

MANAGING SYMPHYLANS BY ESSENTIAL OIL-BASED PESTICIDES ON VEGETABLES

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Symphylans or garden centipedes, *Scutigera immaculata*, are not insects; they belong to the arthropod Class Symphyla that is related to centipedes and millipedes. Symphylans are occasional pests that feed on young roots of all plants and decaying organic matters. Their feeding on crops could stunt and kill the plants that might cause no yield in patchy areas of fields. The reasons of “why and when” that cause outbreak of the pest in different sites of fields are still not fully understood. The only strategy for managing the pest is conducting preventive tactics of applying pesticides in the hot-spot of past years in suppressing their activities to maintain the potential yield of the crops. The objective of the study was to investigate the effectiveness of essential oil-based pesticides for the management of symphylans on vegetables.



Fig. 1. Symphylans collected in the field by potato station

Management on Artichoke

A 10-acre perennial artichoke field with 2.5-acre of severe symphylan damage reported in the past years (hot-spot) at a commercial farm near Lompoc, CA was selected for the trial. The trial was conducted from October 2009 through June 2010.

Treatments

The perennial artichokes were chopped in early October 2009 and the EcoTec G was applied in the 2.5-acre hot-spot on the following day. EcoTec was then applied monthly from late October to February 2010 in the 10-acre field, except a 0.25-acre for Sesamin EC treatment and a 0.75 acre for EcoTec G treatment (Fig. 2). EcoTec G was applied on the artichoke beds and incorporated in 2-3 inch soil; whereas EcoTec or Sesamin EC was applied through the drip irrigation system.

1. *Treatment 1 on a 1.5-acre hot-spot*: 28 lb EcoTec G per acre was applied once in October 2009 and 32 oz EcoTec per 100 gal water per acre (+ 0.5% Widespread Max) was applied monthly from November 2009 through February 2010.
2. *Treatment 2 on a 0.25-acre (1-row) next to Treatment 1 in the hot-spot*: 28 lb EcoTec G per acre was applied once in October and 1 gal Sesamin EC per 100 gal water per acre was applied monthly from November through January 2010.
3. *Treatment 3 on a 0.75-acre next to Treatment 2 in the hot-spot*: 28 lb EcoTec G per acre was applied once in October 2009.
4. *Treatment 4 on a 7.5-acre next to Treatment 3*: 32 oz EcoTec per 100 gal water per acre (+ 0.5% Widespread Max) was applied monthly from October 2009 through February 2010.

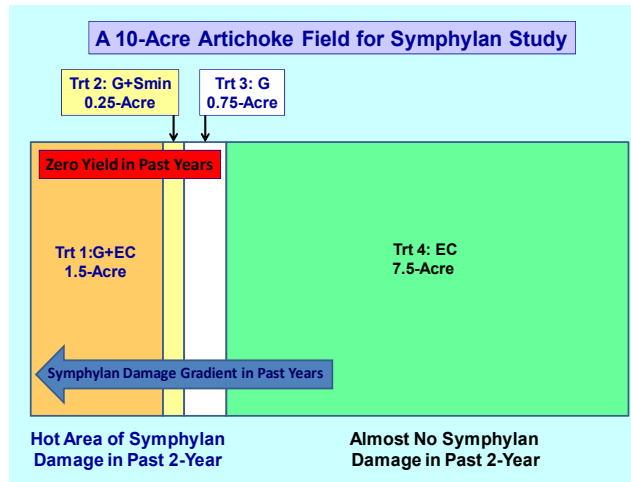


Fig. 2. The experimental design of the artichoke field.

Results and Discussions

The artichokes were harvested for 8 times weekly from April to June 2010. However, only the yield of Treatments in some reserved areas of the field were recorded and analyzed in this study. A 75-ft bed was reserved in 3 rows of Treatment 1, 1 row of Treatment 2, 2 rows of Treatment 3, and 3 rows of Treatment 4 in estimating the yield. The reserved areas were harvested on April 15, April 27, and May 5 2010.

The artichokes harvested in each treatment were categorized accordingly to the marketing value of artichokes at 15 per box, 18 per box, 24 per box, and 30 per box. The mean number of artichokes harvested and the percentage of the yield potential reserved were calculated and presented in the following bar graphs (Figs. 2 and 3). The highest mean yield (Total) of the 3 harvesting dates was Treatment 4 having 67.3 artichokes per harvesting day, followed by Treatment 3 with 61.3 artichokes, then Treatment 2 with 57.3 artichokes. The lowest mean yield was Treatment 1 that had 55.3 artichokes per harvesting date (Fig. 3).

