Crop Profile for Mint in Indiana

Prepared July, 2000

General Production Information

Mint is grown as a short-term perennial, with the first year as a row crop and the next four to five years as a solid stand or meadow crop.

Peppermint and the spearmints have been grown in Indiana since the late 1800s. The soils and climate of northern Indiana are well suited for mint production. For many years this area and southern Michigan was the major production area of the U.S. After the 1950s, mint acreage increased rapidly in Oregon and Washington, and that area is now the major mint-producing region of the country. However, Indiana continues to be an important mint-producing state.

The mints are grown for the essential oils that they produce in specialized glands on the leaves and stems. This oil is readily recovered by steam distillation of the harvested hay. Peppermint and spearmint oils are widely used to flavor chewing gum, candy, pharmaceuticals, toothpaste and other oral hygiene products. More than 30% of the mint oil produced in the U.S. is exported to Europe and other countries around the world.

There are two types of mint grown for their essential oils. These are peppermint (Mentha piperita) and two species of spearmint: native or American spearmint (Mentha spicata), and Scotch spearmint (Mentha cardiaca). All of these originally came from selections from native plants, and until the 1970s there were no commercially developed varieties of any of these species.

Presently, there are four varieties of peppermint: Black Mitcham (the original selection from the wild), Todd's Mitcham, Murray Mitcham, and Robert's Mitcham. The last three varieties were developed to reduce losses from the highly destructive disease Verticillium wilt.

Native and Scotch spearmints are very similar. Native spearmint is used most often to flavor toothpaste and dental hygiene products. Scotch spearmint has a milder, more pleasant taste and is

used in chewing gum and confections. At present, no new varieties of either type of spearmint are widely grown. Breeding and selection work continue in the development of new varieties.

Indiana Mint Production

Mint is grown as a short-term perennial, the first year as a row crop and the next three to four years as a solid stand or meadow crop. All phases of crop production have been mechanized, so farm acreage is relatively large. Mint production requires an initial high capital investment in specialized planting and harvesting equipment and a custom-built distillery. For these reasons, a base of 300 or more acres is required for long-term profitability.

Mint is grown primarily in north central and northwestern Indiana (see map) because of favorable soil types and a relatively high water table in this area. In some cases the water table can be controlled to help satisfy moisture needs of mint. Mint also requires a day length of at least 15 hours in midsummer for the highest oil yields. In Indiana, this occurs only on a line north of Indianapolis (40th parallel).

Soils and nutrition:
Mint is shallow-rooted and requires loose-textured soils for good root penetration and growth. It requires abundant moisture (equivalent of 60 inches of rainfall) for optimum growth and relatively high fertility (especially nitrogen).

The high organic (muck) soils found in northern Indiana are ideal for mint production because they are deep, light soils with a high water table that can be controlled through drainage systems. Some of the moisture demands of mint can be met by controlling the water table, thus reducing the need for irrigation. However, light, well drained mineral soils also are well suited for mint production, but they may require supplemental irrigation for best growth and oil production. Mineral soils have less than 5% organic matter and varying amounts of humus, silt, sand, and clay.

The optimum soil pH for growing mint is 5.5 to 6.5. Soil tests to determine base fertility levels are done before mint is planted. Mint requires a phosphorus (P_2O_5) level of 100 pounds per acre and a potassium (K_2O) level of 400 pounds per acre. Nitrogen is applied in split applications, the first at crop emergence and the second when plants are 10 to 12 inches tall. The amount of nitrogen varies, but the usual range is 125 to 200 units per acre. The equivalent of 50 pounds of phosphorus and 100 to 150 pounds of potassium is applied each year to maintain optimum fertility. After the first year, these can be applied at fall plowing.

