Changes in Integrated Pest Management in Hazelnut Production in Oregon and Washington Since 2006

Emma K. Tribble
Katie Murray Steve Elliott Matt Baur, Ph.D
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Introduction

Pest Management Strategic Plans (PMSPs) document current pest-management practices used by growers on a specific crop and grower-identified needs in research, regulation and education related to pest management on that crop. Agriculture professionals cite the research and education priorities listed in a crop's PMSP when applying for grants and work to remedy the issues highlighted in PMSPs through research or outreach. The U.S. Environmental Protection Agency also uses the PMSPs to help inform decisions about pesticide registrations, reassessments and emergency exemptions (Boudwin et al. 2022). If Pest Management Strategic Plans are updated periodically, comparing older and newer versions of PMSPs for a crop can demonstrate changes in pest management over time.

Photo courtesy of the Hazlenut Marketing Board.

Oregon produces 99% of the hazelnuts grown in the United States.

In 2006, growers, crop consultants, researchers, industry members and members of government and crop-related organizations such as the IR-4 Project and the Oregon Hazelnut Commission met to create a Pest Management Strategic Plan for hazelnut in Oregon and Washington, including a list of critical needs for the industry at that time. In 2018, a similar group gathered to write a revision to the PMSP, stating where needs from the earlier PMSP had been addressed and what new pest management needs

had arisen. Both strategic plans state that hazelnut growers utilize integrated pest management (IPM), and research into hazelnut pest management since 2018 has continued to focus on IPM. Integrated pest management is defined as controlling pests effectively using multiple practices with lower potential risks to people and the environment while continuing to produce an economically successful crop. This often entails using pesticides more judiciously and implementing non-chemical control strategies. Some examples of IPM practices present in both PMSPs are monitoring for insects, using biological control methods, choosing disease-resistant cultivars and flail-mowing weeds.

Between the 2006 and 2018 PMSPs, the field of integrated pest management for hazelnut production in the Pacific Northwest changed significantly due to the availability and exploration of new techniques and resources. Stakeholders in the hazelnut industry have also continued to research and improve upon hazelnut IPM practices since 2018.

Hazelnut Production

Oregon grows 99% of the hazelnuts produced in the United States. Washington also produces hazelnuts, though not all growing areas in Washington have the moderate weather that hazelnut trees prefer. There is a species of hazelnut native to the Pacific Northwest, but the European hazelnut is the species grown commercially. Hazelnut production nearly doubled between 2006 and 2018 from 27,890 tons in both Oregon and Washington to 51,000 tons in Oregon alone (Oregon State University Extension Service 2019). In 2018, the combined Oregon-Washington hazelnut production accounted for 5% of hazelnut production worldwide.

European hazelnut, although grown in orchards as single-stemmed trees, grows naturally as a bush. Growers treat additional stems growing from the base of the tree with herbicides. Because hazelnut trees need to be cross-pollinated, growers must plant trees of a pollinizer cultivar within 50 feet of the cultivars for the main crop. Pollination occurs between November and March but peaks in January and February. The orchard floor is made level before the nuts start to fall in September. Once most of the nuts have fallen, they are mechanically swept into a windrow between the rows of trees, and a harvesting machine picks up the nuts from the windrow. Hazelnut trees do not produce a commercially viable crop until at least three years after planting and do not produce at full capacity until 10 to 12 years after planting. Well-managed trees can produce at a commercial level for 40 to 60 years or longer.

Some growers and Pacific Northwest residents refer to hazelnuts as filberts, a name that was once common and appears in the names of some hazelnut pests.

Overview of Pest Management Changes

As of 2017, diseases contributed the most to pest-related crop losses in hazelnuts in Oregon, followed closely by insects. The three pests that caused the most damage to hazelnut orchards were eastern filbert blight, filbertworm, and aphids (Murray et al. 2022). Improvements in integrated pest management in hazelnut orchards since 2006 have affected all these pests and others. These key changes include the following:

- In 2006, the industry identified an IPM strategy for handling eastern filbert blight, the most serious pest

Photo courtesy of the Hazlenut Marketing Board.

