

Pest Management Practices in Washington State Mint: A 2002 Survey

Holly Ferguson and Douglas Walsh

**Washington State University
IAREC
24106 North Bunn Road
Prosser, WA 99350**



Table of Contents

Introduction.....□	1
The Mint Industry in Washington.....1	1
Irrigation Methods.....2	2
Pests.....□	2
Insects and Mites.....2	2
Weeds□	3
Diseases and Nematodes.....4	4
Pesticides.....□	5
Pre-Plant Sprays6	6
Dormant/Delayed Dormant Sprays.....6	6
Pre-First Cutting Sprays7	7
Post-First Cutting Sprays.....8	8
Pre-Second Cutting Sprays8	8
Post-Second Cutting Sprays.....9	9
Overall Use of Insecticides/Miticides9	9
Overall Use of Herbicides.....10	10
Overall Use of Fungicides/Nematicides.....11	11
Non-chemical Pest Management Practices.....11	11
Information Sources13	13
Fertilizer Use□	13

Acknowledgements

The authors are very grateful to the growers who participated in this survey. The authors would also like to thank Dr. Rick Boydston and Rocky Lundy for their valuable editorial assistance on this project. Many thanks go to Sally O'Neal Coates for the final editing of this report and its Executive Summary version. Also, much appreciation is extended to Ron Wight for some of the photographs used in the report. This project was supported by grants from the Mint Industry Research Council and the Washington Mint Commission.

An abbreviated (4-page) version of the data presented in this document is available as Washington State University publication EB1988E.

Pest Management Practices in Washington State Mint: A 2002 Survey

Introduction

Mint growers in Washington are concerned about the availability of pest control options. In 2002, a survey was conducted to determine which arthropod, weed, and disease pests impacted Washington mint and what strategies were employed by growers against these pests. This document presents a brief overview of the state's mint industry and reports on the results of the survey. In addition, this document compares the 2002 data with results from a similar survey conducted in 1995 to track changes in pests and pest control practices.

The Washington Agricultural Statistics Service gathers data on planted and harvested acreage and data on mint oil produced, but WASS does not keep track of pest management practices. The 2002 survey queried growers on the severity of their pest problems, their pesticide use, other pest management practices, fertilizer use, and their pest management information sources.



Mint field in Granger

The Mint Industry in Washington

While Washington State's harvested mint acreage decreased approximately 23% from 1995 to 2002, Washington remained the number-one ranked state in the nation for spearmint oil production in both years. During this same time period, Washington moved from the number-two rank (second to Oregon) in 1995 to the number-one producer of peppermint oil in 2002. Historically, Washington mint acreage (mostly peppermint and Scotch spearmint) increased rapidly in the early 1990s, followed by a decline in the mid- to late 1990s.

In 2002, 33,900 acres of mint were harvested in Washington State: 24,000 acres of peppermint, 6,900 acres of native spearmint, and 3,000 acres of Scotch spearmint. Peppermint acreage decreased by 25% from 32,000 acres in 1995 to 24,000 acres in 2002. Native spearmint decreased by only 1,000 acres (approximately 13%) during that time period, from 7,900 to 6,900 acres in 2002. Scotch spearmint acreage declined by 23%, from 3,900 acres in 1995 to 3,000 acres in 2002.

Growers responding to the survey farmed 4,862 acres of peppermint, 1,842 acres of Scotch spearmint, and 1,639 acres of native spearmint in 2002. This represented 20% of the peppermint acreage, 61% of the Scotch spearmint acreage, and 24% of the native spearmint acreage in the state. Table 1 summarizes the data reported by mint type and region.

TABLE 1
SUMMARY OF GEOGRAPHIC DISTRIBUTION OF SURVEY RESPONDENTS
AND ACREAGE OF MINT TYPES IN WASHINGTON STATE

Region	% Respondents	Number of Acres		
		Peppermint	Scotch Spearmint	Native Spearmint
Paterson	5	3,100	900	0
Columbia Basin	19	1,556	790	103
Lower Yakima Valley	76	206	152	1,536
Total	100	4,862	1,842	1,639

Most of the peppermint acreage reported was concentrated in the Paterson area (64%), with the remainder split between the Columbia Basin (32%) and the Lower Yakima Valley (4%). Native spearmint acreage was reported mostly in the Lower Yakima Valley (94%), with the remaining 6% in the Columbia Basin. Reported Scotch spearmint acreage was found mostly in the Paterson area (49%) and the Columbia Basin (43%), with the remainder found in the Lower Yakima Valley (8%).



Harvesting mint

Though the harvested acreage dropped from 1995 to 2002, yield of mint oil was considerably higher in 2002. Survey respondents reported an overall average yield of 130 pounds of mint oil per acre. The average yield among 2002 survey respondents was 118 pounds per acre from peppermint, 129 pounds per acre from Scotch spearmint, and 166 pounds per acre from native spearmint. Peppermint is typically cut only once per year, thus yielding fewer pounds per acre than either type of spearmint. The highest yields reported 1993–1995 were 87 pounds per acre from peppermint, 130 pounds per acre from Scotch spearmint, and 140 pounds per acre from native spearmint.

Irrigation Methods

Growers surveyed used several different types of irrigation systems, including impact sprinklers, center-pivot systems, furrow irrigation, and wheel lines. Fifty-seven percent of the total mint acreage was irrigated with center-pivot drop systems. Furrow irrigation was used in 27% of the total mint acreage reported, followed by 11% with impact sprinklers, 5% with center-pivot overhead systems, and less than 1% with wheel lines.

