PERFORMANCE OF LEVERAGE IN THE SOUTHEAST

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Abstract

After receiving a cotton registration in mid-1999, Leverage was evaluated on-farm by consultants at 15 sites in Georgia and Alabama. Against late season aphids not controlled by an epizootic, Leverage outperformed the commercial standard Capture. In an unanticipated aphid infestation in a plant bug trial, Leverage exhibited a high level of activity with Steward, Tracer and Lorsban offering moderate to poor activity. In Hawkinsville, GA, plant bug control was 92% after 2 applications and 100% after the third. This equalled Steward while Tracer and Tracer + Lorsban had no impact on plant bugs. In Prattville, AL, a dirty bloom measurement for plant bugs showed a Leverage advantage over Provado, Karate and Bidrin. In Tifton, GA, Leverage provided plant bug control comparable to pyrethroids at 3DAT and superior at 6DAT. The impact of Leverage on minute pirate bug paralleled Provado and Steward as opposed to the complete population elimination from pyrethroids. In Moultrie, GA, Leverage out-yielded Decis (69 lbs. lint/A) in replicated stink bug trials. Leverage Suppression of Whitefly was better than Endosulfan/Impede followed by Endosulfan/Karate.

Introduction

Leverage 2.7 SE Insecticide is a new product from Bayer Agriculture Division for broad-spectrum insect control which offers cotton farmers more complete control of insects while maximizing worker safety and preventing the loss of products to resistance. Leverage contains cyfluthrin (1.1 lb. ai/gal.) and imidacloprid (1.6 lb. ai/gal.). Cyfluthrin is a membrane disrupter that is effective against several target pests including bollworm (*Helicoverpa zea*), boll weevil (*Anthonomus grandis*), certain stink bug species and plant bug (*Lygus lineolaris*). Imidacloprid affects insect nerve synapse through direct contact or ingestion and is especially effective against sucking insect pests such as plant bug and cotton aphid (A*phis gossypii*).

Since the eradication of the boll weevil in the Southeast, insect population shifts have occurred in species that were previously considered secondary pests. Prior to eradication, routine boll weevil sprays prevented populations of both stink bugs and plant bugs from becoming significant problems. Reduced insecticide use and lack of sufficient natural enemies have caused the emergence particularly of stink bugs as an annual mid to late season problem requiring pest management (Lee, 1999, Roberts, 1999). The documented preference of stink bugs for bolls under 12 days old (Lee 1999) and the difficulty in detecting stink bug populations by scouting has led to calendar based sprays during critical boll fill in some areas. The widespread acceptance of Bt cotton in the Southeast has further increased stink bug occurrences because of the reduction in pyrethroid use (Greene, 1998). Bt cotton is likely to get a routine August spray which will "blanket" stink bugs, fall armyworms and escaped bollworms (Pitts, 1999). Yield increases of 20-40% have been documented with 1 to 4 stink bug sprays on Southeastern Bt cotton (Turnipseed, 1996).

Aphids, although cited as the fifth most damaging cotton insect beltwide after bollworm/budworm, boll weevil, lygus and thrips (Williams, 1999), have usually been controlled by the natural epizootic fungus *Neozygites fresenii.* But the fungal epizootic may not occur when needed, which can result in decreased photosynthesis and cotton quality damage from sooty mold.

Whiteflies (*Bemesia tabaci* and *Trialeurodes abutilonea*) are a very localized pest in the Southeast. While some small geographic areas have late season problems every year, 1999 had a more wide spread problem in Georgia. Yield losses were significant at some field locations.

The primary spectrum of mid to late season insect pests in the coastal plain of Alabama and Georgia since the eradication of the bollweevil and the elimination of bollweevil sprays is now: stink bugs, fall armyworms, bollworm, plant bugs, cotton leafhopper (Hardee, 1999) and whiteflies. With the total number of insecticide sprays greatly reduced in recent years (Roberts, 1999) and the pest complex shifting (Lee, 1999), the activity spectrum of each spray becomes increasingly critical to a growers ability to economically produce cotton.

