The Benefits of Insecticide Use: Cucumbers

Pickleworm Moth

Pickleworm Moth Damage

Spraying Cucumbers

Bacteria Transmitted by Cucumber Beetle

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Key Points

- The pickleworm survives the winter in south Florida and migrates north in the summer; each female moth can lay 300-400 eggs.
- Cucumbers that are entered by the pickleworm are unfit for human consumption because of the tunneling and excrement of the insect.
- Spraying of cucumbers with insecticides can reduce the pickleworm from 80% to 0.5%.
- Cucumber beetles transmit bacterial wilt which results in plant death due to the presence of masses of bacteria inside the plant.

Technical Summary

U.S. growers produce 1.6 billion pounds of cucumbers with a value of $322 million from 131,000 acres. 66-97% of cucumber acres in individual states are treated with insecticides [22]. Insecticide costs for cucumbers in the southeast are approximately $31-$38/A which represents about 2% of the cost of producing the crop [16][20]. In North Central states and Texas the cost of insecticides is approximately $8-$12/A for cucumbers [17]-[19]. In Florida the cost of insecticides for cucumbers is $219/A representing about 5% of the cost of production [21].

Pickleworm

The most troublesome insect pest on cucumbers in Florida and the southeast is the pickleworm [2]. The presence of wild hosts of pickleworm in Florida is responsible for a year-round population. In January 1985 the pickleworm population on cucurbits in Dade county was estimated at 3765 per acre for a total of ten million [12].

The moth which produces the pickleworm has been known since 1782, but the pickleworm as a pest appears to have escaped attention until 1869 when it was described in processed pickles [8]. Early attempts to control the pickleworm with Paris green and lead arsenate proved they had little, if any, value in fighting the pickleworm [8].

Pickleworm is a tropical insect which survives the winter only in south Florida and south Texas. Pickleworm is highly dispersive and invades much of the southeast each summer. They migrate north when environmental conditions become favorable. North Carolina and South Carolina regularly experience crop damage by pickleworm, but often this does not occur until August or September [1]. In contrast, northern Florida is flooded with moths each year in early June. In some years they reach locations as far north as Michigan and Connecticut.

The adults are active and lay their eggs only at night. None have been seen in the fields during the day. It appears that they spend daylight hours in vegetation near cultivated fields, possibly on trees or high bushes. They fly with the wind and as high as fifty feet from the ground.
The number of pickleworm generations has been estimated to be four in Georgia and two or three in North Carolina. Egg production is estimated to be 300 to 400 eggs per female [1]. Eggs and young larvae are commonly found on new growth and flower buds. As larvae mature, they disperse and tunnel into the fruit.

Cucurbits appear to be the only plants attacked by the pickleworm [10]. Pickleworm feeds on both wild and cultivated cucurbit species. Creeping cucumber is considered to be an important wild host. It attacks cucumbers, squash and cantaloupes. It is rarely a pest on watermelons and pumpkins.

When about half grown, the pickleworm bores into the side of a fruit and feeds there until a rather large cavity is eaten out. When entering the fruit, the pickleworm voids soft excrement which is left in a small pile near the entrance hole. Later, the excrement is left inside the cavity [8]. The larva’s entrance is marked by a small hole, through which frass is extruded. Masses of green waste can be seen in the entrance holes. In addition, the entrance holes also serve as points of entry for decay organisms. Individual pickleworm larvae feed 2 to 3 weeks [10].

Fruits that are entered by the pickleworm are made unfit for human consumption because of the tunneling and excrement of the insect [10].

Pickleworm has several natural enemies, but none reliably suppress damage [1]. Natural enemies are of no significant benefit in suppressing pickleworm populations; consequently, populations usually increase rapidly and often destroy the crop if insecticides are not applied [7]. Six native parasitoid wasps have been found attacking pickleworm in Florida but these parasitoids are ineffective in controlling pickleworm populations. Predators and parasites can moderate the severity of pickleworm damage, but they generally are not present in sufficient numbers for effective control [23].

An entomopathogenic nematode has been shown to effectively suppress pickleworm injury in squash. Nematode survival is quite good in large-blossomed squash, where the nematodes can kill the young pickleworm before it burrows into the fruit. This approach is probably ineffective for species with small, open blossoms such as cucumber because the nematodes die quickly when exposed to sunlight [1]. Bt will kill pickleworm, but is usually not recommended because the internal feeding behavior of the insect puts the feeding larvae beyond the reach of a stomach-active toxin [1].

