: orius, spider, assassin bugs and big eyed bugs. The numbers reported in Tables 6 and 7 are the number of insects found in 20 sweeps through the canopy. This information is also displayed graphically in Figures

5 through 10. Figures 5 and 6 show the presence of lady bugs in the plots. They didn=t arrive in any numbers until September and then their numbers are reduced by all of the chemicals except pyrethroids. It is difficult to make much sense out of the lacewing and other beneficials data. In some cases the check plots have larger number of beneficials, in other cases they have none. It may be that the beneficials are so mobile that they cross plot boundaries and thus don=t correlate well with treatment effects.

The results of the study indicate that the pyrethroids are the most effective at controlling harmful insect in cotton and also the >softest= on at least some of the beneficials. This study will be continued to see if this conclusion can be corroborated.

Table 1. Insecticide applications by treatment and date, insecticide study, Safford Agricultural Center, 1997.

Insecticide applications							
Treatment		8/13	8/20	8/27	9/3	9/10	Cost
1	Untreated Check	--	--	--	--	--	$00.00
2	Garlic/Fish oil	Garlic + Fish	Garlic + Fish	Garlic + Fish	Garlic + Fish	Garlic + Fish	$11.60
3	Pheromone +	NoMate	NoMate	Lorsban + Scout Xtra	Capture + Thiodan	Danitol + Orthene	$86.76
4	Pyrethroid	Scout Xtra	Scout Xtra	Scout Xtra	Scout Xtra	Scout Xtra	$37.50
5	Organo Phosphate /Pyrethroid	Lockon	Karate	Lorsban	Scout Xtra	Lorsban	$48.27
6	Insect Growth Reg	Knack		Applaud		Danitol + Orthene	$87.08

Table 2. Yields and other agronomic values affectable by insect pressure on long staple cotton by treatment on the Safford Agricultural Center, 1997.

Treatment	SC Yield	% 1st Pick	1st Fruiting Branch	Insect Damage	% Fruit Retention	% Aborts	Nonprod. Top nodes
1	639 b	79.4 a	8.8 a	19.3 a	39.5 b	11.7 b	4.6 a
2	816 ab	83.0 a	8.6 a	14.7 a	45.3 ab	11.0 b	4.4 a
3	881 ab	78.5 a	8.4 a	16.7 a	44.2 ab	14.0 ab	3.0 a
4	1071 a	81.9 a	8.7 a	11.2 a	47.5 ab	20.0 a	3.1 a
5	958 a	81.3 a	8.6 a	15.0 a	56.3 ab	14.5 ab	3.2 a
6	955 a	78.5 a	8.4 a	11.6 a	58.4 a	10.5 b	2.4 a
Average	886.8	80.4	8.6	14.8	48.5	13.6	3.5
LSD(05)	266.7	10.2	1.4	8.2	16.2	7.2	3.1
CV(%)	22.8	9.7	12.2	42.3	25.3	40.0	67.3

Table 3. Yields and other agronomic values affectable by insect pressure on short staple cotton by treatment on the Safford Agricultural Center, 1997.

Treatment	SC Yield	% 1st Pick	1st Fruiting Branch	Insect Damage	% Fruit Retention	% Aborts	Nonprod. Top nodes
1	1707 b	90.4 a	8.6 a	8.7 a	13.3 b	57.0 a	10.1 a
2	1865 b	91 5 a	8.2 a	8.7 a	15.5 b	56.2 a	10.8 a
3	2146 a	90.5 a	9.1 a	6.6 ab	25.5 a	53.1 a	9.2 a
4	2233 a	92.7 a	8.1 a	4.6 b	33.2 a	51.2 a	8.0 a
5	2162 a	91.2 a	8.4 a	5.1 ab	27.8 a	58.4 a	8.7 a
6	2065 a	90.7 a	8.6 a	5.5 ab	27.0 a	51.9 a	9.3 a
Average	2029.6	91.2	8.5	6.5	23.7	54.6	9.4
LSD(05)	186.5	2.5	1.4	3.7	9.8	13.5	3.9
CV(%)	7.0	2.0	12.8	42.7	31.2	18.7	31.8

Table 4. Detrimental insects observed in long staple plots by treatment, insect species or group and date of observation, Safford Agricultural Center, 1997.

Trtmt	PBW 1[1][2]	PBW 2	PBW 3	PBW 4