Planting and maintenance:
All commercial mint varieties are seed sterile and are propagated using the underground stolons (runners or rootstock) produced by existing plants. Mint stolons are dug from existing fields or nursery beds established for this purpose. Immediately before planting, dormant stolons are dug with a mechanical

digger similar to a potato digger. The stolons cannot be stored for more than a few days since they deteriorate rapidly due to heat or dehydration. The short shelf-life of the stolons limits the distance from the source to the new growing area.

Mint is planted either in the late fall or in the spring, using specially built mechanical planters. The planter cuts the stolons into 3- to 4-inch pieces and drops them into furrows. The furrows are closed and firmed by a packer wheel to assure good soil contact.

The volume of stolons required to plant an acre of new mint varies with row width, condition of stolons, and other factors. An acre of well-established mint will yield sufficient stolons to plant an average of 10 acres.

New plantings also may be purchased from a certified producer to establish nursery beds for plant increase. This is highly advisable, especially in new growing areas, because a number of serious diseases and insect pests can be introduced on contaminated planting stock from local sources.

In the first-year planting, mint is maintained in 30- to 36-inch rows, but little cultivation is done. Growers rely on herbicides for weed control, and supplemental nitrogen applications are broadcast rather than sidedressed. In the following years the field is worked lightly before crop emergence to eliminate early weed growth and to facilitate herbicide applications.

Shoots and roots sprout from buds on the stolons in the spring to produce new plants. Crop emergence with row mint depends on the time of planting but is usually mid April to early May. In the following years, meadow mint crop emergence usually occurs in early to mid April in mineral soils and later in muck soils.

After harvest, the crop is permitted to regrow to increase stolon production for establishing the next year's crop. Because the crop may be damaged by severe winter conditions, it is plowed under in the late fall after one or more killing frosts have induced dormancy. The depth of plowing does not exceed 4 to 5 inches, but the stolons and crop debris must be turned cleanly so they are fully covered by soil.

With "clean plowing" the soil becomes subject to wind erosion in late winter and early spring. In muck soils, rye is usually drilled in rows or lightly broadcast as a cover crop. However, in mineral soils, fall plowing is often done too late to establish a fall cover crop, so oats are broadcast in early spring. Growers also spread the crop refuse (after distillation) onto the field for protection against wind erosion. If available, irrigation is often used to limit soil losses by wind and to protect the emerging crop from damage by late spring frosts.

Irrigation:
Mints have relatively high water demands during the growing season, yet they do not tolerate waterlogged soils; therefore, soils must be well drained. Also, since mints are shallow-rooted they quickly become stressed if rainfall is untimely or irrigation is unavailable. In muck soils, some of the

moisture demands can be met by adjusting the headgates in drainage ditches to control the water table. However, season-long, optimum soil moisture for mint growth and development can rarely be maintained in either muck or mineral soils without supplemental irrigation. The amount of moisture provided by supplemental irrigation usually ranges from 4 to 8 inches per season, depending on rainfall amount and timing. Pivots and traveling booms are the most common types of irrigation systems.

Harvest:
Maximum oil yield depends upon both the stages of crop development and favorable environmental conditions. Under favorable weather conditions-bright sunny days with warm temperatures-oil increases rapidly as the plant approaches vegetative maturity, that is, when the plant begins to bloom. Optimum oil yield and quality is attained when 10% of a peppermint crop is in full bloom. With the spearmints, harvest begins when all plants are in full bloom. Mint is harvested from late June to mid August.

Oil yields tend to be slightly higher during the first crop year in row mint, declining somewhat in subsequent years. However, weather conditions have the biggest impact on yield in any given season.

Mint is cut and windrowed in much the same manner as is hay. Typically, mint is cut and windrowed with a swather, although other types of harvest equipment, such as a sickle bar or a rotary windrower, may be used. Mint foliage is allowed to partially dry in windrows in the field for 24 to 36 hours before it is collected for distillation. The field drying process is critical in obtaining maximum oil yield. If the leaves become too dry, they shatter, and oil will be lost. If the mint hay is too green or wet, distillation time is prolonged and the oil becomes difficult to recover.

