Crop Profile for Peaches in Missouri

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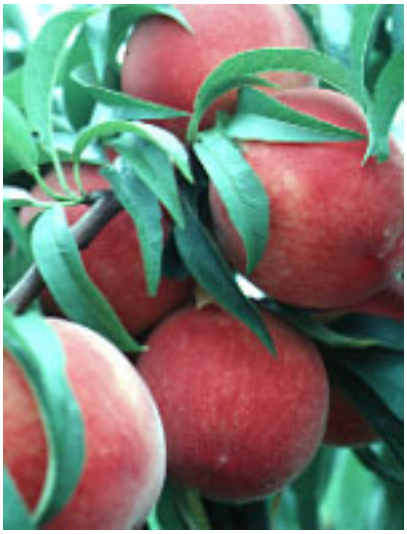
General Production Information



The Missouri Peach Crop Profile was developed from interviews with 6 key peach growers who manage approximately one-third of the production acreage in the state. Other information was gleaned from Extension Fruit Specialists at the University of Missouri and Southwest Missouri State University. The third key information source was from census data and pesticide usage data obtained from USDA and the Pesticide Impact Assessment Program.

Peach production in Missouri occurs primarily in three regions: southeast, southwest, and north-central Missouri. The most concentrated acreage of peach production occurs in southeast Missouri in the "Bootheel" region along Crowley's Ridge. In North Missour, two areas of production exist, one in the north-central part of the state along the Missouri River from Carrollton then west to Kansas City and north to St. Joseph, and one in the southwest around the Springfield area.

One grower in southeast Missouri produces 40% of the total Missouri peach crop. Other growers in southeast Missouri have considerably smaller operations, however, at greater than 50 acres, these are still larger than the most of the peach orchards found elsewhere in the state, which average about 15 to 30 acres. The peach operations located in southwest and north-central Missouri are coupled with production of other fruit, primarily apple.

Production Information

- Missouri ranks between 15th and 23rd in the production of Freestone peaches.
- Missouri produces 0.4% of the total United States peach crop.
- In 1999, 34 million pounds of peaches, valued at $5 million was produced on approximately 2,500 acres. The 5-year average production was 38 million pounds valued at $7 million/year.
- Production costs are estimated at $1200 per acre.
- All the peaches produced in Missouri are for fresh market. The majority of the crop is marketed and sold locally.

Cultural Practices

In Missouri, peaches are grown in a wide range of soil types. Optimal production is achieved in soils that are deep (2 to 3 feet or more), light textured (sandy loams to clay loams), well-drained and at pHs between 6.0 to 6.5. Peaches are planted on sloping land, generally bluffs and ridges, for adequate airflow, drainage and protection from spring frosts. The majority of the peach crop is grown without irrigation.

All peach cultivars are bud-grafted onto adaptable rootstocks. Almost all the acreage in Missouri is planted to Lovell rootstock with some acreage planted to Halford or Nemaguard (resistant to root-knot nematode) rootstocks. The productive life of a peach orchard in Missouri will average 15-20 years. Generally, the first crop is harvested 4 years after young trees are planted. Once an orchard is destroyed, peaches should not be planted after peaches for at least 4 years. This practice is generally followed in Missouri. The specific cause is unknown but research on Peach Tree Short Life in the Southeastern United States has implicated nematodes and other soil-borne pathogens.

Pruning is done by hand during the winter months starting in December and extending into April. Thinning is also done by hand, however, the amount required is dependent upon the extent of winter and spring freezes. In areas outside southeast Missouri, pruning and thinning are often delayed until fruit buds begin to swell and trees are pruned according to fruit load.

Most growers apply nitrogen fertilizer annually in the spring in the form of ammonia nitrate. Most split the applications and apply 1/3 of the total amount in mid-March and apply the remainder after bloom when it is determined that a crop will be present. The larger growers will also apply foliar sprays containing nitrogen and various micronutrients at several times during the early season.

The determination of which peach varieties will be grown is based on harvest or ripening date so that growers will have a constant crop of peaches throughout the summer. In the Bootheel, harvest usually begins with a few varieties producing a small crop by June 15th, but the bulk of the peaches start coming on by July 4th with the maturation of Redhavens. The season extends through the middle of September. Some of the varieties commonly grown include Derby, Garnet Beauty, Redhaven, Topaz, Loring, Cresthaven, Jersey Queen and Rio-Oso-Gem. In Northern Missouri, the earliest varieties ripen around July 4th with the maturation of Flaming Fury. The season extends through the middle of September. Some of the varieties commonly grown include Flaming Fury, Raritan Rose, Redhaven, Jim Dandy, Nectar, Envoy, Jayhaven, Contender, Harcrest, Belle of Georgia, and Encore.

