Residual Efficacy of New Insecticide Chemistries Against Cabbage Looper in Head Lettuce

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Abstract

Several new insecticide chemistries were evaluated and compared with standard chemistries for residual efficacy against cabbage looper in lettuce. Four field trials were conducted at thinning, and heading stages of lettuce. These replicated trials clearly demonstrate that the new insecticides provide a solid 7 day residual efficacy (>90% control) following spray applications. Overall, Success at rates ranging from 4.5-6.0 oz/acre appeared to provide the most consistent residual activity on larvae present on plants at time of application. Confirm, appeared to have less consistent residual, but control was generally similar to Success. The newer compounds Proclaim and Avaunt, showed good residual efficacy for up to 7 days, and will be a welcome additions to the growers insecticide arsenal. Finally, the fact that all of these compounds are effective against large larvae, in part explains their consistent residual activity on lettuce.

Introduction

The number of effective insecticides available to growers for insect control in desert lettuce production is rapidly increasing. The Arizona vegetable industry is fortunate that there are several new insecticide chemistries currently being developed that offer novel modes of action and selective activity. Some of the most exciting breakthroughs in agricultural chemicals have come in the last few years with the development of several new classes of chemistry for the control of lepidopterous pests such as cabbage looper (CL). These insecticides are similar in that they are very efficacious, relatively selective for larvae, and safe to use and apply. This has been achieved through the development of novel modes of action and type of activity. Of the compounds tested, most of them are new chemistries with independent modes of action (neurotoxic, metabolic, and insect growth regulators). Several posses translaminar activity such as Success (spinosad), Alert (chlorfenapyr), and Proclaim (emamectin benzoate) where the foliar spray penetrates the leaf surface providing toxicity through contact and ingestion. Others must be ingested to be toxic to larvae. These compounds are are now registered for use or will be in the next few years. We have a very good understanding of the field activity of these compounds, but are lacking information on their residual efficacy under field conditions. The objectives of this study were to compare and document the residual efficacy of several new insecticides against cabbage looper larvae.

Materials and Methods

In each trial, lettuce or broccoli was direct seeded into double-row beds at the Yuma Valley Agricultural Center, Yuma, Az. Each plot consisted of four, 30 ft long beds spaced 42 inches apart and bordered on each side by an two untreated bed. Plots were arranged in a completely randomized block design with 4 replicates. Crop varieties, planting dates, treatments, formulations, rates and application techniques are provided separately for each trial below.

Residual Efficacy on Thinning Stage Lettuce I. Lettuce 'Desert Queen' was planted on Sep 11, 1999. Sprinkler

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irrigation was used at stand establishment and furrow irrigated thereafter. Foliar applications were made with a CO^2 backpack sprayer with a two-row boom operated at 40 psi and 20 gpa. A broadcast spray was delivered through 3 nozzles (TX-6) per bed. Silwet at 0.125% v/v was added to all treatments except Confirm, which received Latron at 0.125% v/v. Sprays were applied on 7 and 19 Oct. The plant size at the 1st application was 5-6 leaf stage, and 11-12 leaves at the 2nd application. The following treatments were evaluated: Avaunt 30WG (indoxacarb) at 4.0 oz/acre; Alert 2SC (chlorfenapyr) at 7.0 oz; Success 2SC (spinosad) at 4.5 oz; Proclaim 5SG (emamectin) at 2.4 oz; Confirm 2F (tebufenozide) at 8.0 oz; Lannate SP (methomyl) +Warrior T (lambda-cyhalothrin) at 0.65 lb+ 3.2 oz; and an untreated control.

Residual Efficacy on Thinning Stage Lettuce II. Lettuce 'Desert Storm' was planted on Sep 14, 1999. Sprinkler irrigation was used at stand establishment and furrow irrigated thereafter. Foliar applications were made with a CO^2 backpack sprayer with a two-row boom operated at 40 psi and 15 gpa. A broadcast spray was delivered through 3 nozzles (TX-6) per bed. Silwet at 0.125% v/v was added to all treatments except Confirm, which received Latron at 0.125% v/v. Sprays were applied on 6 and 13 Oct. The plant size at the 1st application was 4-5 leaf stage, and 7-8 leaves at the 2nd application. The following treatments were evaluated: Avaunt 30WG at 4.0 oz/acre; Success 2SC at 6.0 oz; Proclaim 5SG at 3.2 oz; Confirm 2F at 8.0 oz; and an untreated control.