The cured mint hay is picked up from the windrow with a field chopper and blown into a portable distillation tub for transport to the distillery. The tubs are equipped with perforated steam lines in the bottom and a closed top so that a steam line and vapor pipe can be attached at the distiller to recover the oil. A tub generally holds mint harvested from .75 to 1.25 acres, depending on yield.

Oil distillation:
Mint oil is recovered from the cured mint hay in a mint distillery on the farm. A grower just beginning mint production may have distillation done by another local grower. However, because distilling must be done in a timely manner, it is almost essential to have a distillery on the farm.

The mint distillery consists of a high-pressure steam boiler, portable distillation tubs, a condenser, a receiver, and a redistillation unit. Although some of this equipment can be purchased from manufacturers, much of it is custom built locally or on the farm. Mint oil is recovered from the hay by applying steam to the distillation tub through a series of perforated pipes on the bottom of the tub. After distillation, the mint oil/steam mixture flows through a water-cooled condenser to recondense the oil. Mint oil floats on top of the water in the receiver, where it is recovered.

Mint oil can be kept for two or more years if it is handled properly and stored to reduce oxidation or heat deterioration. Growers raise mint primarily on contract with mint buyers. During harvest, oil buyers pick

up oil almost daily from the growers. Often growers exceed the amount of oil stipulated in their contract, and in these instances oil buyers generally store the excess oil at no charge to the grower.

Mint oil buyers may further refine the oil and blend it for uniform quality before selling it to the end user. Quality standards on odor, taste, and color are very strict and outlined in the contract. Oil failing to meet the specified standards may bring reduced prices or result in termination of the contract.

Post production:
At the end of the four- to five-year rotation the mint is allowed to regrow after harvest. The hay is cut a second time and distilled. The mint stand is then disked or otherwise "torn up" and left over winter. Generally there is little problem of volunteer mint growth the next season. Corn commonly follows mint in the crop rotation and the herbicides used for corn effectively control volunteer mint growth.

Timeline of Meadow Mint (2 years and older):

March:
Cover crop planted in mineral soils

April:
Preemergence herbicide applied
Crop emergence - N applied - Sidedress N

May:
Herbicide applied
If needed, chlorothalonil for mint rust

June:
Herbicide applied
Bloom

July:
Harvest

August:
If needed, malathion for flea beetle

September:
Killing frost

October:
Clean plow and fertilizer application

November:
Cover crop planted in muck soils

Pest Management:
A number of diseases can affect mints, and insects, weeds, and nematodes also can cause problems. However, the occurrence and level of crop damage from them vary with the season, crop and variety grown, management practices, and other factors. Direct control with pesticides is usually on a prescription basis after scouting and diagnosis estimate the potential crop damage. Management practices, such as crop rotation, tillage practices, varieties used, etc., reduce the occurrence of many of these pests. Chemical control is most effective when used in conjunction with these practices. Growers generally apply the pesticides to their own mint acreage.

Insect Pests

A number of insect pests may cause damage to mint in Indiana, but most occur sporadically. Regular scouting determines the presence and potential damage of insect pests. Cropping systems used by Indiana mint growers help to control insect populations; insecticides are applied only as needed. The following insects are the most important.

Mint flea beetle
Longitarsus waterhousei

The mint flea beetle was an important insect pest of the mints, especially peppermint, in the early years of mint production in Indiana. Recently, its importance has diminished, due to shorter rotations and effective control of the adult insects on the stubble immediately after harvest.

The adult mint flea beetle is a very small, tan or bronze-colored insect. It is difficult to find because it remains in the plant can-opy. Adults emerge in early July and feed for two or three weeks, then begin laying eggs. Eggs are laid in the soil at the crown of the plant where they overwinter. The eggs hatch when the soil warms in the spring and the larvae feed first on the fine roots and then in the main underground stem of the mint plant.

