FACTORS AFFECTING PERFORMANCE OF CONFIRM IN COTTON

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Abstract

Confirm is a new insecticide for control of lepidopterous insects. Confirm Recieved Section 18 registrations for during 1994, 1995 and 1996 for control of Beet Armyworms in Cotton. While being used under these registrations, questions of Confirm's speed of kill, rainfastness, residual activity, application volume and rate arose. These issues were addressed in large and small plot field trials conducted from 1994 to 1996. While feeding cessation occurs within 8 - 10 hours, death occurs in 3-5 days with the primary cause of death being starvation and desiccation from blood loss. Retention of Confirm on leaf surfaces is affected most when rainfall occurs less than three hours after application. Confirm consistently gave control of BAW for periods of 10 - 14 days. For the two trials considered, application volumes of 1 and 3 GPA gave slightly slower control than 5 GPA. Reduced rates of Confirm have shown control of BAW however, these rates have been slower acting than the 0.125 lbs AI/A.

Introduction

Rohm and Haas Company is pleased to introduce Confirm insecticide. Confirm belongs to a new class of insecticides known as diacylhydrazines. Confirm derives it's insecticidal properties by mimicking the molting hormone 20-Hydroxyecdysone. During a normal molt, ecdysone concentration in the larvae's bloodstream increases, binding with the receptor sites occurs and digestive enzymes are released into the bloodstream. This binding with ecdysone is reversible, once the old cuticle is digested, the binding is reversed and the new cuticle begins to reform. When Confirm is ingested by sensitive species, Confirm binds irreversibly with the ecdysone receptor sites and digestive enzyme production is induced. However, larvae intoxicated with Confirm continue to produce molting enzymes resulting in a premature lethal molt. Feeding cessation occurs 8-10 hours after ingestion, with death occurring within 3-5 days.

Confirm is classified as a reduced risk pesticide and received Section 18 / Crisis Exemptions during 1994 and 1995 for control of beet armyworm (BAW). During 1994, late season outbreaks of BAW occurred in Mississippi and Alabama for which Confirm 2F received Section 18 registration. This was the first commercial registration and use of Confirm in the United States. In late June of 1995, damaging BAW outbreaks occurred in south Texas and continued to develop across all cotton growing regions of the southern states. Confirm received Section 18 or Crisis Exemption registrations in all states from Texas to North Carolina.

Prior to these registrations, it was known that Confirm was highly effective for controlling BAW. However, Confirm was still in development for the cotton market during 1994 and 1995 and the sporadic nature of BAW populations had given only limited opportunities for investigating aspects of field performance. While being used commercially during 1994 and 1995 several questions arose regarding Confirms performance given several variables. The heavy infestations occurring in the cotton growing areas offered the opportunity to address many of these questions via large plot trials. The following is a list of the most frequently arising issues:

- Speed of Kill. Comparisons based on traditional evaluation methods indicated Confirm was slow acting.
- Rainfastness. Confirm requires ingestion for activity and residual could potentially be affected, rainfastness was a major concern in many areas of the Belt.
- Residual. Could Confirm control populations of BAW given extended egg lays or multiple generations?
- Application volume. Aerial applicators preferred reduced application volumes.
- Rate. Lower rates (cost / Acre) were attractive to growers.

Data Review - In the trials listed, all treatments of Confirm included Latron CS-7 at 0.125 % V/V and application volumes were made at 10 GPA by ground or 5 GPA with aerial equipment unless specified otherwise.

Field trials of Confirm using traditional evaluation methods (number of larvae per 6 row feet and percent mortality) have indicated that Confirm requires three to five days to reduce beet armyworm numbers to levels of other products. However, due to the mode of action of Confirm, mortality is the final result of the intoxication process that begins soon after ingestion of Confirm.

A series of trials were conducted by Dr. Atlon Sparks at the Texas A&M research station in Weslaco to determine how much plant tissue was consumed in the course of Confirm intoxication. Dr. Sparks performed experiments to determine leaf area consumed and percent larvae feeding after exposure to treated leaf areas for various time periods.