Pests

The growers were asked to estimate the severity of their arthropod, weed, and disease pest problems using the same index developed for the 1995 survey, as follows:

- 1 = severe problem, limits where mint can be grown
- 2 = severe problem, decreases yield significantly
- 3 = moderate problem, decreases yield somewhat
- 4 = minor problem, slight yield reduction
- 5 = present but not a problem
- 6 = not present or unsure if present

In order to standardize the severity ratings, weighted averages, based on the number of acres each rating score represented, were calculated for each pest for peppermint, Scotch spearmint, and native spearmint. The results are in Tables 2–4. Average ratings were compared to those reported in the 1995 survey to determine if there had been a change in the importance of these pests over time.

Insects and Mites

Insects can reduce mint yield by feeding on foliage and/or rhizomes (cutworms, loopers, and mint root borer) or sucking on plant juices (spider mites). Nine insect/mite pests were given severity ratings by the respondents (Table 2).



Mint root borer inside plant tissue

The most important insect pest with the worst severity rating was mint root borer. While its overall rating was 3.4, note that it was rated as much more severe in peppermint (2.8) and Scotch spearmint (2.6) than in native spearmint (4.8). This pest appears to have become increasingly problematic

TABLE 2
INSECT AND MITE PESTS OF WASHINGTON MINT, 2002

Insect/Mite	Average Severity Rating by Mint Type			Overall Rating of Pest	Change from 1995 Survey
	Peppermint	Scotch Spearmint	Native Spearmint		
Mint root borer	2.8	2.6	4.8	3.4	Greater problem
Aphids	4.2	3.9	5.0	4.4	Greater problem
Spider mites	4.2	3.8	5.1	4.4	Lesser problem
Mint cutworm	3.9	3.5	5.9	4.4	Lesser problem
Alfalfa looper	4.4	5.4	5.7	5.1	Lesser problem
Spotted cutworm	4.4	5.3	6.0	5.3	Lesser problem
Redbacked cutworm	4.4	5.3	6.0	5.3	Lesser problem
Cabbage looper	4.8	5.4	6.0	5.4	Lesser problem
Garden symphylan	6.0	6.0	6.0	6.0	Lesser problem
Overall by Mint Type	4.3	4.6	5.6		

Guide to ratings: 1 = severe problem, limits where mint can be grown; 2 = severe problem, decreases yield significantly; 3 = moderate problem, decreases yield somewhat; 4 = minor problem, slight yield reduction; 5 = present but not a problem; 6 = not present or unsure if present. **Other insects** noted by growers were wireworms, grasshoppers, strawberry root weevil, army cutworm, and western yellow-striped armyworm.

since the 1995 survey. Mint root borer is typically controlled in the field after harvest in the fall.

Aphids and spider mites tied as the second most important pests (4.37), followed by mint cutworm (4.43). According to the respondents, aphids have become a greater problem since the 1995 survey, but spider mites and mint cutworm have become less of a problem. Spider mites can be kept under control with conservation of naturally occurring predator mites; this requires judicious use of pesticides that are easy on beneficial mites.

Alfalfa looper (5.1), spotted cutworm (5.3), and redbacked cutworm (5.3) were rated as considerably less important and less of a problem than seven years ago. Natural control of loopers and cutworms occurs through the action of a parasitic wasp.

Finally, cabbage looper (5.4) and garden symphylan (6.0) received the mildest severity ratings, and they were deemed less of a problem than in 1995. Overall by mint type, insect and mite pests tended to be judged more severe in peppermint (4.3), followed by Scotch spearmint (4.6), and least severe in native spearmint (5.6).

Weeds

Many annual and perennial weeds emerge from dormancy as the mint does and can reduce yield by competing with the mint for sunlight, water, and

nutrients. Sixteen weeds were given severity ratings by the respondents (Table 3). Among these were eight annual broadleaf weeds (common groundsel, western salsify, pigweed spp., kochia, prickly lettuce, mustard spp., common lambsquarter, and horseweed), three perennial broadleaf weeds (field bindweed, Canada thistle, and yellow nutsedge), three annual grasses (foxtail spp., barnyardgrass, and downy brome), and two perennial grasses (bermudagrass and quackgrass). Field bindweed was rated the worst (2.8), followed by common groundsel (3.4), Canada thistle (3.6), bermudagrass (3.7), and western salsify (3.8). Field bindweed was more severe in peppermint (2.5) and Scotch spearmint (2.1), than in native spearmint (3.8). This weed was judged more of a problem than in the 1995 survey. None of the herbicides registered for mint give good control of field bindweed.



Field bindweed

TABLE 3
WEED PESTS OF WASHINGTON MINT, 2002

Weed	Average Severity Rating By Mint Type			Overall Rating of Pest	Change from 1995 Survey
	Peppermint	Scotch Spearmint	Native Spearmint		
Field bindweed	2.5	2.1	3.8	2.8	Greater problem
Common groundsel	2.9	2.9	4.3	3.4	Lesser problem
Canada thistle	3.0	2.9	4.8	3.6	Same level
Bermudagrass	2.7	2.6	5.7	3.7	Greater problem
Salsify	3.2	3.1	5.2	3.8	Greater problem
Pigweed spp.	3.8	3.7	4.9	4.1	Lesser problem
Kochia	4.3	3.9	4.4	4.2	Lesser problem
Prickly lettuce	3.8	3.8	5.5	4.4	Lesser problem
Foxtail spp.	3.8	3.7	5.9	4.4	Lesser problem
Mustard spp.	4.5	4.2	5.2	4.6	Same level
Barnyardgrass	4.5	4.2	5.0	4.6	Lesser problem
Common lambsquarter	4.5	4.3	5.5	4.8	Lesser problem
Yellow nutsedge	4.6	4.0	6	4.9	Greater problem
Quackgrass	5.0	4.4	5.4	5.0	Lesser problem
Downy brome	5.0	5.2	6	5.4	Lesser problem
Horseweed	5.3	5.5	6	5.6	Same level
Overall by Mint Type	4.0	3.8	5.2		

Guide to ratings: 1 = severe problem, limits where mint can be grown; 2 = severe problem, decreases yield significantly; 3 = moderate problem, decreases yield somewhat; 4 = minor problem, slight yield reduction; 5 = present but not a problem; 6 = not present or unsure if present. **Other weeds** noted by growers were: dandelion, puncturevine, and Russian thistle.