Flea beetle damage appears first in the spring, shortly after plant emergence. Affected plants are stunted,

usually red in color (especially peppermint), and occur in spots in the field. Stunted plants may die. The fine roots of affected plants are clipped back to the underground stem, and the stem is furrowed and brown due to tunneling of the larvae. Adults, which feed on the lower leaves in the inner canopy, cause little financial crop damage.

Crop loss: Flea beetle damage usually occurs the third year of a mint stand or later. Because there is only one generation a year, the population increases slowly. Damage to the underground part of the stem is of concern because soil microorganisms invade these wounds and cause decay.

Control: Insecticide applications may be necessary if scouting just prior to harvest shows the presence of adult beetles, or if the stand is more than three years old. Within three days after the mint is harvested, the stubble is sprayed to eliminate the remaining adults and interrupt egg-laying. Malathion and methomyl (Lannate) are registered for use on mint for flea beetle control. Reducing volunteer mint on roadsides and in ditches helps to control populations.

Mint bud mite

Floridotarsonemus sp.

Mint bud mite has recently been associated with the condition known as "squirrelly" peppermint. This mite causes stunting and distortion of the upper plant late in the season. The mite is spread by infested planting stock, and damage increases in older stands. There is still much that is not known of the life cycle of this mite.

Crop loss: The oil yield of affected plants is dramatically reduced. At present, damage occurs only on peppermint grown in muck soils.

Control: Effective control depends on careful scouting. The presence of the mite is limited to the buds on the plant terminals and requires some magnification to be seen. If more than 10 mites are found in 30% of the terminals, direct control with the miticide propargite (Omite 6E, Comite) is recommended. Two applications at intervals of 10 to 14 days are required for suppression of mite populations. Other important control practices include use of planting stock from mite-free areas, crop rotations of four years or less, and fall plowing.

Other Insect and Mite Problems

There are a number of other insects and mites that may occur sporadically in mint, such as mint looper, cutworms (especially the variegated cutworm), two-spotted spider mite, and European corn borer. Careful scouting of fields identifies the damage, and control, if necessary, can be initiated.

Chemical Control:

Malathion

Target pest: mint aphid, flea beetle
Acres treated: 6.8% of peppermint acres
Application and rate: One to two applications at 0.67 lb ai/acre made to mint stubble immediately after harvest.
PHI: 14 days

Lorsban (chlorpyrifos)

Target pest: cutworm, armyworm, mint looper
Acres treated: 1.6% of peppermint acres
Application and rate: One application at 2.0 lb ai/acre per season.
PHI: 90 days

Omite 6E, Comite* (propargite)

Target pest: spider mite, bud mite
Acres treated: 0.6% peppermint acres
Application and rate: One application at 2.5 pt/acre.
PHI: 14 days
Comments: *Comite is currently 24C registration in Indiana and Wisconsin.

Kelthane (dicofol)

Target pest: spider mite, bud mite
Acres treated: Not applied in year of survey.
Application and rate: One application at 2.5 pt/acre.

Lannate (methomyl)

Target pest: flea beetle, variegated cutworm
Acres treated: Not applied in year of survey.
Application and rate: For flea beetle control, one application
of 3 pt/acre applied to crop stubble immediately after harvest.
Treatment threshold for cutworm is 1.3 larvae/sq ft. One or two applications at 3 pt/acre.
PHI: 14 days

Diseases

Verticillium wilt

Verticillium dahliae

A soil-borne fungus causes Verticillium wilt, the most serious disease of mint. The fungus spreads readily via diseased planting stock and soil-contaminated equipment. Once established in the soil, the fungus persists for many years, regardless of rotation or other management practices. Infection occurs through natural openings and wounds on the roots.

Infected plants are stunted and have smaller, twisted top leaves; the affected plants may be found in spots or portions of a field. The plants first yellow, then die progressively from the bottom up. Infected plants usually die before harvest, but infected stolons and roots may survive to infect the next year's crop.