In his first experiment, starved larvae were exposed to treated leaves for 2 -10 hours. After the specified initial exposure period, larvae were transferred to untreated leaf tissue and observed for additional feeding to 24 hours (Figure 1). Feeding damage during initial exposure periods was not significantly different than untreated plots of similar exposure periods. However, cumulative feeding damage for the 24 Hour period for Confirm treatments was

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reduced 50% from similar exposure periods for control plots.

In a similar experiment, Dr. Sparks collected treated leaf tissue after application and exposed starved BAW larvae to disks cut from this treated leaf tissue. Leaf tissue was changed every 2 hours and evaluated for percent larvae feeding (Figure 2). Percent larvae feeding was similar in Confirm and control plots for the first 8 hours of exposure however, at periods beyond 10 hours, the number of larvae feeding in Confirm treatments was significantly reduced.

Dr. Sid Hopkins (Hopkins Agricultural Services) established a replicated small plot trial in a heavily infested field during 1996 near Corpus Christi, Tx. Evaluations in this trial consisted of both larval counts and % defoliation ratings. Larval infestations were monitored by shaking 6 row ft of cotton over a beat cloth and counting live larvae on the cloth. Percent defoliation was monitored by flagging 13 feet of row per plot and taking visual observations of feeding damage from these areas throughout the trial (Figure 3). Evaluations of larval infestations indicate that Confirm is giving moderate control of beet armyworm on all evaluation dates. However, evaluations of feeding damage indicate that by 3 DAT, feeding damage has ceased and control was obtained.

Because Confirm must remain on the plant surface for residual activity, there is a potential to be affected by rainfall. Field trials were conducted at the Rohm and Haas Houston Farm to investigate the effects of interval between application and rainfall on the retention of Confirm and the biological response of BAW. Studies were conducted by making applications to large blocks of cotton with a broadcast boom. One inch of simulated rainfall was then applied (via overhead irrigation system) at 1, 3, 6 and 12 hours after application. Samples of leaf tissue were collected 24 hours after application for quantitative and biological studies. Quantitative analysis was performed by cutting 5-two inch diameter disks from leaf tissue collected from the first fully expanded leaf position, with three subsamples per plot. Disks were then rinsed in methanol and the rinsate analyzed via HPLC for Confirm residue. Bioassays were performed by collecting 5 leaves per plot and placing 10 - 3rd instar larvae per leaf and evaluating them for biological response at 3, 5 and 7 DAE.

Results of quantitative analysis (Figure 4) indicate intervals between application and rainfall of 1 hour or less greatly affected the retention of Confirm on leaf tissue. Retention of Confirm on leaf tissue with rainfall intervals of 3 -12 hours after application greatly increased the retention of Confirm on cotton. While quantitative analysis of Confirm applied at commercial rates showed distinct differences in retention levels among rainfall intervals after treatment, biological response was only affected when rainfall occurred 1 hour after application. All other intervals showed mortality above 60%.

Dr. Sparks performed trials to investigate the residual BAW control of several insecticides during 1996. Dr Sparks made field applications to cotton plants and collected leaf tissue from treated plants at specified dates after application. Bioassays were performed by placing individual BAW on the leaf tissue collected from the uppermost part of the plant. Leaf tissue was replaced daily with tissue collected on the original sampling date. Mortality was monitored at 3, 5 and 7 days after exposure however, only seven day evaluations are represented. Bioassays were performed on leaf tissue collected to 14 DAT (Figure 5). Results of 5 and 7 DAT samples were not included due to high mortality in control populations on these dates. Confirm gave 79% mortality on leaves collected 14 DAT.

Current Section 18 registrations require Confirm to be applied in a minimum spray volume of 5 gallons per acre in aerial application. Application volumes were implemented in this fashion because experience at lower volumes was limited, and Confirm performance was known to be consistent at 5 GPA for aerial application. Two trials were conducted in 1995 comparing application volumes for control of BAW. During 1995, Larry Walton of Rohm and Haas company conducted a trial near Inverness, MS in which he compared 5 GPA Vs 1 GPA and Kenneth Buchert (also with Rohm and Haas), compared 5 GPA Vs 3 GPA near Kingsville, TX. In 1995 Mr. Walton made Confirm applications using aircraft calibrated at both 1 and 5 GPA to building BAW infestations (Figure 6). Evaluations of larval infestations and % defoliation were made using the methods described for Dr. Hopkins trial. At 4 DAT a slight rate response was noted between application volumes for both number of larvae and % defoliation, however both application volumes showed much less damage than untreated plots. While damage in untreated areas increased from 18.6% to 36% between 7 and 12 DAT, feeding damage remained below 8% for both application volumes at 12 DAT. It was also noted that while larval numbers dropped drastically between 7 and 12 DAT, % defoliation doubled.