Similarly, common groundsel was more severe in peppermint and Scotch spearmint (2.9) than in native spearmint (4.3). However, common groundsel was deemed less of a problem in 2002 than in 1995. Canada thistle (3.6), bermudagrass (3.7), and western salsify (3.8) ratings followed a similar pattern, showing less pest severity in native spearmint. Canada thistle severity rating remained the same as the 1995 survey. Both bermudagrass and western salsify have become more of a problem since 1995, according to the respondents.

Minor weed pests, as reported by the respondents, were pigweed spp. (4.1), kochia (4.2), prickly lettuce (4.4), foxtail spp. (4.4), mustard spp. (4.6), barnyardgrass (4.6), common lambsquarter (4.8), and yellow nutsedge (4.9). Quackgrass (5.0), downy brome (5.4), and horseweed (5.6) were deemed not problematic. Overall by mint type, weeds were deemed more pestiferous in peppermint (4.0) and Scotch spearmint (3.8) than in native spearmint (5.2).

Diseases and Nematodes

Four diseases and the general category of nematodes were given severity ratings by the respondents (Table 4). Verticillium wilt was rated the most severe (3.2), followed by nematodes (3.5). There was a marked difference in severity ratings by mint type.



Verticillium wilt on mint leaves

Verticillium wilt was rated sufficiently problematic to decrease yield in both peppermint (2.1) and Scotch spearmint (2.2), but was not a problem at all in native spearmint (5.3). Similarly, nematodes, which cause both direct damage and indirect damage through exacerbation of disease, were judged to be a moderate to severe problem in peppermint (2.9) and Scotch spearmint (2.7) but a rather insignificant problem in native spearmint (5.0).

Verticillium wilt and nematodes are not easy to control in mint; use of crop rotation, soil fumigants, and clean rootstocks are the most effective ways to prevent problems with these pests. Minor diseases identified were rust (4.4), powdery mildew (4.9), and black stem (5.3). Generally speaking, by mint type, diseases and nematodes were deemed more severe problems in peppermint (3.7) and Scotch spearmint (3.7) than in native spearmint (5.3).

TABLE 4
DISEASES OF WASHINGTON MINT, 2002

Disease	Average Severity Rating by Mint Type			Overall Rating of Pest	Change from 1995 Survey
	Peppermint	Scotch Spearmint	Native Spearmint		
Verticillium wilt	2.1	2.2	5.3	3.2	Greater problem
Nematodes	2.9	2.7	5.0	3.5	Greater problem
Rust	4.1	3.8	5.1	4.4	Same level
Powdery mildew	5.0	4.3	5.1	4.9	Lesser problem
Black stem	4.5	5.4	6.0	5.3	Greater problem
Overall by Mint Type	3.7	3.7	5.3		

Guide to ratings: 1 = severe problem, limits where mint can be grown; 2 = severe problem, decreases yield significantly; 3 = moderate problem, decreases yield somewhat; 4 = minor problem, slight yield reduction; 5 = present but not a problem; 6 = not present or unsure if present.

Pesticides

Growers were asked for information about their pesticide use in 2002, including information on date applied, application method, acres treated, targets, pesticide used, and rate per acre. To facilitate the reporting process for the growers, the growing season was divided into spraying periods—pre-plant, dormant/delayed dormant (early spring), pre-first cutting (late spring), post-first cutting (mid-summer), pre-second cutting (late summer), and post-second cutting (fall). Discussion on the pesticide applications used during these periods follows. Percentages given are of the total acreage reported for the mint type (i.e., peppermint, Scotch spearmint, native spearmint) unless otherwise indicated. Pesticide rates in the text refer to amount of formulated product. Next, the pesticide data were



Spraying pesticide on mint field

compiled to determine overall use of insecticides/miticides, herbicides, and fungicides/nematicides. From these data, the following were calculated: percent acres treated, application rate, number of applications per year, and total active ingredient applied per year in Washington State.

Pre-Plant Sprays

These sprays were applied before planting or post plant pre-emergence to first-year mint fields (baby mint) for pre-emergent control of weeds and disease. Applications were made either the fall before, early spring before, or soon after planting. Only one herbicide and one fungicide/nematicide were reported.

Herbicide

Sinbar (terbacil): Sinbar was used at the rate of 1 pound per acre for pre-emergent control of all weed species listed in Table 2. Only 352 acres (4.2% of all mint acreage reported) were treated with Sinbar at this time. This amounted to approximately 6% of the reported peppermint, 2.5% of the Scotch spearmint, and 1.5% of the native spearmint being treated with Sinbar.

Fungicide/Nematicide

Vapam HL (metam-sodium): Vapam was used to control nematodes and verticillium wilt. It was used on 40 native spearmint acres (0.5% of all mint acreage reported) the fall before planting.