Discussion

Due to the late registration during the 1999 growing season, commercial use of Leverage was limited to consultant testing on grower fields. Documentation and results are available from 15 of these test fields in Georgia and Alabama. Most of the fields were split at the time of a consultant recommended application, with half receiving the standard recommended insecticide and half receiving the corresponding label rate of Leverage. At four locations, the treatments were replicated. Seven locations reported efficacy results numerically instead of qualitatively. These results are included in addition to the qualitative overview of all 15 sites.

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Aphids

Newton, GA. A late season aphid infestation that was not responding to the epizootic was used to evaluate Leverage (3.75 fl oz/A) compared with the commercial standard Capture 2EC (3.2 fl oz/A). In the split field comparison, a 100% aphid infestation was reduced to 6% in the Leverage treatment and 16% in the Capture when scouted 7 days after treatment. At 14 days, Leverage maintained 92% control and the Capture portion of the field 78%. Both treatments reduced the Southern Armyworm (*Spodoptera eridamia*) population from heavy to a very low level. The subthreshold population of stink bugs (2-3 per 48 row feet) was eliminated by both treatments.

Hawkinsville, GA. In a replicated large plot air vs. ground plant bug study, cotton aphids became a significant problem by the first application (table 1). Treatments were applied 8/5, 8/10 and 8/13. Aphid severity was evaluated 7 days after the third application using a 0-10 severity index (0=none). Leverage provided a visual and numerical advantage over all other treatments.

Plant Bugs

While not the magnitude of problem that may occur in the Mississippi Delta, plant bugs in the SE may lengthen the season by reducing boll retention. They are still pyrethroid sensitive but infestations begin prior to the July 15th limited pyrethroid timing. Trials were planned to determine the possibility of additive efficacy from two modes of actions and two differing residual lengths.

Hawkinsville, GA. With a heavy plant bug infestation by Georgia standards, both Leverage and Steward gave near complete control after applications (table 2). Square retention increased markedly, from 78 (untreated) to 93% for Leverage and from 78 to 100% for Steward ground and to 83% for Steward aerially applied.

Prattville, AL. With a heavy plant bug population, Bidrin, Karate, Provado and Leverage all reduced nymph numbers > 70% 2 weeks from 1st application (table 3). At 10DAT2, "dirty bloom" counts were used to measure plant bug damage. Leverage had a slight advantage over the standards.

Tifton, GA. While a moderate plant bug population was not definitive for efficacy comparisons, this test demonstrated the quicker knock-down (3DAT) of all pyrethroid containing compounds (including Leverage) but the good eventual efficacy (6DAT) of "new" chemistries especially Regent and Leverage (table 4).

The high level of Leverage efficacy in these trials, may be attributed to the additive effect of two modes of action and two differing residual lengths.

Beneficials

The use of Leverage insecticide had an impact on minute pirate bugs more closely corresponding to its active ingredient imidacloprid than its pyrethroid component (Table 5). Leverage's initial knock-down of Minute pirate bug was less than that of pyrethroid-only products which were needed at full rates to obtain plant bug efficacy.

Stink Bug

In 10 of the 15 consultant test sites, stink bugs were present in sufficient numbers to be noted during scouting. Control was rated qualitatively good to excellent at all 10 locations (Table 9). In Colquitt County Georgia, where the field was divided into 2 treatments x 6 replications of 16 rows the length of the field, yields were recorded by plot (table 6). The Southern green stink bug (*Nezara viridula*) was the dominant species in the field. The commercial standard treatment was Decis at "1 gallon to 60 acres" (0.025 lbai/A). Leverage was applied at 3.75 fl oz/A. Two applications were made on a calendar basis beginning 7/27/99 and 14 days later. The 69 lb lint yield advantage of Leverage over Decis was statistically significant (P=0.05). Insufficient untreated areas (2 replications) prevented calculation of yield loss due to stink bugs but the insecticide treatments reduced internal boll damage 86-90%.

