

Potential of Particle Film Technology for Insect Management in Crisp Head Lettuce

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Abstract

A new insect management technology known as “particle film” technology (Surround) was evaluated for its potential for control of early fall pests of head lettuce in Yuma, AZ. Surround did appear to slightly reduce larval population of cabbage looper, beet armyworm and Heliothis, but not enough to be considered a commercially effective treatment. Additionally, Surround appeared to antagonize Success’s activity towards cabbage loopers. Against whiteflies, Surround did appear to reduce ovipositioning, but resultant impact on the nymph population could not be adequately assessed. Overall, Surround does not appear to have a good fit in the pest management system in leafy vegetables in Yuma, AZ.

Introduction

Particle film technology is a new and novel approach to managing insect in agricultural crops. Currently, there is only one product under development, Surround (kaolin). Surround is a highly refined kaolinic mineral, it is white in appearance and highly hydrophobic. Its insecticidal qualities are thought to result from its irritative, repellent, and anti-ovipositional qualities. Surround has proven effective against a number of insect pests of fruit crops, including pear psyllid, codling moth and thrips. Before this product can be effective, the plant must be essentially painted white with the product. Although Surround can be easily washed from the plant, this white washing greatly limits its utility in leafy vegetables which are often field packed. The obvious window for using Surround on lettuce in Yuma, would be during the fall from plant emergence to thinning. During this period, insect pressure is high and those portions of the plant that would be white washed would not be harvested. Here we report the potential of Surround for use in leafy vegetables for managing early season fall pests: beet armyworm, *Spodoptera exigua*, cabbage looper, *Trichoplusia ni*, Heliothis, *Heliothis virescens* and *Helicoverpa zea*, and whitefly, *Bemisia argentifolii*.

Materials and Methods

Crisp head lettuce, ‘Empire’ was direct seeded into double rows on 42-in beds on 24 August 1998 at the Yuma Valley Agricultural Center, Yuma, AZ. Plots were 12 beds X 50 ft, bordered on each side by 2 blank beds and on each end by 5 ft alleys. The test was a split-split design, with 4 replicates. Main plots were those treated with standard foliar Lepidopterous insecticides and an untreated. Success (spinosad) at 5 oz/ac and Warrior (lambda cyhalothrin) at 3.84 oz/ac + Lannate (methomyl) at 1 lbs /ac were the standard foliar sprays. Hereafter the Warrior + Lannate treatment will be referred to as “Standard”. Subplots included an untreated, and one treated with Surround at 75 lbs/100 gallons. Foliar applications included MO-3 spreader sticker at 0.25% v/v. All foliar

applications were applied at 85 gallons/ac total volume. A large spray volume was used to insure adequate coverage of the Surround. Foliar treatments were sprayed using a tractor mounted sprayer. The boom covered 4 rows, with 3 hollow cone TXV-4 nozzles per row, one centered over the bed and two on angled drops on each side of the bed. Foliar treatments were applied on 19 and 28 September, and 2 and 8 October.

The sub-subplots consisted of and untreated and a soil applied treatments targeting whitefly. Admire (imidacloprid) at 20 oz/ac was injected 1.5-2.0 inches below the seed line just prior to planting in 10 gallons/ac total volume.

Populations of cabbage loopers, beet armyworms and *Heliothis* were estimated on 22 and 25 September, and 1, 6, 12 and 15 October by counting their number of eggs, small larvae (1st and 2nd instar) and large larvae (3rd - 5th instar) from 10 plants per subplot. Because Admire had effect on Lepidopterous pests, sub-subplot data were pooled. Evaluations of whitefly populations were made on 7, 13 and 20 October by counting the number of eggs and small nymphs per 1 inch² from 10 leaves collected from a mid-frame leaf. Red-eyed nymphs and eclosed pupae were not recorded because none were found on this portion of the plant. Because we were primarily interested in comparing Surround to Admire for whitefly control with no influence from other factors, comparisons were made using data only from the untreated main plots.