Residual Efficacy on Heading Stage Lettuce. Lettuce 'Desert Queen' was planted on Sep 11, 1999. Sprinkler irrigation was used at stand establishment and furrow irrigated thereafter. Foliar applications were made with a CO^2 backpack sprayer with a two-row boom operated at 40 psi and 20 gpa. A broadcast spray was delivered through 3 nozzles (TX-6) per bed. Silwet at 0.125% v/v was added to all treatments except Confirm, which received Latron at 0.125% v/v. A single spray was applied on 3 Nov. The plant size at application was early heading stage (18-20 frame leaves, leaf cupping with 2" diameter heads). The following treatments were evaluated: Avaunt 30WG at 4.0 oz/acre ; Success 2SC at 5.0 oz; Proclaim 5SG at 3.2 oz; Confirm 2F at 8.0 oz; Confirm 2F at 8.0 oz+ Warrior T at 3.5 oz; oz; Lannate SP +Warrior T at 0.65 lb+ 3.5 oz; and an untreated control

Influence of Spray Frequency on Residual Efficacy. Lettuce 'Desert Queen' was planted on Sep 1, 1999. Sprinkler irrigation was used at stand establishment and furrow irrigated thereafter. Foliar applications were made with a CO^2 backpack sprayer with a two-row boom operated at 40 psi and 17 gpa. A broadcast spray was delivered through 3 nozzles (TX-6) per bed. Silwet at 0.125% v/v was added to all treatments except Confirm, which received Latron at 0.125% v/v. The plant size at the 1st application was 4-5 leaf stage. Listed in the below table is the description of active ingredients, spray frequencies and dates used in the study.

Treatment combinations for Spray Frequency and Residual Efficacy Trial

Active Ingredient (rate/acre)	**Spray Frequency** (# applications)	**Spray Dates**
Success 2SC (6 oz/ac)	3 day interval (4)	Sep 21, Sep 24, Sep 27, Oct 1
Confirm -2F (8 oz/acre)	6 day interval (2)	Sep 21, Sep 27
Proclaim-5SG (3.2 oz/acre)	10 day interval (2)	Sep 21, Oct 1
Lannate (0.8 lb) +Warrior (3.7 oz)		

Evaluation procedures: Evaluation of cabbage looper control was based the number of live larvae per plant sampled from the center 2 rows of each replicate. The plots were sampled before the first application, and at various intervals after treatment (DAT). 10 plants per plot were destructively sampled on each sample date. The sample unit consisted of examination of whole plants for presence of cabbage looper larvae. Each larva was characterized as either large or small. Larvae were considered small if <10 mm, large if > 10 mm. Treatment means were analyzed using a 1-way ANOVA and means separated by a protected $LSD_{(P<0.05)}$.

Results and Discussion

Residual Efficacy Thinning Stage Lettuce I. CL pressure was moderately high, but larval numbers diminished following the 2nd application (Figure 1). Lannate+Warrior and Success appeared to have the most significant impact on small larvae. All of the materials provided a solid 7 day residual (>90% control). Beyond 7 days, Success and Avaunt provided the most consistent reduction of large larvae. We're uncertain whether similar residual control would occur under more constant, heavier pest pressure.

Residual Efficacy on Thinning Stage Lettuce II. CL population pressure was higher in this study, peaking at 2.2 larvae / plant in the untreated check (Figure 2). All of the chemistries provided excellent CL control (>90%) of large larvae for 7 days following both sprays. Success provided consistent residual activity against both small and large CL larvae for 7-11 days residual control.

Residual Efficacy on Heading Stage Lettuce. All of the products provided efficacy against large CL at 7 and 11days after treatment (Fig 3). Overall, Success and Confirm +Warrior provided the greatest reduction of large larvae. The lack of differences between Confirm and the Untreated check at 3 DAT reflects the slow activity of the IGR., which ultimately provided significant control. The rate of Confirm activity at heading stage appeared to be enhanced with the addition of the pyrethroid.