Crop loss: Immediate losses from wilt occur when stands become thinned as plants die. Chronic, nonlethal infections result in stunting of the plants, a reduction of the total leaf area, defoliation of the plants, and reduced oil production. Severity and yield losses depend on the level of fungus in the soil, weather conditions, and variety susceptibility.

Control: In new growing areas, it is essential that only certified, disease-free planting stock be used. Peppermint (especially Black Mitcham variety) is most susceptible, while Scotch spearmint is less susceptible, and native spearmint is highly resistant. Once the wilt disease is present, peppermint can usually still be profitably grown by using one of the more wilt-resistant varieties (Murray Mitcham, Robert's Mitcham, or Todd's Mitcham) in a shorter rotation of at least three years, followed by three years in corn or soybeans.

There is no chemical control for Verticillium wilt.

Mint rust

Puccinia menthae

Both peppermint and the spearmints are susceptible to mint rust, but only the spearmints suffer damage in Indiana. Although rust affects some shoots in the early spring, it usually is noticed first on older plants as orange to reddish-brown spots on the underside of the lower leaves. In late summer and fall, the rust disease appears as dark brown spots on the leaves of plants in regrowth, as the fungus produces spores that overwinter.

Crop loss: Rusted leaves turn brown and drop off the plants. Defoliation can be severe, late in the season, with accompanying loss in oil yields. Moderate to severe rust infections weaken the plants, reducing winter survival.

Control: Preventing establishment of the disease early in the spring most effectively controls mint rust. Carefully plowing the fields in the fall to bury crop debris prevents or delays infections. When the mint is 3 to 4 inches tall, 1 lb/acre of chlorothalonil (Bravo) is applied, followed by a second application 10 to 14 days later. The timing of these treatments is essential for control. If delayed, control will be less effective.

Mint rust can severly defoliate plants, thus reducing oil yields. Removing volunteer mint plants from field borders helps to reduce the source of infection.)

Minor Diseases

There are a number of minor diseases of both peppermint and the spearmints, such as anthracnose, septoria leaf spot, and fusarium crownroot, that rarely occur at levels that require direct control. Most are held in check by disease-free planting stock, crop rotation, and crop sanitation such as clean fall plowing.

Nematodes

Root lesion nematode

Pratylenchus penetrans

The root lesion nematode occurs on mint in Indiana primarily when grown in muck soils where potatoes or onions were previously grown. The nematode feeds on the fine roots, causing stunted, off-colored plants found in spots or patches in the field. Field symptoms may be confused with the damage caused by mint flea beetle larvae. With nematode injury, the fine roots are brown, but intact. When damaged from the mint flea beetle, the fine roots are clipped off and the underground stem shows evidence of tunneling.

Crop loss: Localized areas of stunted, unthrifty plants in a field indicate infestations. In addition to direct damage, the lesion nematode may also increase the incidence and severity of the Verticillium wilt disease if present in the field. The wilt fungus can enter the plant through nematode feeding areas.

Control: Unless other susceptible crops such as potatoes or onions are grown in rotation with mint, damage by the root lesion nematode or other species is usually of little concern. At present, shorter crop rotations with other nonsusceptible crops, and use of nematode-free planting stock will minimize the potential for damage and crop loss. If chemical control is necessary, soil fumigation with registered nematicides is used prior to planting.

Other nematode species such as the pin nematode, Paratylenchus sp.; needle nematode, Longidorus sp.; and rootknot nematode, Meloidogyne sp. may occur on the mints in Indiana with little or no economic impact.

Chemical control:

Bravo (chlorothalanil)

Target pest: mint rust
Acres treated: 65% spearmint acres treated
Application and rate: Two or three applications at 1.0 lb ai/acre when spearmint is 3 to 4 inches tall; repeated in 10 days.
PHI: 80 days

Telone C-17, C-35 (1,3 dichloropropene and chloropicrin)

Target pest: nematodes
Acres treated: Not applied in year of survey. Only applied to plant propagation beds.
Application and rate: One application of 18 to 25 gal/acre.