Dormant/Delayed Dormant Sprays

These sprays were designed to control emerged winter annual weeds or pre-emergence-to-summer annual weeds before the mint plants broke dormancy in the spring. Occasionally, a spray will be applied to control root-feeding pests. Dates for pesticide applications ranged from late January to early April. One insecticide (Lorsban) and eight herbicides (Assure, Basagran, Buctril, Goal, Gramoxone, Prowl, Sinbar, and Treflan) were reported. Often, the herbicides were tank-mixed for maximum effectiveness.

Insecticide

Lorsban (chlorpyrifos): One grower used Lorsban at 2 pints per acre to control mint root borer. Fifty-one acres of peppermint (1%) were treated in early February.

Herbicides

Assure (quizalofop): One grower reported the use of Assure to control grass weeds at one-quarter pint per acre. It was applied to 630 peppermint acres (13%) and 445 Scotch spearmint acres (24%).

Basagran (bentazone): One grower reported the use of Basagran to control broadleaf weeds. One pint per acre was applied to 630 peppermint acres (13%) and 445 Scotch spearmint acres (24%).

Buctril (bromoxynil): Five growers (24%) reported the use of Buctril to control the broadleaf weeds listed in Table 2. One-half pint to one pint per acre was applied to 51 peppermint acres (1%) and 364 native spearmint acres (22%).

Goal (oxyfluorfen): Half of the growers surveyed reported using the herbicide Goal at a half-pint to three pints per acre rate. A total of 901 peppermint acres (18.5%), 300 Scotch spearmint acres (16%), and 759 native spearmint acres (46%) were sprayed with Goal.

Gramoxone (paraquat): Fourteen out of 21 growers (67%) surveyed used Gramoxone at a rate ranging from half a pint to 2 pints per acre. A total of 3,950 peppermint acres (81%), 1,320 Scotch spearmint acres (72%), and 1,109 native spearmint acres (68%) were sprayed with Gramoxone.

Prowl (pendimethalin): This herbicide had a Section 18 registration in Idaho, Washington, and eastern Oregon; the Section 18 registration in Washington expired 12/31/2003. Twelve out of 21 growers (57%) used Prowl. Growers used from half a pint to 4.8 pints of Prowl in their tank mixes. A total of 901 peppermint acres (18.5%), 420 Scotch spearmint acres (23%), and 549 native spearmint acres (33%) were treated with Prowl.

Sinbar (terbacil): Sinbar was reported as part of the tank mix for nine out of 21 growers (43%), targeting any or all of the weeds in Table 2. One-half pound to 1.5 pounds of Sinbar per acre were applied to 3,191 peppermint acres (66%), 1,020 Scotch spearmint acres (55%), and 1,082 native spearmint acres (66%).

Stinger (clopyralid): One grower reported spraying Stinger on 32 acres of native spearmint (2%) during the early spring.

Treflan (trifluralin): One grower reported the use of Treflan mixed in with Sinbar. A total of 40 acres of peppermint (0.8%) and 230 native spearmint acres (14%) were treated with Treflan.

Pre-First-Cutting Sprays

These sprays were designed to control perennial, and early emerged winter and summer annual weeds as well as early insect/mite pests (spider mites, cutworms, aphids), powdery mildew, and nematodes. Spraying generally took place late March to early May. Two insecticides/miticides (Comite, Orthene), nine herbicides (Assure, Basagran, Buctril, Poast, Select, Sinbar, Stinger, Tough), and three fungicides/nematicides (Vydate, Rally, sulfur) were applied during this time.

Insecticides/Miticides

Comite (propargite): Three growers (14%) reported the use of Comite to control spider mites at the rate of 1 to 2 pints per acre. A total of 1,156 peppermint acres (24%) and 120 Scotch spearmint acres (6.5%) were treated with Comite.

Orthene (acephate): Two growers (9.5%) used Orthene to control cutworms, applying 1 to 1-1/3 pounds per acre to 1,256 acres of peppermint (26%) and 900 acres of Scotch spearmint (49%).

Herbicides

Assure (quizalofop): Three growers (14%) reported use of Assure at a rate of 4 to 12 ounces per acre. Four percent of the peppermint (184 acres), 35% of the Scotch spearmint acreage (640 acres), and 3% of the native spearmint (46 acres) were sprayed with Assure.

Basagran (bentazone): One grower (5%) reported the use of the herbicide Basagran. One quart per acre was applied to 24 acres of peppermint (0.5%).

Buctril (bromoxynil): Four growers (19%) reported the use of Buctril to control broadleaf weeds listed in Table 2. One-half pint to 1.5 pints per acre were applied to 1,298 peppermint acres (6%) and 156 native spearmint acres (9.5%).

Poast (sethoxydim): One grower used the herbicide Poast on 40 acres of native spearmint (2%) at 2 pints per acre.

Select (clethodim): One grower used the herbicide Select at 10 ounces per acre on 24 acres of peppermint (0.5%).

Sinbar (terbacil): Sinbar was used by two growers at one half to 1 pound per acre on 32 acres of Scotch spearmint (2%) and 156 acres of native spearmint (10%).

Stinger (clopyralid): Two growers reported using Stinger for control of weeds, using at the most a 1% solution for spot treatment. Approximately 5 acres of peppermint (0.1%) and 20 acres of native spearmint (1%) were treated.

Tough (pyridate): This herbicide has a Section 24c registration on mint from 2000. Three growers used Tough at 1.5 to 2 pints per acre, treating 3,243 acres of peppermint (67%), and 1,020 acres of Scotch spearmint (55%).

Fungicides/Nematicides

Rally (myclobutanil): Rally was used to control powdery mildew by two growers at a rate of 5 ounces per acre. A total of 123 Scotch spearmint acres (6.7%) and 128 native spearmint acres (8%) were sprayed.