Influence of Spray Frequency on Residual Efficacy. Population pressure for CL larvae was heavy during the beginning of the study, but diminished in the untreated check after 21 days . Numbers of CL larvae in treatments receiving sprays on 3 and 6 -day spray intervals remained significantly low compared with the check throughout the test (Figure 4 & 5). Results from the 10 day spray interval suggest that following initial treatments, these products can be expected to provide about 7 days of residual control, and perhaps longer following subsequent sprays (Figure 6). In general, as the spray interval was extended numbers of small larvae increased following sprays, particularly in the Confirm and Proclaim plots. The importance of this is questionable since these new products have excellent activity on large larvae.

Conclusions: These replicated trials clearly demonstrate that the new insecticides provide a solid 7 day residual efficacy (>90% control) following spray applications. Overall, Success at rates ranging from 4.5-6.0 oz/acre appeared to provide the most consistent residual activity on newly emerging small larvae and larger larvae present on plants at application. Confirm appeared to provide inconsistent results, but residual control was generally similar to Success. The slow acting mortality associated with this IGR makes assessment difficult, especially for small larvae. The newer compounds Proclaim and Avaunt, showed good residual efficacy for up to 7 days, and will be a welcome addition to the growers insecticide arsenal. Finally, the fact that all of these compounds are effective against large larvae in part explains their consistent residual activity on lettuce.