Hazelnuts are gathered into windrows and harvested off the orchard floor.

for hazelnuts. This strategy relies on careful scouting of orchards for disease symptoms, pruning and burning of diseased wood, and planting cultivars with better disease resistance. Since 2006, Oregon State University has produced cultivars with strong resistance to eastern filbert blight, and pruning practices have evolved to include chipping diseased wood.

- Researcher and growers did not know much about kernel mold in 2006. There are now recommended methods for preventing kernel mold.
- The 2006 PMSP mentions the need to pursue biological control in orchards, including preserving the natural enemy of filbert aphid and any other naturally occurring predators for insect pests. A new mating-disruption product for filbertworm allows growers to reduce insecticide use for this pest, preserving beneficial insect populations. A new pest, the brown marmorated stink bug, has appeared since 2006, and researchers are currently using a biological control method to combat it as well.
- Weed management did not change much between the two PMSPs, and weed control is rarely problematic in mature orchards due to the orchard canopy preventing sunlight from reaching the ground. Researchers are examining electric weed control as another option for managing weeds non-chemically. More growers are planting cover crops in their orchards for their many benefits, including weed suppression.

Diseases

Eastern filbert blight, caused by the fungus

Photo courtesy of the Hazlenut Marketing Board.

Hazelnuts being sorted electronically.

Anisogramma anomala, is the most important disease in legacy Pacific Northwest hazelnut orchards with disease susceptibility, and pruning is a common control strategy. The disease creates cankers filled with black stromata on the surface of the tree, girdling and killing shoots inside the canker. Left unchecked, eastern filbert blight can kill most of a tree's canopy in seven to 15 years. Although fungicides and resistant cultivars can prevent infection, pruning diseased branches is the only way to remove the disease once cankers are present (Oregon State University College of Agricultural Sciences 2022). Growers typically prune their orchards in the winter before the susceptible new growth appears, gathering the wood in a pile outside of the orchard and burning it. However, taking the wood outside the orchard is labor-intensive and starting a fire on fresh wood in the wet season is difficult (Jay W. Pscheidt, personal communication, January 19, 2023). Growers wondered if they could chip infested branches instead and leave them inside the orchard for biomass without increasing orchard infection. Stromata continue to produce spores for some time even after branches are cut off, and spores from a pile of intact branches gathered for burning can infect trees as far away as 60 feet downwind. However, research conducted between 2006 and 2018 indicated that stromata in chip piles do not produce enough spores to consistently infect trees, making chipping infested branches a viable alternative to burning (Oregon State University College of Agricultural Sciences 2022). In a research trial that began in 2016, researchers discovered that, in severely diseased orchards, pruned and non-pruned trees have similar yields if treated with the same fungicide program (Pscheidt et al. 2018). If growers have orchards that are too diseased to be saved, they can save money and labor by not pruning the trees in their last years of harvest (Jay W. Pscheidt, personal communication, January 19, 2023).

The release of hazelnut cultivars resistant to eastern filbert blight has reduced the number of necessary fungicide applications for this crop and has revitalized the Oregon hazelnut industry. The Barcelona cultivar, previously the most planted varietal in the Pacific Northwest, has only moderate resistance to the disease. Between 2002 and

2018, Oregon State University's hazelnut breeding program produced more than 10 new main crop and pollinizer cultivars with almost complete resistance to eastern filbert blight. The newer varieties' higher resistance comes from a gene from the Gasaway cultivar, which researchers have been using for breeding since the late 1960s. The release of the Jefferson cultivar, the first of these varieties that was widely available, catalyzed a boom in hazelnut acres planted in Oregon starting in 2009 (Hazelnut Marketing Board 2021). After 20 years of fewer than 30,000 acres of hazelnuts due to disease pressure (Mehlenbacher et al. 2010), hazelnut acreage reached 80,000 acres in 2019 with 20,000 of those acres planted in the two years prior. The Jefferson cultivar accounts for more than half of these acres (Oregon State University Extension Service 2019), and the percentage of the Barcelona cultivar in orchards has decreased by half. Due to their resistance, fewer fungicide sprays are needed for the new cultivars, and fungicide use will likely decrease further as more growers replace older cultivars with resistant ones. The next step in cultivar research is to produce cultivars with stacked gene resistance instead of the single-gene resistance from the Gasaway cultivar. Other strains of *Anisogramma anomala* endemic to the eastern United States could potentially overcome this one resistance gene if they are introduced to the Pacific Northwest. A control order prevents importation of hazelnut plant material into Oregon and Washington to prevent further introductions of eastern filbert blight.