Whiteflies

A field in Omega, GA with significant whitefly populations was treated with Leverage compared to the local standards (table 7). By the final evaluation timing, sooty mold had become a serious yield limiting problem. Very few local control measures have been field validated for this pest which is normally geographically limited and short lived. This limited experience resulted in initiation of control measures too late to be highly affective. Leverage efficacy compared to the local standard in Omega, GA (table 6). Whiteflies did not reach the destructive levels of neighboring fields. The Tifton whitefly site (table 8) had excellent nymph reductions from a single Leverage application. Treatments were not continued and yield was reduced > 400 lbs. lint/A across the field. The Sweet potato whitefly (*Bemesia tabaci)* is also referred to as the silverleaf whitefly due to visual effects on squash.

Ranking

Consultants provided scouting reports for 15 split-field test sites in Georgia and Alabama. For many pests, evaluations were limited to qualitative statements (i.e. high, medium, very low, etc.). If the pre-application population was above treatment threshold and reduced to low or very low by the Leverage treatment, a rating of excellent was given. Alternatively, if the control provided by Leverage was better than the commercial standard, control was considered excellent (table 9).

Summary

Grower-scale evaluation in 15 split-field comparisons in Alabama and Georgia indicated that Leverage had areas of advantage over commercial standard insecticides for aphid, plant bug, stink bug and whiteflies. The combination of two active ingredients with individual high levels of control should provide growers with a spectrum and consistency of control previously unavailable. The advantage of combining a quick "knock-down" insecticide with a long residual efficacy insecticide may fit the grower need for fewer insecticide applications. For insects susceptible to both insecticides, Leverage will provide resistance management. Combining the above characteristics with a high level of worker safety, make Leverage a viable choice during much of the cotton growing season in the Southeast.

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Table 1. Mean Severity of Cotton aphid (A*phis gossypii*) when evaluated 7 days after the third insecticide application. Hawkinsville, GA. Eight replications.

Treatment	Rate (per acre)	Aphid Severity Index (0-10, 0=none)
Untreated		5.3
Tracer +	2 fl oz +	
Lorsban 4E	0.187 lbai	4.0
Tracer	2 fl oz	4.0
Steward	0.09 lbai	3.2
Leverage 2.7 SE	3.75 fl oz	1.4

Applications: 8/5, 8/10 and 8/13 Evaluation 8/20/99

Table 2. Mean Plant bug (*Lygus lineolaris*) counts per 100 row feet and % Square retention 0 and 7 days after the third insecticide application. Four replications. Hawkinsville, GA.

Treatment	Rate (per acre)	Nymphs 8/13 ground	Nymphs 8/20 ground	% Square Retention 8/20	
				ground	air
Untreated		112	34	78	78
Tracer +	2 fl oz +				
Lorsban 4E	0.187 lbai	125	50	90	
Tracer	2 fl oz	79	95	90	70
Steward	0.09 lbai	0	4	100	83
Leverage 2.7 SE	3.75 fl oz	8	0	93	93

Applications: 8/5, 8/10 and 8/13 Evaluation 8/20/99

Table 3. Mean efficacy against plant bugs (*Lygus lineolaris*) as measured by the number of nymphs per 10 row feet (2 DAT2) and % dirty blooms (10 DAT2). Prattville, AL.

Treatment	Rate (per acre)	Nymphs /10 row ft.	% Dirty Blooms
Untreated		7.0	25
Bidrin	0.25 lbai	0.5	5
Karate Z	0.025 lbai	1.0	5
Provado 1.6F	0.047 lbai	2.0	9
Leverage 2.7 SE	3.0 fl oz	2.0	0

Applications: 6/22 and 7/7. Evaluation 7/8/99 and 7/17/99.

Table 4. Mean efficacy against plant bugs (*Lygus lineolaris*) as measured by the Sweep net counts of the total number of nymphs + adults per 25 sweeps (3 DAT) and % boll retention (6 DAT). Tifton, GA. 4 Replications.