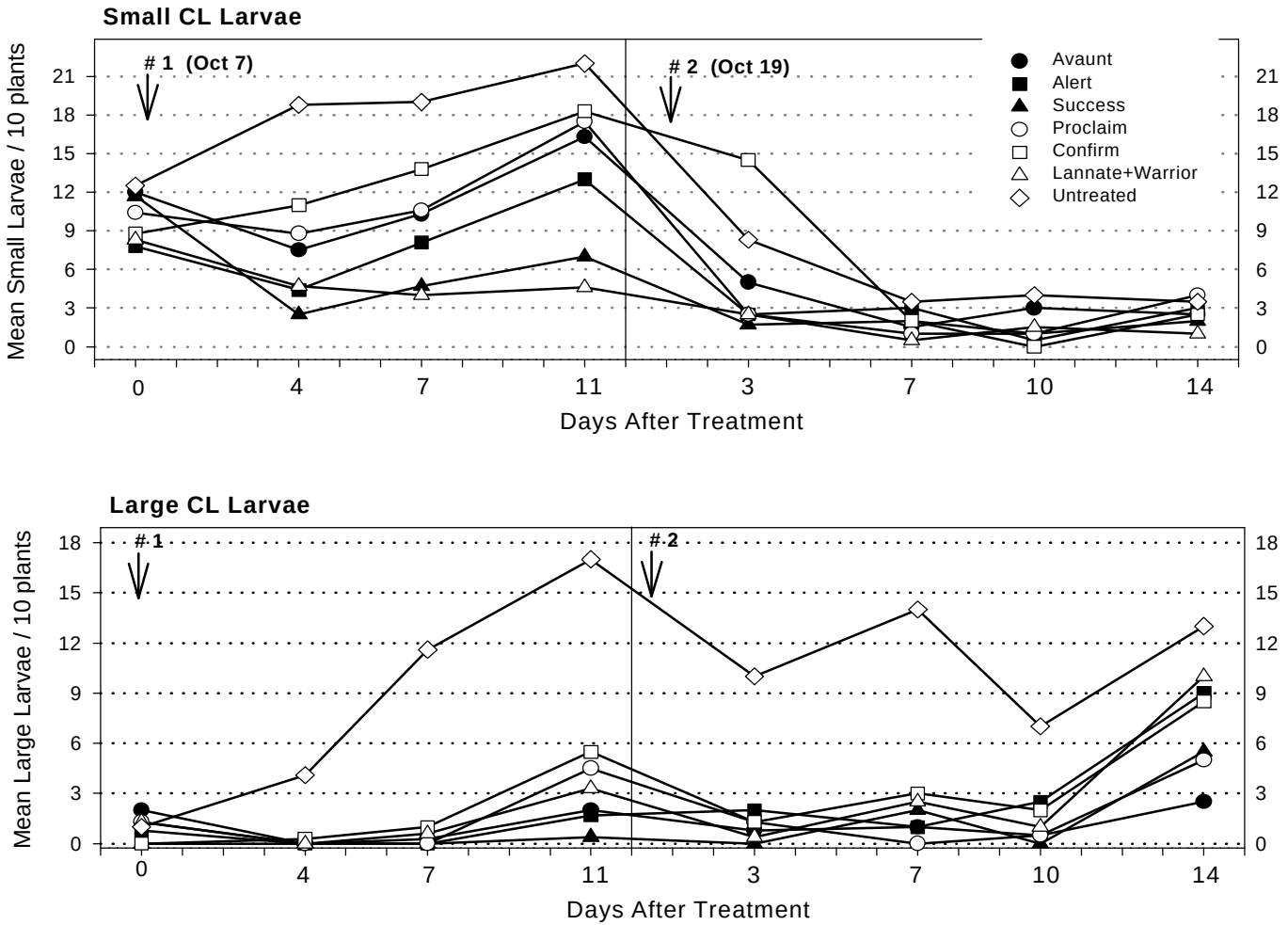


Figure 1. Residual Efficacy of New Chemistires at Reduced Rates Against Cabbage Looper on Thinning Stage Lettuce

