Pest Management Changes in Mint Production in the Pacific Northwest Since 2002

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Photo courtesy of the Oregon Mint Commission.

The Pacific Northwest states of Oregon, Washington and Idaho produce most of the nation's mint.

Introduction

Pest Management Strategic Plans (PMSPs) outline pest management critical needs and pest management practices for a certain crop. They list currently used control methods pest-by-pest for each part of a crop's growing season. This documentation of grower practices for a specific crop and year can be useful for researchers, regulators, commodity organizations and other interested parties. The critical needs highlighted in a PMSP inform researchers of the most important areas to study and provide formal evidence of stakeholder needs. The U.S. Environmental Protection Agency references PMSPs when gathering information to determine pesticide registrations and emergency exemptions for a commodity (Boudwin et al. 2022). Comparing

PMSPs for the same crop from different years can reveal how pest management practices and pest management priorities for that crop have changed over time.

In 2002, mint growers, researchers, farm advisors, industry members, representatives from government organizations and others met to create a Pest Management Strategic Plan for mint grown in Washington, Oregon, Idaho, Montana and California. In 2019, a similar work group developed a new PMSP for mint for only Washington, Oregon and Idaho, the top three states for mint production. Both groups focused on integrated pest management in their summaries of current practices and priorities for the future. 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. Research since the 2019 PMSP has maintained a focus on IPM practices for mint production.

Effective pest management for mint is critical because mint pests have detrimental effects on both mint yield and the quality of mint oil produced. Research into improved integrated pest management strategies for mint and the registration of new pesticides has led to changes in the mint production system both between the 2002 and 2019 PMSPs and afterward.

Mint Production

The United States is the largest producer of peppermint oil and spearmint oil in the world. In 2019, the Pacific Northwest states of Washington, Oregon and Idaho grew 80% of the nation's peppermint and 63% of its spearmint. Mint production has decreased in these three states from about 74,000 acres in 2002 to 58,000 acres in 2019, with an approximately 13% decrease in the pounds of oil produced. Although U.S. mint is primarily grown for its oil, it is also produced for the fresh and dried mint-leaf markets.

When transplanting mint into fields, growers can either plant in the spring with greenhouse-grown mint or plant in the fall with field-grown roots. The mint becomes an established stand by the first summer and is harvested and distilled when the plants bloom each summer. For some varieties of mint, growers in some production areas let the plants regrow after the first harvest, then harvest it again in early fall. A mint stand will stay in production for three to five years.

Overview of Pest Management Changes

In a survey done among peppermint growers in the Willamette Valley in Oregon, growers indicated that pathogens caused the most damage in their crop, followed by invertebrates and nematodes respectively. In terms of specific pests, rust, Verticillium wilt and nematode species had the largest contributions to yield loss (Murray et al. 2021). Although the predominant pests and pest types may be different in different kinds of mint and in different growing regions in the Northwest, the workgroups for both PMSPs highlighted needing better control strategies for these pests and others. Changes in integrated pest management in mint since 2002 include the following:

- The Mint Industry Research Council has mapped the genomic sequences of two of

Photo courtesy of the Oregon Mint Commission.

A flowering field of mint.

the three parent genomes of peppermint and spearmint, and the third is in progress. These maps will assist breeders with creating disease-resistant and high-yielding cultivars.

- Assays testing soil for Verticillium dahliae, the cause of Verticillium wilt, are now commercially available, though they do not test specifically for the V. dahliae pathotype that is common in mint.
- New insecticides have been registered for mint, including one target-specific material.
- Oregon State University has developed a tool to predict the most effective pesticide application window for mint root borer and variegated cutworm.
- Stakeholders expect a new, safer nematicide to be registered soon.
- Researchers developed a new crop-rotation strategy to take advantage of effective herbicides registered for other crops.
- Five new herbicides have been registered for mint to fill gaps in weed control.

Diseases

Verticillium dahliae, the cause of Verticillium wilt, is almost impossible to eradicate once present in a field and is the most significant threat to mint production. High soil inoculum levels can make a field unusable for economically sound mint production, and rotation cycles of up to 10 years may be needed before mint can be planted again. Most available mint varieties are susceptible to Verticillium wilt. The Mint Industry Research Council has been mapping the mint genome to discover genetic markers associated with Verticillium wilt resistance, mint oil flavor and mint

Photo courtesy of the Oregon Mint Commission.

A mint field being irrigated.

yield. Researchers made significant progress on this goal between the 2002 and 2019 PMSPs. By 2021, researchers had mapped apple mint and horse mint, the two parent species of spearmint and two of the three parent species of peppermint. Research is in progress to obtain the genomic map for water mint, peppermint's final parent; this type of mint is more genetically complex than the other two parents ("UC Davis Scientists" 2021). These efforts will allow breeders to target specific beneficial genes already present in mint to develop cultivars with improved disease resistance. This program has not yet released any commercially available cultivars; researchers are currently performing phenotyping studies to determine what genetic markers match the desired traits in mint. Private companies have also produced proprietary improved cultivars since 2002 (S. Salisbury, personal communication, November 9, 2022).

