The Benefits of Insecticide Use: Hazelnuts

Filbertworm

Filbertworm Damage

Shelled Hazelnuts

Harvesting Hazelnuts

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Key Points

- The filbertworm infests all hazelnut growing areas of Oregon.
- During most years, the filbertworm damages 20% of the hazelnuts in untreated orchards.
- Hazelnut shipments are rejected by nut processors if more than 1% filbertworm infestation is present.
- Insecticide sprays reduce filbertworm damage to 0.13%.

Technical Summary

The cultivated hazelnut was introduced from Europe to the west coast of the U.S. during the late 1800s. Commercial production of hazelnuts (then called “filberts”) began in the 1920s. Oregon’s hazelnut orchards, concentrated in the Willamette Valley account for 99% of U.S. hazelnut production and 5% of world production. Oregon’s harvest of hazelnuts ranks third in the world after Turkey and Italy. Oregon growers produce 86 million pounds of hazelnuts with a value of $46 million from 28,000 acres. Shelled nuts account for 53% of the market while nuts in the shell comprise the remaining 47%. Hazelnuts emerge from a husk and drop to the ground where they are collected. Oregon growers began referring to their crop as “hazelnuts” in 1981 to be consistent with the common name for the commodity around the world.

Filbertworm

The most severe insect pest in Oregon is a close relative of the codling moth; the filbertworm which is a native insect that is generally found on acorns and oaks in the Pacific Northwest. The filbertworm made a host shift to the introduced hazelnut. The filbertworm was first discovered in hazelnut orchards in 1917 and became a pest of cultivated hazelnuts in the 1920s. A statewide survey indicated that the pest had infested all filbert-growing areas of the state in 1929 [1]. Filbertworm is perennial problem and occurs in virtually all hazelnut orchards[13].

Filbertworms overwinter as diapausing larvae in silk cocoons in leaves and debris on the ground or in cracks and crevices. Some larvae hibernate 1 to 2 inches below the soil surface [2]. Adults emerge from the cocoons and fly from the middle of June until the end of October. The emergence of the moth is synchronized with the formation and development of the filbert nut [2]. Mating takes place soon after emergence and egg laying begins the next day. They are laid singly on leaves close to the nuts. No eggs are deposited on leaves that are six inches or more away from a nut cluster; thus the female picks egg laying sites that ensure larval development [7]. The eggs hatch in 8 to 10 days and the larvae search for nut clusters. Once a nut is located, the larva tunnels through the husk and continues along the filbert shell until reaching the soft spot where the nut is attached [2]. The nut is penetrated at this point and the larvae feed inside the nut. The larvae are voracious feeders and may be fully-grown within 15 days [8]. Mature larvae exit the nut by chewing a hole through the nut and forming cocoons. Because most infested nuts fall to the ground prematurely, the worm exit occurs after the nut has fallen
A ten year monitoring study indicated that filbertworm damage in unsprayed orchards ranged from a low of 12% to a high of 37% [3]. During most study years, the damage was around 20%.

In the 1930s filbert growers did not have serious concerns regarding the filbertworm since the wormy nuts were sorted out and destroyed in the processing plant [4]. However, the sorting process was expensive [11]. Growers were advised that they could reduce the infestation in the next year’s crop by practicing orchard sanitation. Many of the nuts that drop prematurely from the trees contain worms. By collecting and destroying nuts that fall prematurely, growers not only could reduce the number of wormy nuts going to the processing house but also could reduce the next year’s infestation. Research in the early 1940s indicated that sending a crew of workers through the orchard 4-7 times picking up the drops was effective in destroying 93-95% of the filbertworm larvae in the dropped nuts [4]. The cost of picking up the drops was $3-$7/acre [4].

In the 1940s metallic insecticides like lead arsenate were tested extensively and recommended for filbertworm control [1]. Chemical screening work conducted in the 1940s led to the introduction of DDT for filbertworm control. Carbaryl was registered for filbertworm control in 1960 and was the primary insecticide used for filbertworm control for the next 35 years. Research demonstrated that carbaryl applications resulted in an infestation level of 0.4% in comparison to a 10% infestation with lead arsenate treatments [5].