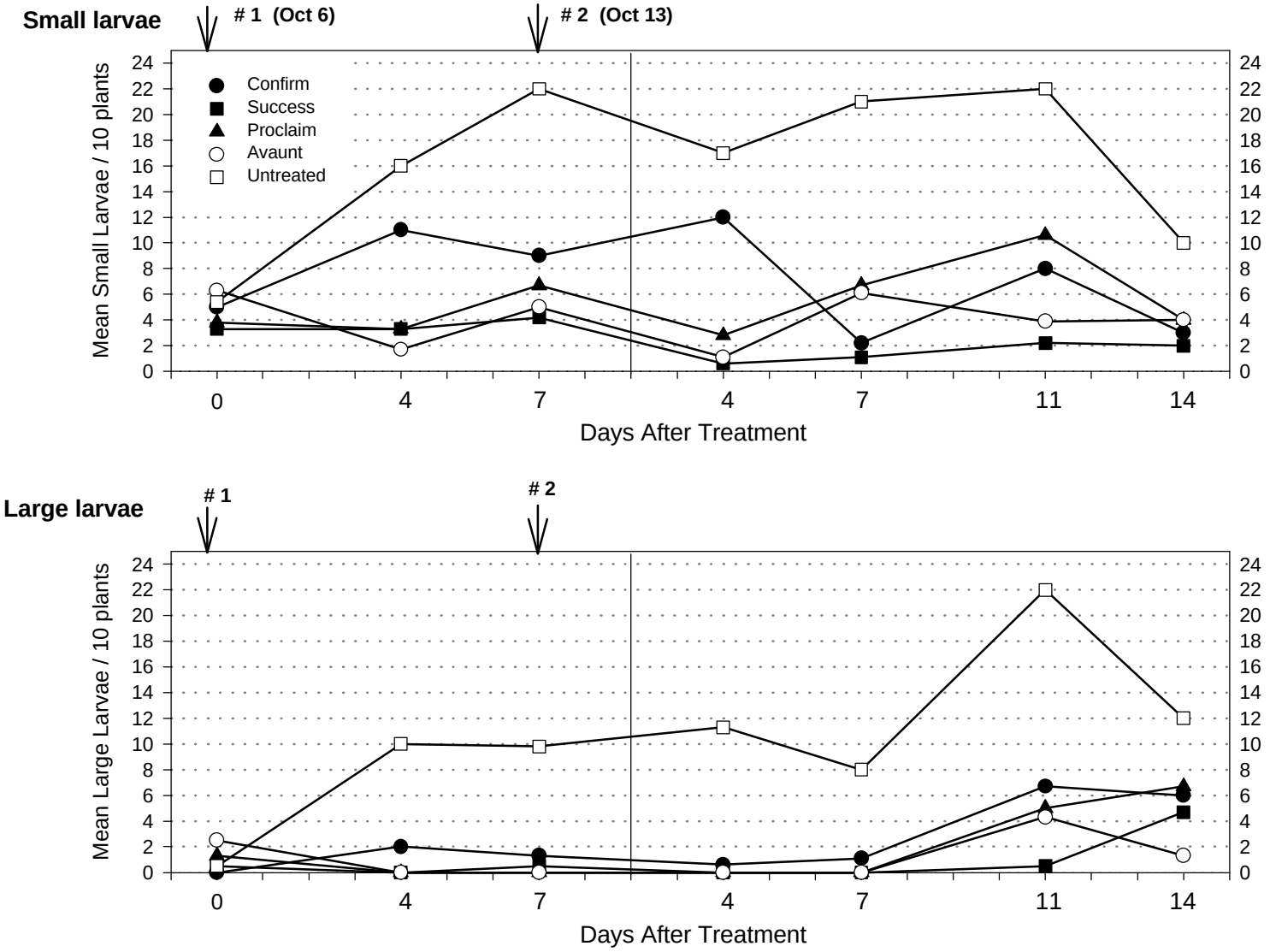
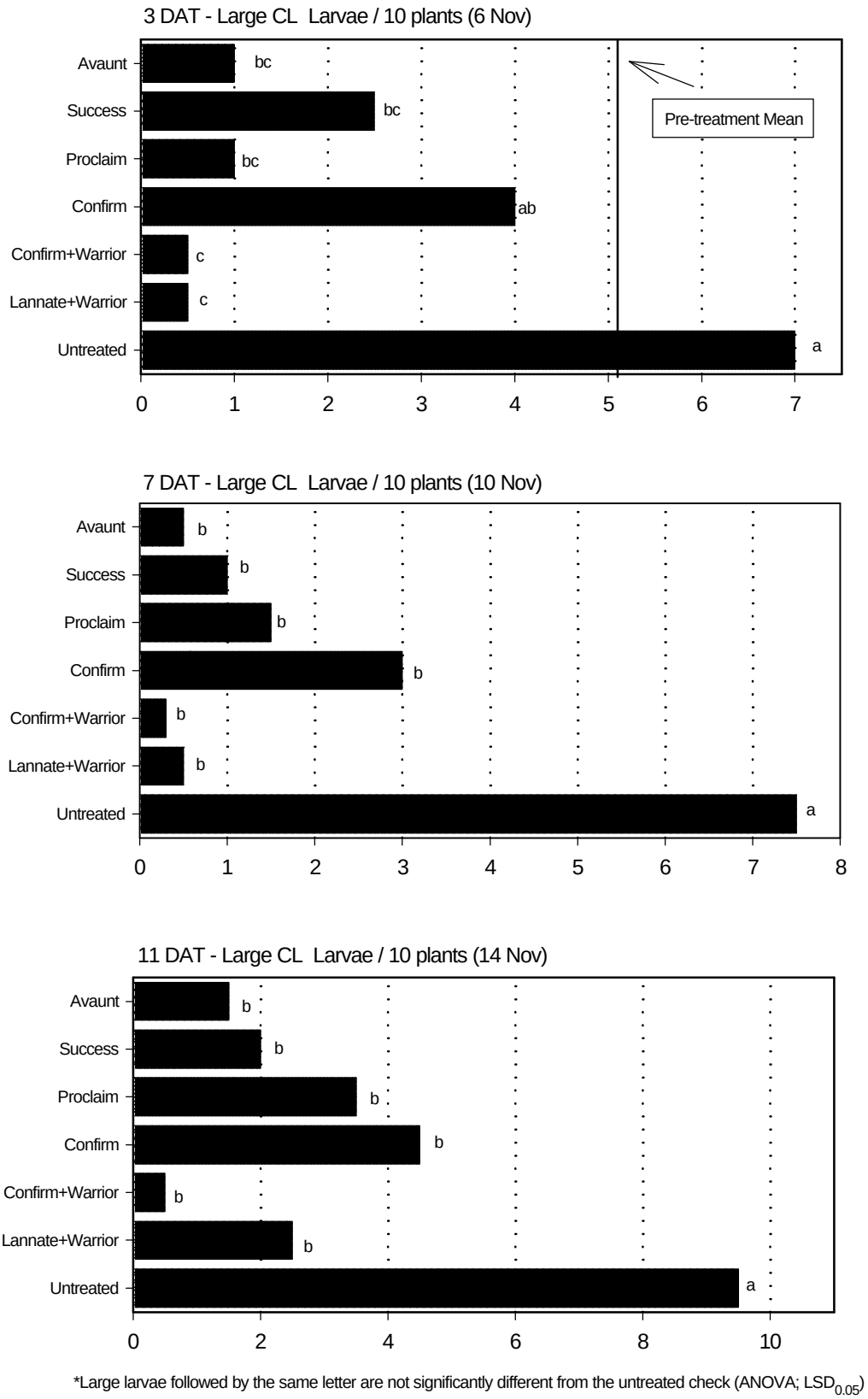