The 2002 PMSP work group also discussed the need for a Verticillium wilt assay for soil testing so that growers can know the levels of disease in their fields and respond accordingly. The 2019 PMSP noted that there are commercially available soil tests for this disease but none of them distinguish between the different strains of Verticillium wilt. The VCG 2B strain of Verticillium dahliae causes the most damage to mint, but the VCG 4A and VCG 4B strains, which commonly infect and damage potatoes, have little to no effect on mint. Because of this, currently available assays only give a rough estimate of the disease pressures present in a mint field. A plate test exists to distinguish between strains of Verticillium dahliae, but it is not feasible to use for making management decisions because it takes at least two weeks to complete (Dung et al. 2019). Researchers are now determining what inoculum levels of Verticillium dahliae in the soil cause significant economic damage for each mint cultivar. Growers need this information to make informed decisions about their fields (Dung & Scott 2021).

Insects

Finding more-effective controls for root-feeding pests has been a longstanding priority for the mint industry. The 2002 PMSP work

group specifically called for the registration of ethoprop for better control of mint root borer, nematodes and symphylans. They also recognized that this organophosphate is a broad-spectrum material and prioritized finding narrow-spectrum alternatives for these root-feeding pests. Ethoprop is now registered for mint but is classified as a highly hazardous pesticide by the World Health Organization and the Food and Agriculture Organization of the United Nations, meaning that ethoprop poses significant risk to human and environmental health. Research into alternatives is ongoing but has produced results; chlorantraniliprole is a narrow spectrum insecticide developed between the 2002 and 2019 PMSPs that effectively controls mint root borer and cutworm. This search for new, effective, target-specific insecticides has increased in importance with the recent registration cancellation of chlorpyrifos, another organophosphate that controlled mint root borer, cutworm and symphylans. In 2021, chlorpyrifos was the only product with symphylan on the label, meaning that new controls are needed for this pest specifically (Salisbury 2021).

The 2002 PMSP work group also identified a need to educate growers about using new techniques for conventional pesticides as good pesticide practices can reduce the amount of pesticide used while still managing pest populations. In 2014, Oregon State University created a mint pest alert system to help farmers decide how to best use insecticides for mint root borer and variegated cutworm (Sullivan & Walenta 2018). This electronic newsletter is sent out weekly during the summer months to growers subscribed to the service. The researchers writing the newsletter use degree-day models to predict mint root borer and variegated cutworm population development in different Oregon growing regions and supplement this data with the number of insects caught in traps in those regions. Ideally, one application of chlorantraniliprole between peak mint root borer catch and peak egg laying provides sufficient control of mint root borer as well as variegated cutworm, loopers and armyworms. The newsletter authors calculate and report this time period using the

Photo by Christy Tanner, Oregon State University Extension Service.

Insect trap counts and weather information are used to advise growers the best time to apply insecticides.

collected data so that growers can manage these pests with fewer pesticide applications. This tool also encourages growers to monitor their fields for insect populations and to use chlorantraniliprole instead of broad-spectrum products (Oregon State University 2022). Based on survey responses, newsletter recipients feel that this pest alert system has increased their knowledge of insect development and chlorantraniliprole use and has influenced their decisions about pesticide application timing and pesticide product choice (Sullivan & Walenta 2018).

Nematodes

All nematodes can reduce mint yield by damaging the plant's root system, but root-lesion nematodes can also increase the likelihood and severity of Verticillium wilt in a field. Fluopyram, a potential new nematicide for mint, is currently pending approval by the U.S. Environmental Protection Agency. This product should act as a safer alternative to the commonly-used nematicides ethoprop, mentioned earlier, and oxamyl, a carbamate and another highly hazardous pesticide (S. Salisbury, personal communication, February 13, 2023). Mint has not had a new material for nematode control for some time, and fluopyram will give growers a new mode of action to use against this pest ("Two New Modes" 2020).

Weeds

Good pre-plant weed management practices are essential for mint. The crop is most susceptible to weed growth during its first year before its canopy closes and few herbicides are registered for this stage of mint growth. Growers can use crop rotations, a common pre-plant IPM practice, to take advantage of pest management strategies used on previously planted crops to benefit the current crop. The 2002 PMSP work group

Photo courtesy of the Oregon Mint Commission.

Weed control in mint can be aided by well-planned crop rotations to reduce broadleaf weeds.

Photo by Christy Tanner, Oregon State University Extension Service.

Mint being harvested. After planting, mint stands can stay in production for three to five years.

highlighted crop rotation as a necessary area of study; in response to this, the 2019 PMSP details a newly implemented rotation strategy for controlling broadleaf weeds. If growers plant annual crops like grain or sudangrass for two seasons prior to planting mint, the more effective herbicides registered for these crops will eliminate the presence of broadleaf weeds in the field. Growers can then plant mint without applying additional herbicide. The 2019 PMSP work group valued finding more crop rotation strategies like this one for other weed pests in mint.

Although growers use herbicides in all stages of mint growth, herbicides are the main method of weed control after mint is established. The IR-4 Project, a federal program that helps develop pesticides for small-acreage specialty crops, tested five herbicides between 2002 and 2019 that mint growers now commonly use. (The IR-4 Project). One of these newer products, MCPB sodium salts, provides good control of field bindweed. In 2002, growers could only control this weed with glyphosate, which would also kill nearby mint. These newly registered products also represent three different modes of action. Researchers focused on finding new herbicides for mint partly because pyridate, an effective and non-toxic herbicide for post-emergence annual broadleaf weeds, did not have registration in the United States from 2006 to 2017. One of the more common herbicides for mint, terbacil, has also had resistance issues recently (“Tough Registration” 2017). With the increase of new products and the re-registration of pyridate, mint growers now have more resources for integrated weed management.

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