Mr. Buchert made aerial applications using methods similar to those used by Mr. Walton however, 5 GPA was compared with 3 GPA and no untreated areas were left for comparison. Application was made to building BAW infestations. Evaluations of larval infestations were made using the beat cloth method described above. No differences were detected between application volumes although larval numbers were lower at 6 DAT in the 5 GPA treatment (Figure 7).

During 1994, 1995 and 1996 the lowest labeled use rate of Confirm 2F was 8 oz product per acre (0.125 lb. AI/A). Confirm has given consistent performance at this rate however, there was an economic need to develop information at rates below 8 oz. During 1995, Larry Walton of Rohm and Haas company conducted a trial near Inverness, MS in which he compared 0.06 vs. 0.125 lb.

AI/A of Confirm 70W. Evaluations of larval infestations and % defoliation were made using the methods described in Mr. Waltons trials referenced earlier. At 4 DAT a slight rate response was noted between 4 and 8 oz. in both number of larvae and percent defoliation (Figure 8). At 7 DAT the difference in larval infestation of 8 oz increases slightly however the damage in plots treated with 4 oz is slightly higher than that in plots treated with 8 oz. The 4 oz rate of Confirm 70W did not give the same level of control as the 8 oz rate.

Summary

In the past, evaluation parameters have been based on the assumption that larval numbers are directly associated to crop damage. Because Confirm belongs to a new class of chemistry and has a novel mode of action, understanding the mechanism of intoxication is essential to evaluating the performance of Confirm. While feeding cessation occurs within 8 - 10 hours, the primary cause of death is starvation and desiccation from blood loss. In most field trials, larval mortality occurred 3 - 5 DAT, which would be considered normal. Fair evaluation of any product should be based on it's respective contribution to crop protection. Confirm demonstrated rapid control of BAW feeding in both laboratory and field trials. Comparing Confirm with more traditional insecticides using traditional evaluation parameters may overlook Confirm's unique crop protection capabilities.

While the retention of Confirm on Cotton leaves is affected by rainfall after application, retention is effected the most when rainfall occurs less than three hours after application. Also, the amount of deposition must be greatly reduced before biological response is affected. Confirm consistently gave control of BAW for periods of 10 - 14 days. This period was noted in instances of commercial use.

For the two trials considered, application volumes of 1 and 3 GPA gave control slightly less than that of 5 GPA however, more trial information is needed to make conclusive decisions about the effects of reduced application volumes. Reduced rates of Confirm have shown control of BAW however, these rates have been slower acting than the 0.125 lbs AI/A.

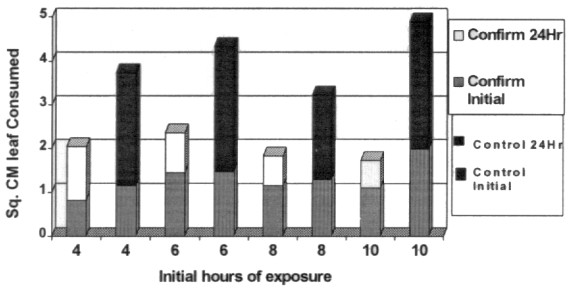

Figure 1. Leaf consumption Vs duration of exposure, A. Sparks, 1996

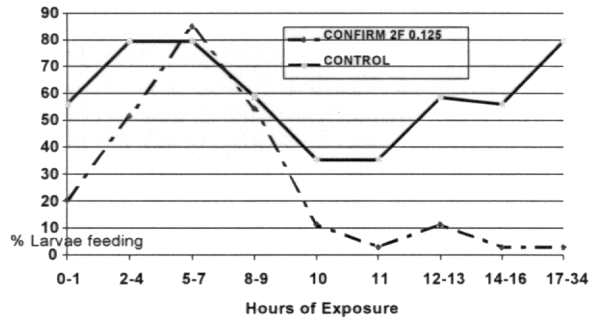

Figure 2. Beet armyworm feeding vs. Duration of exposure, A. Sparks, Weslaco, TX. 1996.