Figure 2. Residual Efficacy of New Chemistries Against Cabbage looper in Thinning Stage Lettuce



*Large larvae followed by the same letter are not significantly different from the untreated check (ANOVA; $LSD_{0.05}$)

Figure 3. Residual Efficacy of New Active Ingredients Against Cabbage Looper on Heading Stage Lettuce

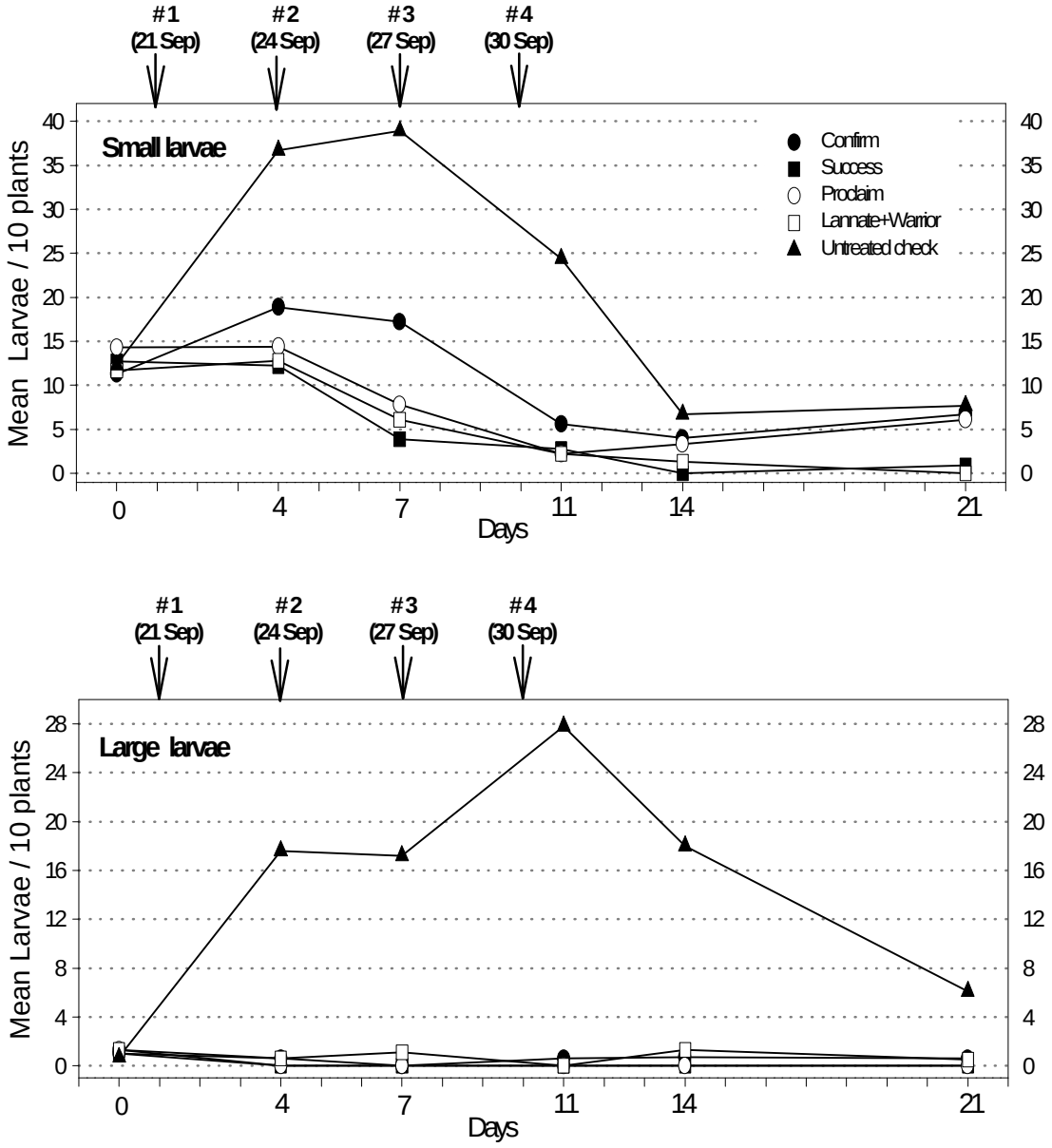


Figure 4. Cabbage Looper Residual Efficacy - **3 Day** Spray Regime on Thinning Stage Head Lettuce