Treatment	Rate /A	Plant bugs /25 sweeps		% boll retention
		3 DAT	6 DAT	
Untreated		2.3	5.3	73
Leverage 2.7 SE	3.0 fl oz	0.3	0.8	85
Provado 1.6 F	3.75 fl oz	1.5	1.8	83
Regent 2.5 EC	.038 lbai	3.3	0.0	72
Steward	.09 lbai	2.8	2.3	77
Baythroid 2	.025 lbai	0.8	2.0	87
Karate Z	.025 lbai	1.3	1.8	76
Decis 1.5 EC	.019 lbai	0.5	1.5	79

Application: 7/6.

Table 5. Impact of insecticide treatments on populations of Minute Pirate bug (*Orius tristicolor*) and speed of recovery (2 DAT2, 10 DAT2). Prattville, AL.

Treatment	Rate /A	Pirate Bugs /10 rowft. (sweep net)	Pirate Bugs /4 row ft. (drop cloth)
Untreated		14	9
Bidrin	0.25 lbai	5	6
Decis 1.5EC	0.019 lbai	0	3
Karate	0.025 lbai	0	3
Provado 1.6F	0.047 lbai	4	7
Leverage 2.7 SE	3.0 fl oz	4	5
Steward	0.11 lbai	5	5
Pirate	0.35 lbai	12	4

Applications: 6/22 and 7/7. Evaluation 7/8/99 and 7/17/99.

Table 6. Impact of insecticide treatments on stink bug damage and yield of NuCotton 35B in Moultrie, GA. 1999

Treatment	Rate/A	% *Damage	% Damage	Yield lint/A **
Untreated				
Decis 1.5 EC	0.025 lbai	2012	313.0	na1125 a
Leverage 2.7 SE	3.75 fl oz	7.5	4.5	1194 b

* interior boll wart or stained lint of 60-100 bolls per treatment.

** means followed by the same letter are not statistically different a the 5% level by Duncan's Multiple Range Test.

Applications: 7/27/99 and 8/10. Evaluation 8/16, 8/27 and 10/29.

Table 6. Impact of insecticide treatments on populations of Sweet Potato Whitefly (*Bemesia tabaci)* nymphs and adults. Omega, GA.

Treatment	Rate/A	Adults/10 row ft.	Nymphs	Nymphs
Endosulfan + Impede		8.3	5.0	18.7
Fb Endosulfan + Karate Z				
Leverage 2.7 SE	3.75 fl oz	5.9	3.8	10.4

Applications: 8/8/99 and 8/14. Evaluation 8/11, 8/13 and 8/23.

Table 7. Impact of insecticide treatments on populations of Sweet Potato Whitefly nymphs (*Bemesia tabaci)* and adults. Tifton, GA. 2 Replications.

Treatment	Rate (per acre)	Adult Population Index*	Nymphs per leaf **
Untreated		7.2	58
Decis 1.5EC + Orthene	2 fl oz + 1 lb form.	5.8	35
Leverage 2.7 SE	3.75 fl oz	4.0	13

* Adult whitefly population index was made by shaking 6 feet of row and evaluating the flying population with a 0-10 index (0=none, 10=flying population unable to see through). 25 Evaluations were made per replication.

** Number 3rd and 4th instar nymphs were counted (10X) on three 2.25 cm^2 areas per leaf.

Table 8. Qualitative evaluation determined from consultant scouting reports of the 15 GA/AL Leverage test sites.

Location:	Plant-bug	Aphid	Stink-bug	Cotton Bollworm	Southern Armyworm	Fall Armyworm	Whitefly
Albany, GA		+++	+++		+++		
Bainbridge, GA			+++				
Bainbridge, GA			+++	+++		+++	
Millen, GA			+++	+++			
Hawkinsville,GA	+++	+++		--*			
Tifton, GA							0
Omega, GA				0			0
Tifton, GA	0						
Moultrie, GA			+++				
Prattville, AL	0		0				
Ozark, AL	+++	+++	+++	+++			
Andalusia, AL			+++				
Midland City, AL			+++				
Headland, AL	0						
Samson, AL	+++		+++			+++	
Summary:	0	+++	+++	+++	+++	+++	0

* pyrethroid resistance

(+++) = excellenet, equal or better than the commercial standard, (++) = good, (+) = fair, (-) = poor, (- -) = no control.