By 1980 almost all Pacific Northwest nut processors required that filbert nuts be free from filbertworm damage and they reserved the right to reject shipments if more than 1% damage was present [3]. Practically all commercial growers made two carbaryl applications with resultant damage close to zero. Research demonstrated substantial economic benefits from the spraying. The average control costs were $26/A with an estimated income increase of $101/A plus an additional savings of about $21/A in processing costs [3]. Benefits of the filbertworm program were estimated to be as much as 30% of the total revenue in hazelnut growing. Cost/benefit analysis indicated that every dollar spent on the filbertworm control program returned an average of $3.80 [3].

Esfenvalerate has become the insecticide of choice for filbertworm control over the past decade due to increased residual control. Carbaryl sprays are effective for 7-14 days while esfenvalerate provides protection for 21 days. Currently, 90% of hazelnut acreage is treated with an average of 1.5 applications for filbertworm control [6]. Research has demonstrated that two esfenvalerate applications result in 0.13% damage in comparison to 19% damage in the uncontrolled blocks [6]. The average cost of the filbertworm spray program is estimated at $34/A [12].

In Oregon, the current IPM program is based on regular monitoring. Sprays for filbertworm are applied when the action level of five moths in a pheromone trap has been accumulated or when the traps have caught an average of 2-3 moths. Because of the
prolonged moth emergence and long flight periods, a second application is usually necessary [2].

Mating disruption has been researched and found to be ineffective with high populations of filbertworm moths [10]. More than a dozen parasites have been reared from filbertworms, but none seem to be important enough to control filbertworm populations below damaging levels [2]. Although two species of *trichogramma* have been shown to parasitize the egg of filbertworm, they rarely provide economical control [9]. In a recent study, no noticeable reduction of nut infestation caused by filbertworm was achieved when *trichogramma* wasps were released at a rate of 100,000-300,000 wasps per acre [7]. Because larvae do almost no feeding before they penetrate the nut, Bt failed to control filbertworm [7]. Old insecticides like extracts of the pyrethrum plant are used to control the filbertworm in organic systems, although they may provide unpredictable results [9].

About 2% of hazelnut producers in Oregon are organic. Organic growers spray azadirachtin, Bt, and spinosad to kill the filbertworm[13]. Although there is a small amount of organic hazelnut acreage in Oregon and Washington, the primary challenge has been to economically control filbertworm. This has limited the expansion of organic acreage[13].

If completely unsprayed, commercial production of hazelnuts would be impossible due to heavy infestations of filbertworm [3].

An additional cost of $100/A would be incurred for sorting hazelnuts without the filbertworm spray.

*Filbert Aphid/Large Hazel Aphid*

The parasitoid *Trioxys pallidus* has provided nearly complete biological control of the filbert aphid and has almost eliminated insecticide use for this pest [13]. However, the recently-introduced large hazel aphid (also known as the hazelnut aphid) is not controlled by *Trioxys pallidus*[13].

The filbert aphid feeds on any green tissue, and this can reduce plant vigor, the percent of nut fill, and the size of nuts. In addition, the honeydew that is produced by aphids causes a black, sooty fungal mold that can reduce the photosynthetic capacity of the leaves. Aphids appear at bud break and can be problematic throughout the growing season [13]. A small wasp *Trioxys pallidus* was released in many Oregon hazelnut orchards in the early 1980s and has naturalized throughout the hazelnut-growing regions of Oregon and Washington. Today, nearly every hazelnut orchard shows signs of this parasitic wasp that helps keep the aphid population in check[13]. Wasp eggs may overwinter on fallen leaves on the ground, so growers delay flail mowing in early spring in order to protect the eggs and allow them to hatch.
The large hazel aphid was first reported in Oregon in 2003 and has rapidly spread into many of the areas where hazelnuts are grown [13]. It is believed that the large hazel aphid now comprises about half of the total aphid population found in hazelnut orchards. This new aphid is believed to have a life cycle similar to the filbert aphid. *Trioxys pallidus* does not appear to parasitize the large hazel aphid. If aphid populations are high in the summer, they are usually suppressed when a pesticide application is made at this time for control of filbertworm [13].

References