In 2006, growers and researchers did not know much about kernel molds, which are caused by various fungus species. Growers have traditionally associated the total amount of rainfall in a season with the amount of kernel mold in their hazelnuts. However, a research trial ending in 2018 demonstrated that the amount of time dropped nuts sit on wet orchard soil has the most effect on kernel-mold presence. Growers can avoid prolonged nut contact with the orchard floor by harvesting multiple times a season and starting harvest before the fall rains. Some newer cultivars have kernel-mold resistance and drop their nuts earlier when the weather is dry (Pscheidt and Heckert 2021).

Insects

A new mating-disruption product for filbertworm has the potential to greatly reduce the amount of chemical insecticide used for this pest and indirectly enhance biological control for other pests. In 2006, pheromone lures existed for filbertworm, but chemical insecticides, primarily pyrethroids, were the primary method of filbertworm suppression. The 2018 Pest Management Strategic Plan highlighted that a mating-disruption product was commercially available that could reduce the amount of insecticide needed for filbertworm by up to 75%. Growers using this control method still need to apply insecticides at the edges of the orchard to prevent female filbertworm moths from coming from other orchards or habitats to lay eggs. Lower levels of insecticide use also contribute to conservation biological control. Research has shown that a pest management strategy using filbertworm mating disruption and fewer insecticides can also reduce aphid populations by preserving their natural predator Trioxys pallidus. This small wasp has led to a reduction of insecticide use for aphid management,

and non-chemical controls for other insect pests can lower aphicide use even further. Although the filbertworm mating-disruption product is not yet economically feasible for all growers, it is slowly being adopted especially by organic growers, who had limited control options for filbertworm before this product was released. The use of more selective insecticides against filbertworm is also gaining more acceptance and can help enhance biological control.

The brown marmorated stink bug is a new pest to hazelnuts since 2006. The invasive insect from Asia arrived in Oregon in 2004 and feeds on many kinds of fruits, nuts, and vegetation, including hazelnut kernels. Researchers explored classical biological control for this pest, importing its natural predator the samurai wasp in 2012 for lab research. The samurai wasp reduces stink bug populations by laying its eggs inside of brown marmorated stink bug eggs, which the hatched wasp larvae eat from the inside out. The 2018 PMSP workgroup identified the continuation of research into this predator as a critical need for the industry. Although the wasp had already arrived in Oregon and Washington on its own four years earlier, researchers concluded in 2020 that the samurai wasp could be released for control efforts. Currently, the Oregon State University Extension Service and the Oregon Department of Agriculture rear these wasps, release them in places with high stink bug pressure and monitor them to see their effect on brown marmorated stink bug populations (Frost 2022).

Weeds

Although hazelnut weed management did not change significantly from 2006 to 2018,

Photo courtesy of Zasso.

Electric weed control, here employed in a vineyard, is being explored in hazelnut production.

Photo courtesy of the Hazlenut Marketing Board.

Hazelnut trees reach full production in 10 to 12 years and can produce commercially for 40 or more.

researchers have recently been exploring mechanical and cultural controls for weeds to avoid herbicide-resistance issues. Growers traditionally flail mow between the rows of trees for weed control and apply herbicides in the rows. Electric weed control, which kills weeds by electrocution, is gaining traction in Europe, and Oregon State University researchers have been experimenting with this method in hazelnut orchards with positive results. The applicator is attached to a tractor, making it suitable for weed control between rows but not within them (Lies 2022). Because this treatment electrocutes plants down to their roots, its effects last longer than flail mowing weed control, which only cuts off the tops of weeds (Allen 2022). Electric weed control works best on broadleaf weeds, especially horsetail; grasses can be controlled but require a second treatment. The largest concern with this technique is the danger of starting fires with the electrical currents. To avoid this, weed control would need to occur primarily during the fall and spring when the ground is not too dry (Lies 2022). This technique may be a good solution for growers in future years when products become commercially available.