New fungicide
Tilt (myclobutanil) controls mint rust and powdery mildew.

It works as an eradicant as compared to a protectant like chlorothalonil. It has passed IR-4 and is awaiting release.

Weeds

Midwestern mint growers rank weed control as the number one pest control practice that all growers incorporate into their production system. However, growers feel that most weeds can be adequately managed with the herbicides available, with the exception of pigweeds.

Crop loss: Yield loss in heavy infestations of grasses and broadleaf weeds can be as high as 80% and 40%, respectively. If weeds are left uncontrolled or poorly controlled, they compete with the mint stand and reduce yields. The exact loss due to quality reduction caused by weeds is more difficult to estimate since oil buyers decide quality issues as outlined in the contract.

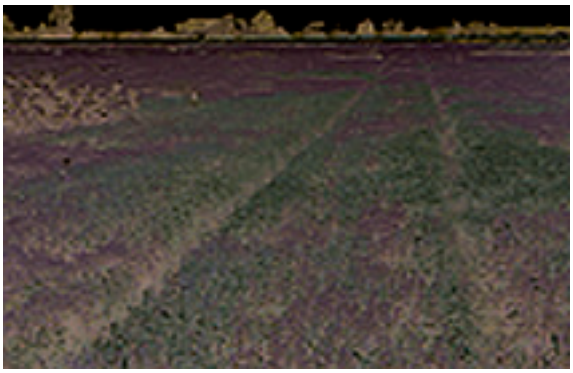
Annual weeds:
Pigweeds, foxtail, and lambsquarters are present in mint fields 100% of the time. Other prevalent annual weeds are morning-glory (80%), ragweed (80%), smartweed (50%), nightshade (50%), crabgrass (50%), and barnyardgrass (50%). Annual grasses have become a major factor in weed management.

Pigweed species are the group of annual weeds that growers classify as the most difficult to control. The pigweeds include redroot, smooth, tumble, prostrate, water hemp, and powell amaranth. Smooth and redroot pigweed are the most prevalent, with waterhemp becoming more common.

Perennial weeds:
Perennial weeds are a minor to moderate problem for most well- managed mint fields. Problems with perennials are generally encountered in the third or fourth year of the mint rotation or in longer rotation (more than four years). When present, perennials are concentrated within specific areas in the field.

Canada thistle and yellow nutsedge are reasonably easy to control with clopyralid and bentazon, respectively. Other perennials, including white cockle, field bindweed, and swamp smartweed, generally are not well-controlled, but rather suppressed.

Perennial grasses, such as quackgrass, cause problems in mint stands. They produce runners similar to mint, and when mint stolons are dug for planting these grasses can also be dug and replanted.



Quackgrass is a perennial grass that reproduces by runners, similar to mint, making it difficult to control.

Nonchemical control:
The most common cultural practice in Indiana mint production is a four- to five-year mint crop rotation followed by at least a three-year rotation to another crop. This rotation is useful for several reasons. A short rotation assists in weed management. The limited number of effective herbicides in mint results in a buildup of less well-controlled species such as pigweeds and the beginning of problem perennial weed populations. Rotation to agronomic crops (generally corn or soybeans) allows the grower a wider choice of effective herbicides for control of problem weeds. Good weed management during the agronomic rotation lessens weed problems in the next mint crop.

Some hand removal of weeds or spot spraying with herbicides is practiced in fields with severe weed infestations.

Some cultivation for weed control is possible in the first year, when mint is in rows. But subsequent years of meadow mint prevent cultivation except in early spring before crop emergence.