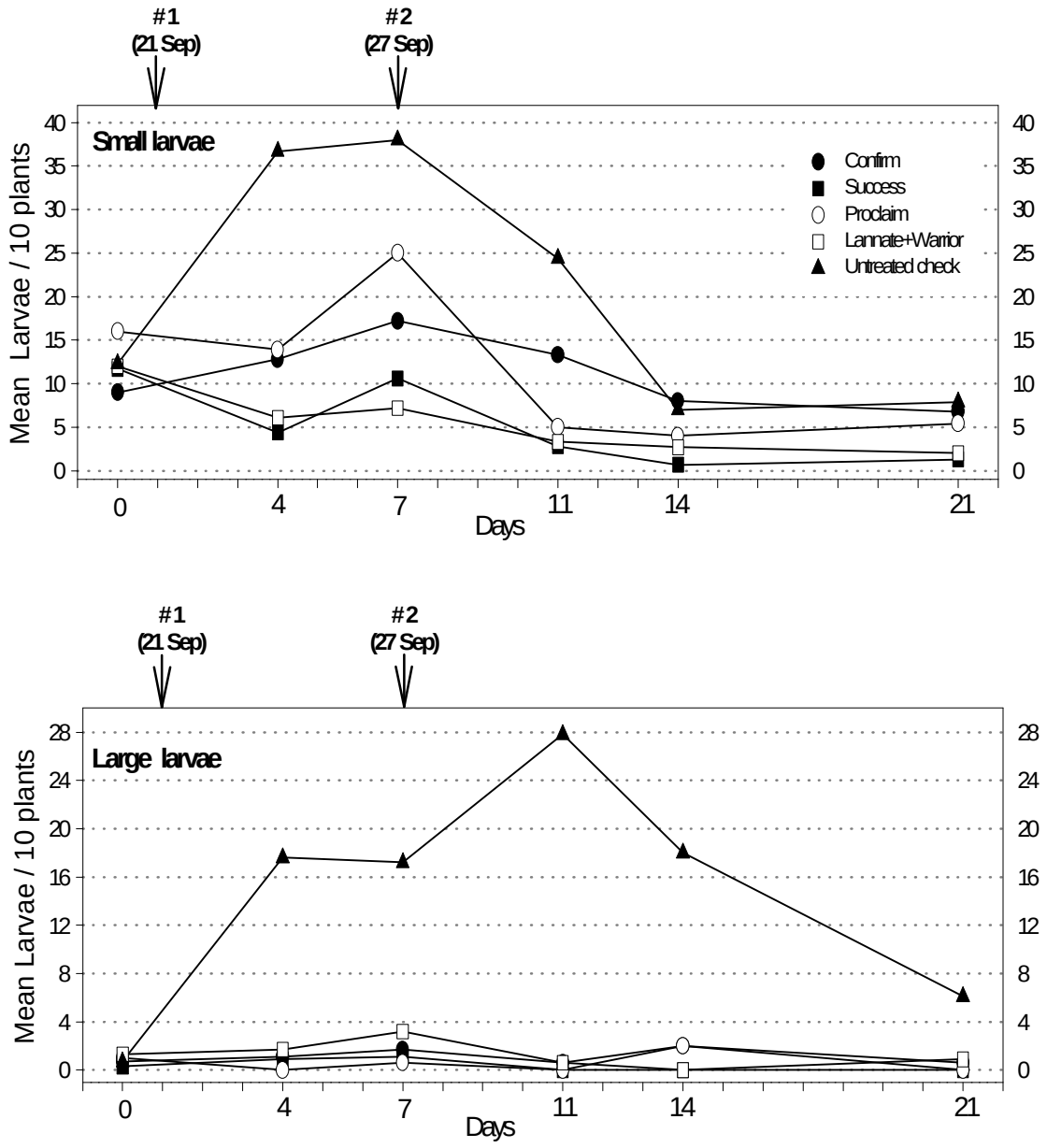


Figure 5. Cabbage Looper Residual Efficacy - **6 Day** Spray Regime on Thinning Stage Head Lettuce