More growers are planting cover crops in their hazelnut orchards primarily to prevent soil erosion but also to improve soil health and suppress weeds. Growers tend to choose grass crops for this purpose, though they sometimes use nitrogen-fixing crops, pollinator-attractive species or volunteer plant growth. Cover crops out-compete weeds on the orchard floor but can also compete with the hazelnut trees for water. Growers mow their cover crops before harvest so that the hazelnuts can still be harvested off flat ground (Lies 2020).

References

Allen L. (2022, May). Electric weed control taking hold in orchards. Western FarmPress, 44(6):13.

Boudwin R, Magarey R, Jess L. 2022. Integrated pest management data for regulation, research, and education: Crop Profiles and Pest Management Strategic Plans. Journal of Integrated Pest Management. 13(1):13, 1–8. https://doi.org/10.1093/jipm/pmac011.

DeFrancesco J. (2006, November 29.) Pest Management Strategic Plan for Hazelnuts in Oregon and Washington. [data file] Available from https://ipmdata.ipmcenters.org/documents/pmsps/ORWA_Hazelnut.pdf.

Frost A. (2022, December 6.) Oregon fruit, hazelnut farmers struggling with invasive stink bugs. Oregon Public Broadcasting. https://www.opb.org/article/2022/12/06/oregon-fruit-hazelnut-farmers-struggling-with-invasive-stink-bugs/.

Hazelnut Marketing Board. (2021, May 14.) Oregon hazelnut varieties in a nutshell: Nearly a dozen new varieties have been made available in the last decade. West Coast Nut. https://www.wcngg.com/2021/05/14/oregon-hazelnut-varieties-in-a-nutshell/.

Lies M. (2020, July 10.) Cover crops catching on in hazelnuts: Practice helps control erosion, manage weeds and improve soil health on Oregon hazelnut farms. West Coast Nut. https://www.wcngg.com/2020/07/10/cover-crops-catching-on-in-hazelnuts/.

Lies M. (2022, October). Electric weed control being examined in hazelnuts. Western FarmPress, 44(11):20–21.

Mehlenbacher SA, McCluskey RL, Smith DC. 2010. Hazelnut breeding at Oregon State University. Corylus & Co. (Rivista del Centro Studi e Ricerche sul Nocciolo e Castagno). 1(2):6–15. www.cefas.org/pb/flz/corylus%20n.%2002%20imp._layout%201.pdf.

Murray K, Jepson PC. 2018. An Integrated Pest Management Strategic Plan for Hazelnuts in Oregon and Washington. Oregon State University Extension Service Publication EM 9223. Corvallis, OR.

Murray K, Sandlin I, Wiman N, Ellsworth P, Jepson PC, Fourier A, Luh H, Hedstrom C. 2022. Measuring the Economic Impact of Pests and Pest Management on Oregon Hazelnuts. Oregon State University Extension Service Publication EM 9370. Corvallis, OR.

Oregon State University College of Agricultural Sciences. (2022) Burning rules for cankered tree prunings. https://bpp.oregonstate.edu/efb/management/burning-rules-cankered-tree-prunings (Accessed January 20, 2023).

Oregon State University Extension Service. (2019, May) Oregon state hazelnut varieties save industry, expand production. https://extension.oregonstate.edu/impact/oregon-state-hazelnut-varieties-save-industry-expand-production (Accessed January 13, 2023).

Pscheidt JW, Bassinet JP, Heckert S, Cluskey SA. (2018) Whole orchard evaluation of pruning strategies for management of eastern filbert blight, 2017-18. Oregon State University Fruit and Ornamental Disease Management Testing Program. http://sites.science.oregonstate.edu/bpp/Plant_Clinic/Fungicidebooklet/2018/Hazel4.pdf.

Pscheidt JW, Heckert S. 2021. Progression of kernel mold on hazelnut. Plant Disease. 105(5):1320–1327. https://doi.org/10.1094/PDIS-05-20-1088-RE.

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