Sulfur: Sulfur was used extensively to control powdery mildew by one grower, who reported using 5 pounds per acre per application. A total of 120 acres of Scotch spearmint (6.5%) were treated with three applications of sulfur during this time period.

Vydate (oxamyl): Two growers treated for nematodes with Vydate, using 2 to 6 quarts of material per acre. Approximately 2,660 peppermint acres (55%), 140 Scotch spearmint acres (8%), and 37 native spearmint acres (2%) were treated.

Post-First-Cutting Sprays

These pesticide applications were implemented after the mint had achieved a little growth after the first cutting. These sprays occurred during July 2002, and nearly half of the growers surveyed put on at least one pesticide application at this time. Common targets were all the weeds listed in Table 2 (herbicides: Assure, Buctril, Poast, Sinbar, Stinger, Tough), though one grower sprayed to control spider mites with Comite and two targeted powdery mildew with sulfur.

Insecticide/Miticide

Comite (propargite): One grower reported the use of Comite to control spider mites at the rate of 2 pints per acre on 60 peppermint acres (about 1%).

Herbicides

Assure (quizalofop): Three growers reported the use of the herbicide Assure. Ten to 12 ounces per acre were applied to 900 peppermint acres (18.5%), 900 Scotch spearmint acres (49%), and 28 acres of native spearmint (2%).

Buctril (bromoxynil): Two growers reported the use of the herbicide Buctril. One pint per acre was applied to 192 native spearmint acres (12%).

Poast (sethoxydim): One grower used the herbicide Poast at 0.3 pound ai per acre on 72 acres of native spearmint (about 4%).

Sinbar (terbacil): Sinbar was reported to be used by four out of 21 growers. One-half pound of Sinbar per acre was applied to 471 native spearmint acres (29%).

Stinger (clopyralid): One grower reported using spot treatment with the herbicide Stinger, spraying merely 5 acres of native spearmint (0.3%).

Tough (pyridate): Tough was used by one grower at a 1.5 pints per acre rate. About 3,100 acres of peppermint (64%) and 900 acres of Scotch spearmint (49%) were treated with Tough.

Fungicides/Nematicides

Sulfur: Sulfur was used extensively to control powdery mildew by one grower, with one application of 5 pounds per acre to 40 acres of Scotch spearmint (2%).

Microthiol (sulfur): One grower used this micronized wettable formulation of sulfur to control powdery mildew. About 60 acres of peppermint (1%) were treated with Microthiol at a 5 pounds per acre rate.

Pre-Second-Cutting Sprays

Five out of 21 growers surveyed (24%) sprayed during this time period, from late July to late August. Targets included loopers (Orthene), mites (Comite), summer annual weeds (Sinbar), and powdery mildew (sulfur).

Insecticides/Miticides

Comite (propargite): One grower reported the use of Comite to control spider mites at the rate of 2 pints per acre on 120 acres of peppermint (2.5%).

Orthene (acephate): Two growers used this insecticide during this time period, one of whom specified loopers as the target. Approximately 3,020 acres of peppermint (62%) and 680 acres of Scotch spearmint (37%) were treated with Orthene, with a 0.5 to 1.3 pounds per acre rate.

Herbicide

Sinbar (terbacil): Sinbar was reported to be used by one grower at this time, targeting a broad spectrum of weeds in Table 2. One pound of Sinbar per acre was applied to 32 Scotch spearmint acres (1.7%).

Fungicides/Nematicides

Sulfur: Sulfur was used extensively to control powdery mildew by one grower, this time using 2 pounds per acre on 120 Scotch spearmint acres (6.5%) and 80 native spearmint acres (5%).

Microthiol (sulfur): Another grower applied sulfur in the form of Microthiol to 120 peppermint acres (2.5%). This grower used 5 pounds per acre.

Post-Second-Cutting Sprays

Sprays initiated in this period targeted late-season insect/mite pests (aphids, mint root borer, and mites) and winter annual and perennial weeds. Also known as “the fall spray,” this pesticide application took place between late August and November. It was designed to control pests that might overwinter and affect the mint fields the following spring. Most growers surveyed (62%) made an application during this time.

Insecticides/Miticides

Comite (propargite): One grower reported using Comite to control spider mites at the rate of 2 pints per acre on 51 acres of peppermint (1%).

Lorsban (chlorpyrifos): Five out of 21 growers used Lorsban against insect pests at a rate of 2 quarts per acre. A total of 1,026 peppermint acres (21%), 720 acres of Scotch spearmint (39%), and 84 native spearmint acres (5%) were treated.

Overall Use of Insecticides/Miticides

An estimated total of 47,512 pounds of insecticides and miticides were applied to mint during 2002. Most of the poundage was applied to peppermint, primarily because of the larger number of peppermint acres. Table 5 shows a summary of insecticide/miticide use, based on grower reports. More pounds of Orthene were applied to mint fields than the other two pesticides in this category. Lorsban was the second most used insecticide, and Comite, a miticide, was in third place for pounds applied. The need for insecticide/miticide use

Herbicides

Buctril (bromoxynil): One grower reported the use of Buctril to control weeds. It was applied to 120 native spearmint acres (7%).

Poast (sethoxydim): One grower used the herbicide Poast at ½ pint per acre on 120 native spearmint acres (7%).

Sinbar (terbacil): Sinbar was reported to be used by 10 out of 21 growers, targeting a broad spectrum of weeds in Table 2. One-half to 1 pound of Sinbar per acre was applied to 162 peppermint acres (3%), 120 Scotch spearmint acres (6.5%), and 1,127 native spearmint acres (69%).