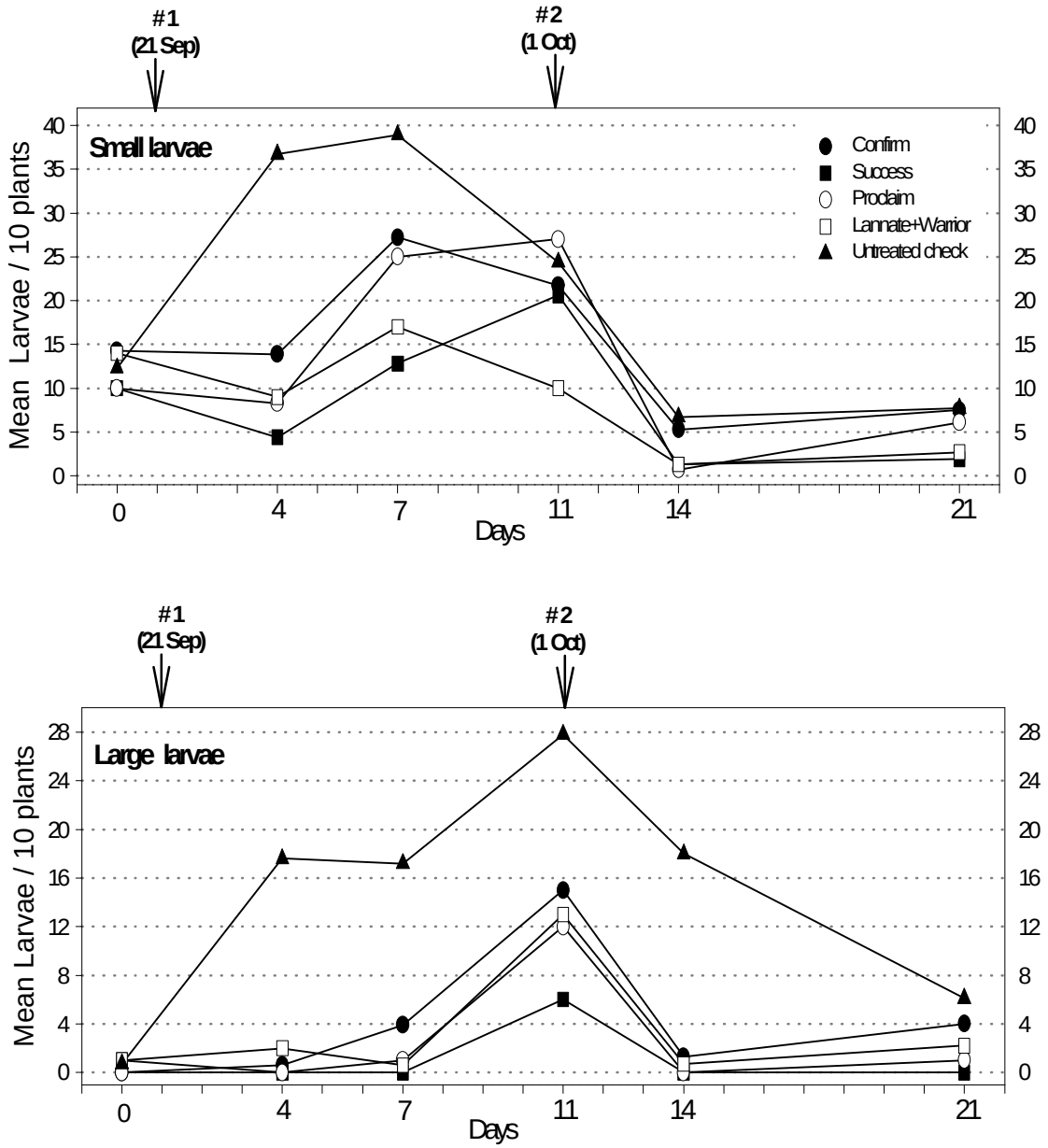


Figure 6. Cabbage Looper Residual Efficacy -**10 Day** Spray Regime on Thinning Stage Head Lettuce