Results and Discussion

Following the first two foliar applications, cabbage looper populations were high in this test, and the data for each evaluation is presented. Beet armyworm and *Heliothis* were less abundant, and data for these pests were pooled into seasonal means. Although there were some slight differences among treatments, Surround did not consistently appear to reduce the number of cabbage looper eggs (Figure 1). Thus, white washing the plants does not appear to adversely affect the female cabbage looper moths ability to locate a suitable host, nor did it appear to repel them. Based on small cabbage looper larvae, both Success and the Standard (Warrior + Lannate) were effective in reducing the population (Figure 2). Surround did not appear to have any appreciable impact small cabbage looper when applied with the Standard or alone. However, when applied with Success there appeared to be some antagonism. On most sample dates there were more larvae in the Success + Surround plots than those with Success alone. Success is a translaminar product, and most of its activity comes following ingestion. Surround may hamper its activity by binding it up and preventing it from translaminarily moving from the top surface of the leaf where it was applied, to the underside of the leaf where most of the larvae are feeding. Surround may also interfere with Success's activity by repelling the larvae away from the white surfaces onto tissue that may not have been adequately covered where they can feed without contacting the poison. This scenario is partially supported by data collected from large cabbage looper larvae. Surround alone may have some negative impact on cabbage looper larvae survivability. On 1 October when cabbage looper numbers were especially high, Surround statistically contained either fewer larvae than the untreated (Figure 3). However, this finding was inconsistent and not evident on other sample dates. Additionally, although greatly reduced in number, Success + Surround does appear to fairly consistently contain more larvae than Success alone. Even though Surround alone does appear to have some activity, the inconsistency and magnitude of this reduction is not sufficient to be commercially acceptable.

Although populations were not as great as for cabbage looper, we were able to generate some data regarding Surround's activity towards beet armyworm and *Heliothis*. Results on these pests were similar in trend as with cabbage looper, except the antagonism with Success was not evident (Figure 4).

Surround did appear to have repellent qualities towards whiteflies. The Surround treated plots consistently contained fewer eggs than the Admire and/or untreated plots (Figure 5). However, this impact did not necessarily appear to result in fewer whitefly nymphs. Only on 7 October, did the Surround plots contain fewer nymphs than the untreated. On 13 and 20 Oct, there was a great deal of variability and there were no statistical difference among treatments. Thus it is difficult to adequately assess Surround effectiveness on whiteflies.

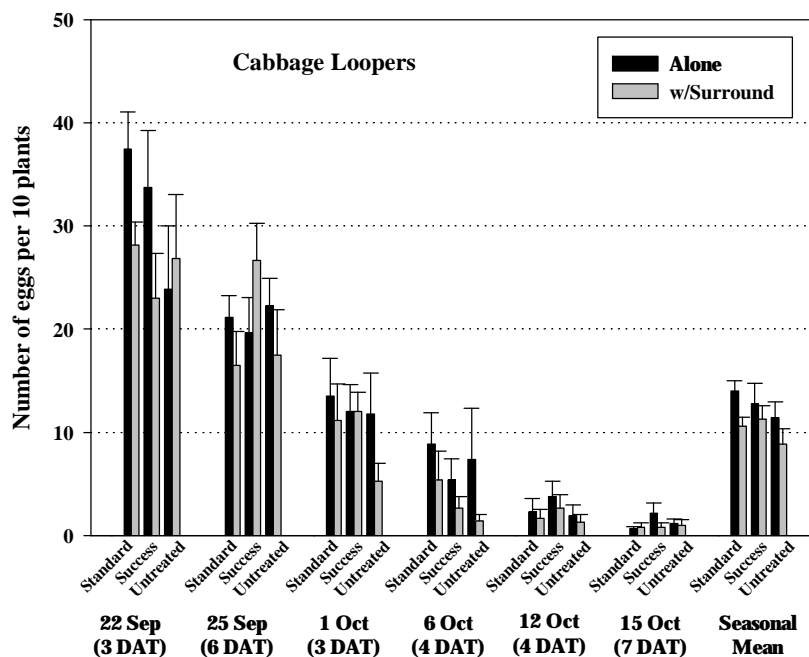


Figure 1 Impact of Surround with and without other insecticides on reducing cabbage looper ovipositioning.