Fungicide/Nematicide

Microthiol (sulfur): One grower reported using Microthiol on 51 acres of peppermint (1%). This grower used 2 pounds per acre.

was greatest for peppermint (73% of the acreage), followed by Scotch spearmint (55% of the acreage). Only 5% of the native spearmint acreage was treated with insecticide. Insecticide/miticide use has decreased from the 1995 report, which stated that an estimated 53,444 pounds were applied to mint in Washington State annually from 1993–1995. The decrease in insecticide inputs was apparent for all mint types but was most noticeable in native spearmint, where in 1995, it was reported that 82% of the native spearmint was sprayed with insecticide or miticide.

TABLE 5
INSECTICIDE AND MITICIDE USE IN WASHINGTON MINT, 2002

Insecticide or Miticide	Mint Type	% Acres Treated	Mean Rate (lb ai per acre)	Mean No. Applications/Year	Total lb (ai/year)
Orthene (acephate)	peppermint	69	0.93	1.27	19,698
	Scotch spearmint	49	0.9975	1.76	2,567
	native spearmint	---	---	---	---
Lorsban (chlorpyrifos)	peppermint	21	1.95	1.04	10,271
	Scotch spearmint	39	2.00	1.00	2,345
	native spearmint	5	2.00	1.00	707
Comite (propargite)	peppermint	27	1.64	1.05	11,709
	Scotch spearmint	7	1.08	1.02	215
	native spearmint	---	---	---	---
All Insecticides/ Miticides	peppermint	73			41,678
	Scotch spearmint	55			5,127
	native spearmint	5			707
	All mint	56			47,512

Overall Use of Herbicides

Approximately 84,186 pounds of herbicide were applied to Washington mint in 2002, nearly twice the amount of insecticide applied (Table 6). Most of this input was on peppermint. However, 92% of all mint was sprayed with at least one herbicide application (peppermint, 89%; Scotch spearmint, 98%; native spearmint, 92%). Twelve herbicides were reported to be used in mint, with Tough (pyridate) ranking as the most heavily used. Sixty-seven percent of the peppermint and 55% of the Scotch spearmint were sprayed with Tough for a total estimated input of 32,347 pounds statewide. Sinbar (terbacil) was the second most utilized herbicide, with a total estimated input of 22,746 pounds statewide. Gramoxone

(paraquat), ranked as the third most used herbicide, with an estimated 13,950 pounds applied statewide. Prowl (pendimethalin, 6,771 lbs.) ranked fourth, followed by Goal (oxyfluorfen, 3,355 lbs.), Basagran (bentazone, 2,035 lbs.), and Buctril (bromoxynil; 1,189 lbs.). Other herbicides used were Treflan, Assure, Poast, Stinger, and Select, each with less than 1,000 estimated pounds applied annually. Herbicide use appears to have increased from the 1995 survey, which reported an estimated average of 74,565 pounds applied annually from 1993 to 1995. Factors contributing to the evident increase include greater use of Gramoxone and Goal, and the special registrations and use of Prowl (Section 18, expired 12/31/2003) and Tough (Section 24c).

TABLE 6
HERBICIDE USE IN WASHINGTON MINT, 2002

Herbicide	Mint Type	% Acres Treated	Mean Rate (lb ai per acre)	Mean No. Applications/Year	Total lb (ai/year)
Tough (pyridate)	peppermint	67	0.94	1.96	29,354
	Scotch spearmint	55	0.96	1.88	2,993
	native spearmint	---	---	---	---
Sinbar (terbacil)	peppermint	71	0.79	1.05	14,232
	Scotch spearmint	56	0.78	1.25	1,622
	native spearmint	89	0.58	1.95	6,892
Gramoxone (paraquat)	peppermint	81	0.54	1.00	10,566
	Scotch spearmint	72	0.52	1.00	1,115
	native spearmint	73	0.49	1.00	2,269
Prowl (pendimethalin)	peppermint	19	0.78	1.00	3,468
	Scotch spearmint	23	0.68	1.00	464
	native spearmint	33	1.23	1.00	2,839
Goal (oxyfluorfen)	peppermint	19	0.44	1.00	1,975
	Scotch spearmint	16	0.13	1.00	61
	native spearmint	46	0.41	1.00	1,318
Basagran (bentazone)	peppermint	13	0.52	1.00	1,673
	Scotch spearmint	24	0.50	1.00	362
	native spearmint	---	---	---	---
Buctril (bromoxynil)	peppermint	7	0.30	1.00	515
	Scotch spearmint	---	---	---	---
	native spearmint	43	0.19	1.17	674
Treflan (trifluralin)	peppermint	<1	0.75	1.00	148
	Scotch spearmint	---	---	---	---
	native spearmint	14	0.75	1.00	726
Assure (quizalofop)	peppermint	32	0.05	1.10	455
	Scotch spearmint	73	0.06	1.48	192
	native spearmint	5	0.04	1.00	14
Poast (sethoxydim)	peppermint	---	---	---	---
	Scotch spearmint	---	---	---	---
	native spearmint	14	0.21	1.00	201
Stinger (clopyralid)	peppermint	<1	0.03	1.00	<1
	Scotch spearmint	---	---	---	---
	native spearmint	3	0.15	1.00	35
Select (clethodim)	peppermint	<1	0.16	1.00	19
	Scotch spearmint	---	---	---	---
	native spearmint	---	---	---	---
All Herbicides	peppermint	89			62,407
	Scotch spearmint	98			6,809
	native spearmint	92			14,970
	All mint	92			84,186