Chemical control:
In Indiana, all mint acres have at least one herbicide application each year and most are treated at least two or more times, depending on the problem. Most growers attempt to control annual weeds either with soil-applied preemergence herbicides or with a postemergence spray when weeds are small. Annual weeds that escape control and are larger than 4 inches are difficult to control with herbicides. The main limitation to weed control in Indiana is the lack of a good preemergence grass herbicide and herbicides that provide good control of all types of pigweeds.

The primary herbicides used in Indiana are terbacil (Sinbar), bentazon (Basagran), sethoxydim (Poast) and, recently, haloxyfop (Assure II). These herbicides are generally applied at least two times. The majority of acres received one or two applications of a postemergence treatment of Sinbar alone, Basagran alone, Sinbar mixed with Basagran, or, in some cases, mixtures with Poast or Assure II. Such

combinations are necessary for acceptable control (see table on page 8).

Other herbicides used on a limited basis include bromoxynil (Buctril), oxyfluorfen (Goal), clopyralid (Stinger), and glyphosate (Roundup). In 1999 and 2000, pyridate (Tough) was labeled under a Section 18 emergency exemption for control of emerged pigweeds.

All registered mint herbicides (Sinbar, Basagran, Goal, and Buctril) have some limitations for controlling pigweeds. This results in pigweeds being the major weed problem in Midwest mint production. Even with repeated applications of post-emergence herbicides, pigweeds are not totally controlled.

Goal can be applied only as a preemergent on soils with an organic matter content greater than 20%, which reduces its use in the Midwest since much of the mint is now grown on mineral soils.

Diuron (Karmex), although registered, is not used in Midwest mint production. Some growers obtain limited control of perennials by using spot sprays of Roundup or by applying Stinger for control of Canada thistle.

Growers feel the current herbicides labeled for use in mint must remain available in order to continue growing the crop in the Midwest. Mint would be very difficult to grow if Sinbar was lost without any suitable replacement.

Herbicide application timing definitions:

Preemergence (PRE): Application of herbicide prior to weed and crop emergence in the spring.

Postemergence I (Post I): Application to weeds that are 1 to 4 inches in size, usually in mid May.

Postemergence II (Post II): A postemergence application to the second flush of weed emergence; usually late May to early June.

Postemergence III (Post III): Application to a third flush of weeds that can occur after the first to the last of June. Post III is usually applied only to row mint.

PHI: Preharvest Interval

Herbicide use data for three mint herbicides:

Sinbar 80WP (terbacil)

Weed pests: grasses, jimsonweed, lambsquarters, nightshade, ragweed, velvetleaf, smartweed

	Peppermint	Scotch Spearmint	Native Spearmint
Acres treated:	92%	80%	90%

Application and rate:
PRE at 1.12 lb/a, PRE at 0.8 lb/a, PRE at 0.8 lb/a
Post I & II at 0.3-0.8 lb/a, Post I & II at 0.3-0.6 lb/a, Post I & II at 0.4-0.9 lb/a, Post III at 0.2 lb/acre.
Spot treatment on 18% of the acres, Spot treatment on 20% acres.

Comments: Not to exceed total of 2 lb/acre per season.

PHI: 60 days

Basagran (bentazon) 4 lb ai/gal

Weed pests: yellow nutsedge, jimsonweed, smartweed, velvetleaf

	Peppermint	Scotch Spearmint	Native Spearmint
Acres treated:	77%	100%	88%

Application and rate:
PRE at 1 lb/a
Post I & II at 0.9 lb/a, Post I & II at 1-0.85 lb/acre, Post I & II at 1 lb/a, Post III at 0.9 lb/a
Spot treatment on 25% of the acres, Spot treatment on 25% of the acres.

Comments: Not to exceed total of 4 qt/acre per season.