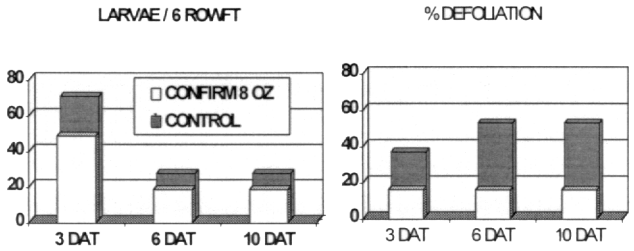

Figure 3. 1996 Beet armywork % defoliation vs number of larvae 2269607, Corpus Christi, TX

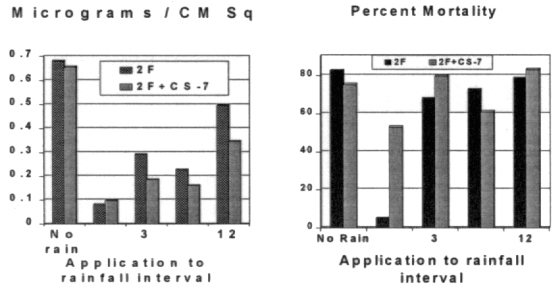

Figure 4. Beet Armyworm mortality following rainfall, A.E. Duttle, Houston TX 1996

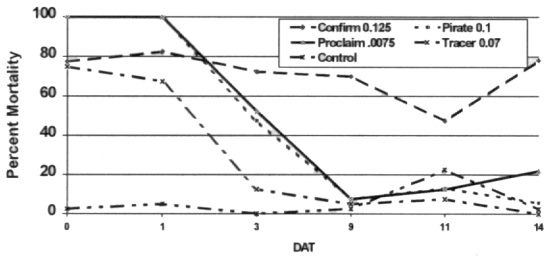

Figure 5. Beet Armyworm bioassay (7 DAE) on treated leaves A. Sparks, Weslaco, TX 1996

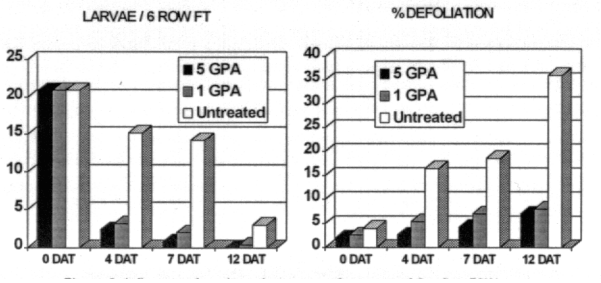

Figure 6. Influence of carrier volume on performance of Confirm 70W L.C. Walton, Inverness, MS.

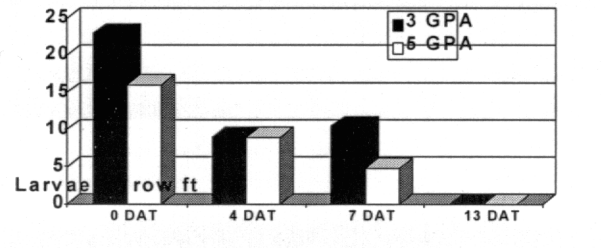

Figure 7. Influence of carrier volume on performance of Confirm 70W K.P. Buchert, Uvalde, TX 1995

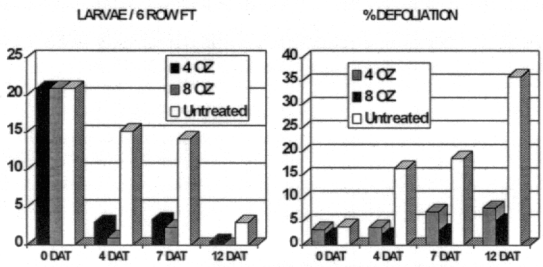

Figure 8. Influence of Rate on performance of Confirm 70W L.C. Walton, Inverness, MS.