Frequent foliar sprays are needed to prevent the pickleworm from entering and contaminating pickles [3]. Pickleworms often pass unnoticed inside fruit and may not be found until after the fruit is processed. Fear of product contamination precludes acceptance of any pickleworm infestation. Lack of treatment may result in condemnation of the entire crop [4]. Pickle processors will refuse to accept a truckload of cucumbers if they notice even one with a pickleworm hole [9].

Regular applications of insecticides have been necessary to control pickleworms in Florida [5]. Although much effort has been put into breeding resistant varieties, no
commercial cultivars are resistant to pickleworm attack [5][23]. In North Carolina for many years it was unprofitable to grow cucumbers in mid or late season due to pickleworms [6]. Low temperatures in the winter kill the pickleworm in North Carolina. The pest is re-established each year when moths fly back from south Florida. The first pickleworms of the summer usually appear any time from mid-June. By August the number is increased and they continue to increase until low temperatures kill plants, insects or both [6]. Cucumber crops grown in North Carolina during the late summer and fall must be treated in 9 out of 10 years with insecticides to obtain marketable fruit [6].

Before the development of effective insecticides for pickleworm, it was the practice in the Carolinas to raise cucumbers only in the early part of the summer [8]. Cucumbers maturing after this time were usually completely destroyed by pickleworms [11].

The tendency for pickleworm larvae to move from leaf and flower buds where most of the eggs are laid provides an opportunity to control the insect with an insecticide before they begin tunneling in fruit. Before the development of DDT, cryolite was recognized as the most effective chemical for control of the pickleworm. Weekly applications of 30 pounds of cryolite dust per acre were recommended [8]. Research demonstrated that the cryolite applications would reduce the incidence of wormy fruit from 67% to 6% [8].

Research with DDT showed a reduction of wormy cucumbers from 80% to 0.5% [11].

Some cultural methods formerly recommended in North Carolina have proved to be worthless in the prevention of pickleworm infestations. These include the destruction of dead host plants and weeds in the fall and winter, the turning of the land by deep plowing after harvest, and the rotation of crops. All these measures were founded on the belief that the insect passed the winter in the pupal stage attached to dead leaves [8].

**Cucumber Beetles (Striped and Spotted)**

Cucumber beetles are the key pests of cucumbers in the mid-Atlantic and Midwestern regions. They defoliate plants as well as spread diseases. Striped cucumber beetles feeds only on cucubits while the spotted cucumber beetle is a general feeder on over 200 plants. Striped cucumber beetle larvae can be numerous enough to injure plant roots and reduce yield in extreme situations and can cause up to 100% loss [14].

The beetles overwinter as adults in fencerows, woodlots, ditch banks, and similar sheltered areas. On the first warm days of spring, they move into the cucumber fields, arriving about the time the young seedling plants are emerging. The striped beetle has even been known to dig down in the soil to meet the emerging sprouts [15]. Adults mass on plants and feed voraciously on the foliage and stems, often causing girdling, which greatly reduces plant stands. After feeding for a few days on the seedlings, the adults mate and lay eggs at the base of the plants. The larvae hatch and feed on the roots of the plants for 2 to 3 weeks.
Bacterial wilt disease overwinters only in the gut of cucumber beetles and is transmitted only by feeding of these beetles [14]. The disease organism is transmitted to the plant from beetle feces via open feeding wounds. The pathogen is carried from plant to plant and to field as the beetles feed. Infected plants eventually wilt and die. Once a plant has been infected with bacterial wilt, it cannot be saved. Infected plants rarely produce marketable fruit. The bacteria multiply at the wound site, enter the xylem vessels, and then move down the petiole and stem. Vascular plugging by masses of bacteria and the subsequent formation of gums and resins are the primary mechanisms of wilting [13]. The bacteria spread to unaffected runners through the dissolved walls of adjacent xylem vessels. Infected plants serve as the source of inoculum for subsequent infections. The presence of bacterial slime (masses of bacteria streaming from xylem tissues) extending from one cut surface to the other is a positive indication of bacterial wilt. Bacteria will ooze from exposed vascular elements of infected plants, forming milky strands flowing from cut surfaces [13].

Control of bacterial wilt depends on control of the cucumber beetle vectors. The use of insecticides is prerequisite to profitable cucumber production in areas where the disease is a problem [13].

References


2. “Crop Profile for Cucumbers in Florida.” Available at: http://pestdata.ncsu.edu/cropprofiles/docs/FLcucumber2.html.