Overall Use of Fungicides/Nematicides

An estimated statewide total of 70,739 pounds of fungicides/nematicides were applied to Washington mint in 2002 (Table 7). Four materials were reported by growers: Vydate (oxamyl), Vapam (metam-sodium), sulfur/Microthiol, and Rally (myclobutanol). Vydate ranked first, with an estimated 40,231 pounds applied statewide. Vapam ranked second, with an estimated 23,392 pounds annually; sulfur applications were third, with 7,024 pounds; and Rally, a Section 18 registration, ranked last with

92 estimated pounds applied. A higher percentage of the state's peppermint acreage (58%) was treated with fungicide/nematicide than either Scotch (17%) or native spearmint (15%). Fungicide/nematicide use was down from the estimated average reported in the 1995 survey (77,704 pounds annually 1993 to 1995). During that earlier time period, more mint acreage was treated for powdery mildew; sulfur applications accounted for 65,522 pounds of the total estimate.

TABLE 7
FUNGICIDE AND NEMATICIDE USE IN WASHINGTON MINT, 2002

Fungicide/ Nematicide	Mint Type	% Acres Treated	Mean Rate (lb ai per acre)	Mean No. Applications/Year	Total lb (ai/year)
Vydate (oxamyl)	peppermint	55	3.00	1.0	39,391
	Scotch spearmint	8	3.00	1.0	684
	native spearmint	2	1.00	1.0	156
Vapam (metam-sodium)	peppermint	---	---	---	---
	Scotch spearmint	---	---	---	---
	native spearmint	2	319.50	1.0	23,392
Microthiol (sulfur)	peppermint	4	3.47	1.4	3,957
	Scotch spearmint	7	3.25	4.0	2,528
	native spearmint	5	1.60	1.0	539
Rally (myclobutanol)	peppermint	---	---	---	---
	Scotch spearmint	7	0.13	1.0	25
	native spearmint	8	0.13	1.0	67
All Fungicides and Nematicides	peppermint	58			43,348
	Scotch spearmint	17			3,237
	native spearmint	15			24,154
	All mint	41			70,739

Non-Chemical Pest Management Practices

Growers surveyed reported that their use of pesticides had either stayed the same (57%) or decreased (43%) since the 1995 survey was conducted. Most growers indicated that they practiced certain non-chemical control methods, including field monitoring (scouting), economic thresholds, crop rotation, and mechanical weed control (85.5%, 84%, 70%, and 65%, respectively). Eighty percent indicated that they "sometimes" or "often" used reduced pesticide rates. Up to 35% of the growers reported using integrated mite management or biological control (35% and 25%, respectively). Results of the non-chemical pest management survey questions are presented in Table 8 on the following page.



Dr. Doug Walsh and graduate student Tim Waters inspecting light trap used to monitor pests in mint

Scouting practices were explored in detail in the 2002 survey, including questions about the frequency of scouting and which specific pests were monitored. Approximately 76% of respondents reported monitoring for mint root borer. Spider mites and aphids were monitored by 67% of the growers. Forty-eight percent of the mint growers scouted for mint cutworm, while 38% of the growers looked for alfalfa loopers. Twenty percent of the growers scouted for cabbage loopers, redbacked cutworms, and spotted cutworms. Garden symphylans, wireworms, grasshoppers, strawberry root weevils, army cutworms, and western yellow-striped armyworms were occasionally monitored.

Table 9 summarizes scouting frequency by type of mint. Approximately 97% of the reported peppermint acreage, 92% of the reported Scotch spearmint acreage, and 81% of the reported native spearmint acreage were monitored for arthropod pests. Peppermint and Scotch spearmint were scouted more frequently than native spearmint; at least 98% of both peppermint and Scotch spearmint were scouted at least 4 times per month. About 71% of native spearmint was monitored one to three times per month. All major pests were monitored, regardless of mint type, except garden symphylan, for which no one with native spearmint acreage reported a monitoring program.

TABLE 8
NON-CHEMICAL PEST MANAGEMENT PRACTICES IN WASHINGTON STATE MINT, 2002

Pest Management Practice	Percent of Growers with Response			
	Often	Sometimes	Seldom	Never
Economic thresholds	68	16	0	16
Field monitoring (scouting)	57	28.5	9.5	5
Crop rotation for disease control	50	20	15	15
Reduced pesticide rates	30	50	10	10
Mechanical control of weeds	30	35	20	15
Integrated mite management	15	20	15	50
Biological control	0	25	19	56

TABLE 9
SUMMARY BY MINT TYPE OF SCOUTING PRACTICES OF GROWERS OF WASHINGTON STATE MINT, 2002

Mint Type	No. Times per Month Scouted (% scouted acreage)						Species*
	<1	1	2	3	4	>4	
Peppermint	0	0	1.7	0.0	95.8	2.5	AL,APH,CL,GS,MC,MRB,RBC,SC,SM
Scotch spearmint	0	0	0	2.0	98.0	0	AL,APH,CL,GS,MC,MRB,RBC,SC,SM
Native spearmint	21	18	32	21	8	0	AL,APH,CL,MC,MRB,RBC,SC,SM

*AL=alfalfa looper, APH=aphids, CL=cabbage looper, GS=garden symphylan, MC=mint cutworm, MRB=mint root borer, RBC=redbacked cutworm, SC=spotted cutworm, SM=spider mites.