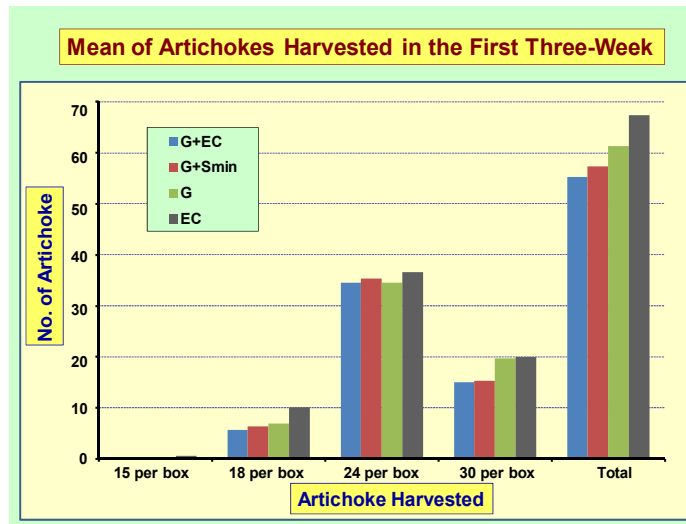


Fig. 3. Mean yield of artichokes harvested in a 75-ft row of the first 3-week of Field.

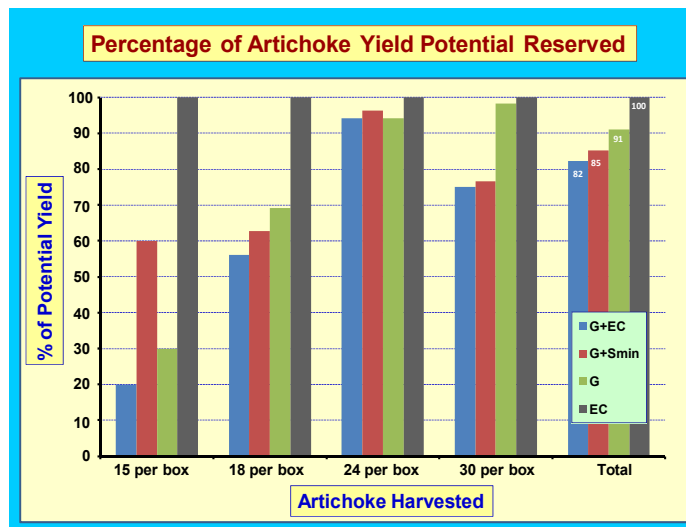


Fig. 4. The percentage of yield potential reserved by all treatments in the first 3-week

In the past 2-year, the 2.5-acre hot-spot with severe symphytan damage in the field had almost no yield because of stunting and killing of the plants by the pests (Personal Communication with the Farms). Thus, no untreated areas were reserved in the field for this study. Instead of comparing an untreated treatment with severe damage and no yield, the objective of the study was focused on reserving the potential yield of the field by the assigned treatments.

Based on the observations in the past years by the Farms, the 10-acre field of the study was believed to have a gradient of symphytan activities with extreme damage on one side and almost no damage in the center and on the other side of the fields. Hence, Treatments 1, 2, 3, and 4 were assigned for the highest to the lowest symphytan damage areas, respectively (Fig. 2).

The results of the study demonstrated that the yield of all treatments were coincident with the symphytan damage gradient in the past years with the highest yield on the lowest symphytan

activity areas and the lowest yield in the highest activity sites (Figs. 2, 3, and 4). There was no symphylan damage observed on all treatments during the study; furthermore, the highest yield was Treatment 4 and the lowest yield was treatment 1. Using the yield of Treatment 4 with low or no symphylan damage recorded in the past years and year 2010 as a 100 % in yield; Treatments 1, 2, and 3, reserved the artichoke yield potential as 82.2, 85.1, and 91.1% in 2010, respectively (Fig. 4). In other words, Treatments 1, 2, and 3 increased the yield of 0% in the past years to more than 82% in 2010. The results of this study indicated that the essential oil-based pesticides, including EcoTec G, EcoTec, and Sesamin EC had strong impact in suppressing or controlling symphylan activities on perennial artichokes.

Management on Tomato

Further investigation of the EcoTec effectiveness on symphylans was conducted on tomato (about 1/4 acre) at the University of California Cal Poly Organic Farms in 2012. The results demonstrated that even the tomato transplants were stunted by the symphylans after transplanted; however, after two applications of 40 fl oz EcoTec through the drip irrigation system, the tomato plants were protected by the EcoTec and fruits were harvested in two months at the Organic Farms.

Management on Vegetables

Further investigation of the EcoTec G effectiveness on symphylans was conducted on vegetables at the hot-spot in the past years (about half-acre) at the Organic Farms of the University of California Santa Cruz in 2012. The results showed that applications of 28 lb EcoTec G that was incorporated in 1-2 inches soil once during planting or transplanting, the essential oil-based pesticide could protect the vegetables from symphylan damage and reserved the potential yield of the crop. Moreover, no symphylan damage was observed in the hot-spot and vegetables were harvested in two months at the Organic Farms.

Conclusions

For short-term control (3-week) of symphylans on annual crops by essential oil-based pesticides, such as on direct seeded vegetables; applying 28 lb EcoTec G and incorporated into 1-2 inch of soil during planting.

For long-term control (seasonal) of symphylans on perennial crops by essential oil based pesticides, such as artichokes; applying 28 lb EcoTec G and incorporated into 2-3 inch of soil, and/or applying 32-64 fl oz EcoTec plus organic or convectional adjuvant through the drip irrigation system during the last watering cycle in every 2-4 weeks, depending on the symphylan pressure.