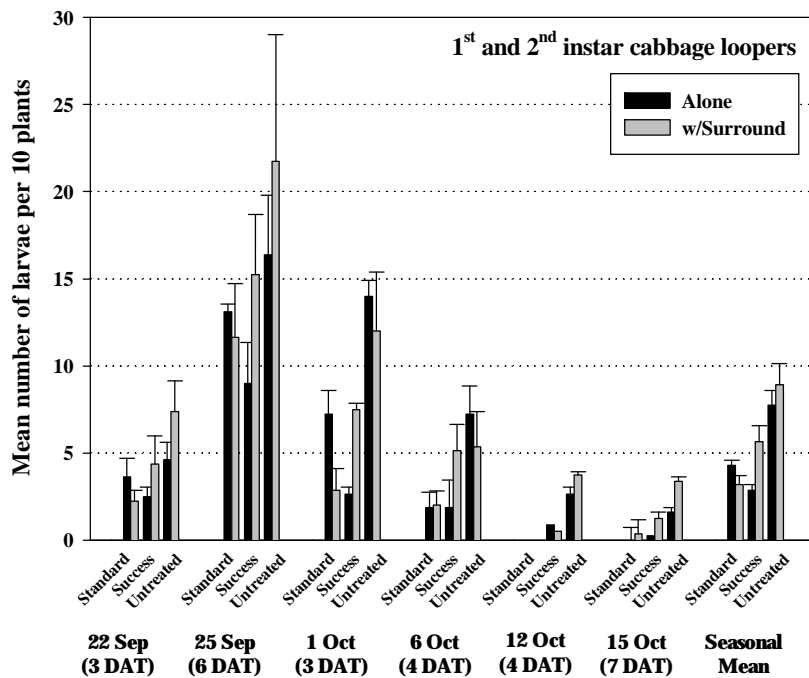


Figure 2 Impact of Surround with and without other insecticides on small cabbage looper larvae.

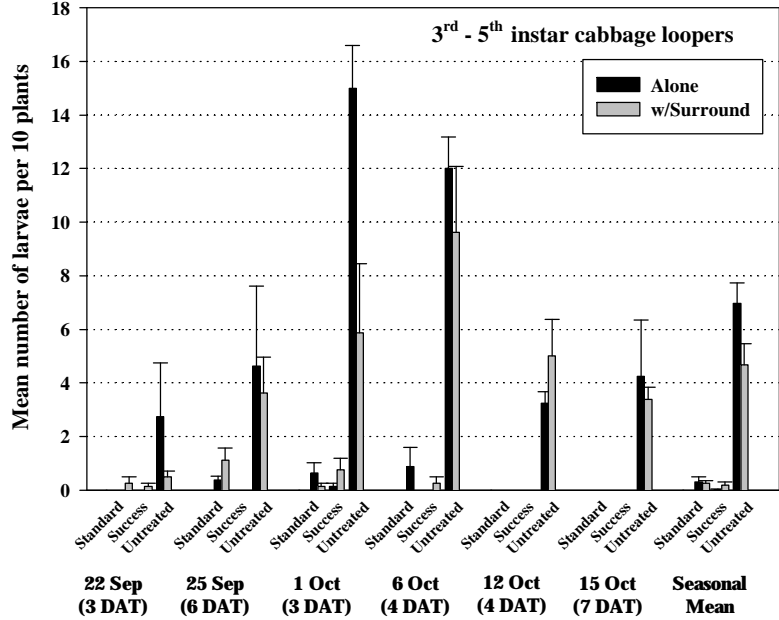


Figure 3 Impact of Surround with and without other insecticides on large cabbage looper larvae.