TABLE 10
IMPORTANCE OF PEST MANAGEMENT INFORMATION SOURCES AVAILABLE TO GROWERS OF WASHINGTON STATE MINT, 2002

Information Source	Importance (% of Growers With Response)		
	Very Important	Somewhat Important	Not Important
Own experience	90	10	0
Chemical firm representative	55	30	15
Private consultant	41	24	35
Other growers	35	65	0
Cooperative Extension	28	50	22
University <i>Crop Protection Guides</i>	25	70	5
Corporate scientist	6	55	39

Information Sources



Dr. Holly Ferguson discussing mint pests on farm tour

Growers were asked about the importance of certain information sources to them as they made decisions regarding the use of pest management practices. They were asked to rate certain information sources as very important, somewhat important, or not important. The results are summarized in Table 10.

By far the most important information source for mint growers in Washington State was their own experience: 90% called personal experience very important. The second highest ranked source of pest management information was chemical firm representatives; 85% of respondents rated this source either very important (55%) or somewhat important (30%). Private consultants were deemed a very important source by 41% of respondents. Other grow-

ers, university Extension personnel, university crop protection guides, and corporate scientists were each rated somewhat important by half or more of the respondents (65%, 50%, 70%, and 55%, respectively), but were ranked as very important by 35% or fewer of the growers. The lowest ranked of the seven sources listed was corporate scientists; 39% of the respondents rated this source not important.

Fertilizer Use

Fertilizer applications play a role in overall chemical inputs. Nutrient applications also affect the vigor of plants, which can in turn determine the extent of pest problems encountered by growers.

The survey asked growers to list fertilizer applications to mint acreage in 2002. From these data, the number of acres treated, percent acreage treated, average pounds per acre, and total estimated pounds applied per year statewide were calculated. Table 11 summarizes the fertilizer use information gleaned from the respondents.

Nearly all of the reported mint acreage received at least one nutrient application. Nitrogen was applied to most of the mint acreage, with 99% of the peppermint, 100% of the Scotch spearmint, and 91% of the native spearmint treated. An estimated 9.3 million pounds of nitrogen were applied to Washington mint in 2002, similar to that applied

TABLE 11
FERTILIZER USE IN WASHINGTON MINT, 2002

Nutrient	Mint Type	% Acres Treated	Estimated Acres Treated in State	Average lbs/acre	Estimated Total lbs Applied /Year
Nitrogen	peppermint	99	23,778	303.3	7,210,899
	Scotch spearmint	100	3,000	276.2	828,601
	native spearmint	91	6,247	201.6	1,259,218
Potassium	peppermint	74	17,854	115.0	2,053,525
	Scotch spearmint	51	1,539	118.6	182,492
	native spearmint	56	3,894	52.2	203,380
Phosphorus	peppermint	86	20,668	76.0	1,570,341
	Scotch spearmint	76	2,275	68.7	156,375
	native spearmint	80	5,536	47.6	263,328
Sulfur	peppermint	22	5,366	34.2	183,727
	Scotch spearmint	27	809	28.3	22,876
	native spearmint	79	5,481	44.1	241,521
Zinc	peppermint	10	2,345	4.0	9,379
	Scotch spearmint	9	269	4.7	1,270
	native spearmint	28	1,907	4.6	8,723
Boron	peppermint	74	17,854	0.6	10,203
	Scotch spearmint	58	1,735	0.5	904
	native spearmint	37	2,560	1.2	3,065
Magnesium	peppermint	---	---	---	---
	Scotch spearmint	---	---	---	---
	native spearmint	8	577	3.9	2,231

during 1993 to 1995, according to the earlier survey. Large amounts of potassium (2.4 million pounds estimated) and phosphorus (2 million pounds estimated) were applied to mint statewide. Applications of minor nutrients such as sulfur (448,124 pounds), zinc (19,372 pounds), boron (14,172 pounds), and magnesium (2,231 pounds) were reported by mint growers as well (all estimates). Sulfur as a nutrient application was separated from sulfur as a fungicide in the analysis. Growers reported that their nutrient applications varied according to field and soil test results.

Additional Resources

A Guide to Peppermint Insect and Mite Identification and Management.

Life histories, economic thresholds, and treatment options for the common mint pests; several pages of color photos of pests and beneficials. By Ralph E. Berry and Glenn Fisher. Available from the WSU Extension Bulletin Office, WSU, Pullman, WA, 509-335-2857. Publication number PNW 182. Revised 1993.

Pest Management Strategic Plan for Pacific Northwest Mint Production.

Up-to-date working strategies for pest management in mint. Identifies critical research needs.
<http://pestdata.ncsu.edu/pmsp/pdf/PNWMintPMSP.pdf>

United States Mint: All Natural Flavor.

Informative publication on mint production in the United States. Available from Rocky Lundy, Mint Industry Research Council, Stevenson, WA 98649, 509-427-3601.

Using Biological Control in Mint.

Mint growers' bulletin details the beneficial arthropod complex in mint and explains how growers can use these organisms to their advantage. By Mark Morris and Joyce Takeyasu. Available from Rocky Lundy, Mint Industry Research Council, Stevenson, WA 98649, 509-427-3601.



College of Agricultural, Human, & Natural Resource Sciences

Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Copyright 2004 Washington State University

WSU Extension bulletins contain material written and produced for public distribution. You may reprint written material, provided you do not use it to endorse a commercial product. Alternate formats of our educational materials are available upon request for persons with disabilities. Please contact the Information Department, College of Agricultural, Human, & Natural Resource Sciences, Washington State University for more information.

You may download copies of this and other online publications at <http://pubs.wsu.edu>.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. WSU Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, sex, religion, age, color, creed, national or ethnic origin; physical, mental or sensory disability; marital status, sexual orientation, and status as a Vietnam-era or disabled veteran. Evidence of noncompliance may be reported through your local WSU Extension office. Trade names have been used to simplify information; no endorsement is intended. Published December 2004. Subject Code 350. EB1989E