PHI: 0 days

Poast (sethoxydim) 1.53 lb ai/gal

Weed pests: grasses, foxtail

	Peppermint	Scotch Spearmint	Native Spearmint

Acres treated:	76%	90%	60%

Application and rate:
PRE at 0.6 lb/a
Post I & II at 0.2 lb/a, Post I & II at 0.2-0.3 lb/a, Post I & II at 0.2-0.3 lb/a, Post III at 0.2 lb/a
Spot treatment on 20% of the acres, Spot treatment on 20% of the acres, Spot treatment on 20% of the acres

PHI: 20 days

Buctril (bromoxynil)
Used on peppermint only. Buctril only controls broadleaf weeds less than 2 inches and must be applied when air temperatures are less than 70°F. Buctril can cause foliar burn, which can stunt growth, limiting its use.

Stinger (clopyralid)
Used on peppermint only.

Roundup (glyphosate)
Used on peppermint, native spearmint, and Scotch spearmint.

Assure II (quizalofop-P-ethyl)
Used on peppermint and Scotch spearmint. Not registered at the time of the pesticide-use survey.

Contacts

Authors:

Steve Weller, Department of Horticulture and Landscape Architecture, Purdue University
Ralph Green, Jr., Department of Botany and Plant Pathology, Purdue University
Cheri Janssen, Purdue Pesticide Programs, Purdue University
Fred Whitford, Purdue Pesticide Programs, Purdue University

Reviewed by:

Rick Foster, Department of Entomology, Purdue University

Ed Lambert, Jr., mint grower, North Judson, Indiana

Edited by: Arlene Blessing, Drew Martin, and Cindy Myers, Purdue Pesticide Programs

References

1. Lacey, Melvyn L., Christine T. Stephens, Ralph J. Green, Jr., Alan York. Mint Production in the Midwestern United States. NCR publication number 155.

2. Weller, Stephen C. and Larry K. Binning. Pesticide Use Survey for the Midwestern States of Indiana, Wisconsin and Michigan. 1998.

The data presented are the results of a grower survey on pesticide use patterns conducted in the spring of 1996 in the Midwestern mint states of Indiana, Wisconsin, and Michigan. The survey was funded by the Mint Industry Reserch Council and was conducted by Purdue University and the University of Wisconsin.

There were 30 respondents to the survey. These respondents represented 18,000 acres of peppermint and 3,447 acres of spearmint (1,875 acres of Scotch spearmint and 1,572 acres of native spearmint). Based on 1995 Indiana Agricultural Statistics there were a total of 27,000 acres of peppermint and 5,000 acres of spearmint in Indiana; therefore, the responses represented 67% of the peppermint and 69% of the spearmint acreage. A base acreage of 27,000 acres of peppermint, 3,000 acres of Scotch spearmint, and 2,000 acres of native spearmint were used for the calculations of total pesticide use.

Resources:

Newsletters and websites

State of Indiana Pesticide Impact Assessment Program website.
http://www.btny.purdue.edu/PPP/SIPIAP/

Commercial Vegetable and Specialty Crops Home Page. Purdue University.
http://www.hort.purdue.edu/hort/ext/veg/

Down the Garden Path newsletter. Plant and Pest Diagnostic Lab. Purdue University.

http://www.ppdl.purdue.edu/ppdl/Newsletters.html

Vegetable Crops Hotline newsletter. Department of Entomology, Purdue University.
http://www.entm.purdue.edu/Entomology/ext/targets/newslett.htm

Extension publications

Foster, R., R. Latin, E. Maynard, R. Weinzierl, D. Eastburn, H. Taber, B. Barrett, and B. Hutchison. 1998.
The Midwest Vegetable Production Guide. Purdue University Cooperative Extension Service. ID-56.

Commodity groups

Indiana Mint Market Development Council
President: Henry Coussens, Jr., 14753 South 50 East, Kentland, IN 47591.
Administrative Advisor: Ralph Green Jr., Botany and Plant Pathology Department, Purdue University.

Photo credits

The photos used in this publication are from the collection of Ralph Green, Jr., professor of Botany and Plant Pathology, Purdue University.