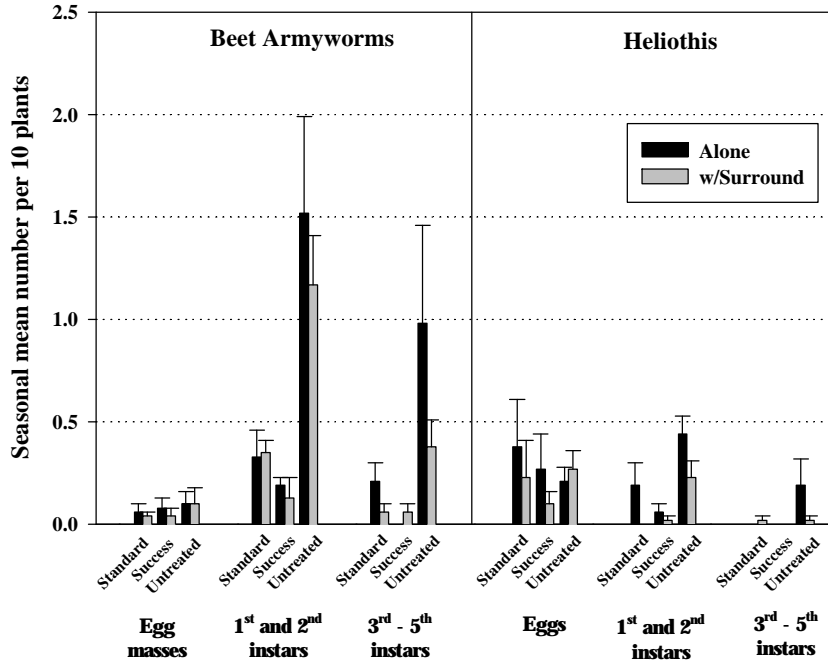


Figure 4 Impact of Surround with and without other insecticides on ovipositioning and larvae of beetle armyworm and Heliiothis..

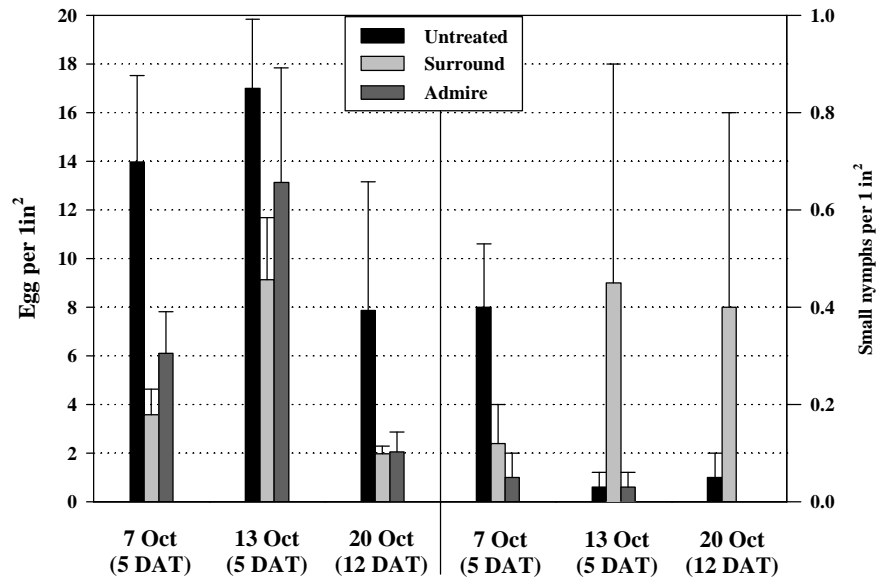


Figure 5 Impact of Surround on whitefly ovipositioning and population development on head lettuce.