The most limiting factor affecting peach production in Missouri is the occurrence of spring frosts in southeast and southwest Missouri and winter freezes in north-central Missouri. Winter temperatures below -10^0 to -15^0 F kill dormant fruit buds. Because Central and Northern Missouri are only marginally

adapted for peaches, growers in these areas plant varieties that are winter hardy. A full crop in these areas is only expected 4 out of 10 years, a partial crop 3 out of 10 years and complete crop failure is expected every 3 out of 10 years. In contrast, growers in Southeast Missouri expect a full crop every 8 out of ten years. Complete crop failure occurs only 1 out of every 10 years.

Pest Management in Peaches

Peaches cannot be commercially grown unless a wide variety of insect, disease and weed pests are controlled. Three key insect pest complexes, the peachtree borers, oriental fruit moth and the catfacing insects, cause economic losses in peach unless populations are kept below economic injury levels. One mite pest occurs sporadically in Missouri. The key diseases are brown rot, peach scab, bacterial spot and peach leaf curl. Brown rot and peach scab are the primary economically limiting diseases of peaches for Missouri growers. Growers expect yield losses from diseases to occur 9 out of every 10 years if left uncontrolled. Bacterial spot and peach leaf curl occur less frequently, but can cause economic losses. Annual and perennial weeds (grasses and broadleafs) must be managed to reduce competition for water and nutrients and omit as overwintering sites for insects and diseases. A brief synopsis that includes the biology of and the type of damage caused by each these key and secondary pests of peaches is listed below.

Insect Pests

Peachtree borers:
Lesser peachtree borer (*Synanthedon pictipes*)
Peachtree borer (*Synanthedon exitiosa*)

Borers are a very serious insect pest problem in peaches if left uncontrolled. Severe infestations of lesser peachtree borers on older trees significantly reduce the tree's vigor; making it more susceptible to other insects and diseases. Infested trees often exude copious amounts of gum around the wounds. The wood chips, frass and sawdust from larval feeding are embedded in the gum.

Lesser peachtree borer: There are two generations per year of the lesser peachtree borer in Missouri. Larvae overwinter in tunnels under the bark. During the winter, all stages of larvae can be seen except the first instar. The larvae resume feeding in the spring. The larvae will pupate near the surface of the bark. After the moths emerge, the pupal cases can be seen protruding from the bark surface. The first generation of moths begin to emerge in late April to early May. A second generation emerges in late July to early August. Moths are attracted to injured areas on trees to lay eggs. Infestations are almost always associated with damage cause by previous insect infestations, disease, mechanical wounds or

winter injury. The cracks and crevices around these sites provide easy entry into the tree for the young larvae.

Peachtree borer: There is only one generation of this borer in Missouri. The larvae also overwinter in the wood and resume feeding and growth in the spring. Mature larvae leave the wood to pupate in the soil near the base of the tree. Adults emerge over a four-month period, beginning in late June, with peak emergence occurring in late July and early August. Eggs are laid on trunks of trees in cracks or under bark scales and in the soil near the trunk. Unlike infestations of lesser peachtree borer, which can occur throughout the tree, infestions of the peachtree borer are usually on the main trunk within several inches above and below the soil line. Larvae hatch in 8 to 10 days and bore through the bark and to feed on the cambial tissue.

Catfacing insects

Tarnished plant bug (*Lygus lineolaris*)
Green stink bug (*Acrosternum hilare*)
Brown stink bug (*Euschistus servus*)

This group of true bugs cause economic losses in fruit quantity and quality for Missouri peach growers if left uncontrolled. Most of the early insecticide sprays are targeted toward the control of these insects. Early in the season plant bugs and stink bugs will feed on buds and blossoms, causing the abnormal development of the bud and drop of the blossom. Later the feeding of these insects deform fruits through bumps, depressions and corky areas, creating mishappened fruit with the damage known as "catfacing". The earlier the feeding occurs, the more damage to the fruit, so growers recognize that the early season controls are important.

Tarnished plant bugs and stink bugs overwinter in protected areas around the orchards, such as in the leaf litter and under bark. The adults can be readily seen in the early spring feeding on buds and flowers with the onset of warmer temperatures. Adult tarnished plant bugs lay eggs in various plant tissues, while stink bug lay their barrel-shaped eggs on the surfaces of plant leaves. Nymphs hatch in several days. Three to five generations of the tarnished plant bug occur each year, while one to three generations of stink bugs occur each year in Missouri.

Oriental Fruit Moth (*Grapholitha molesta*)

This is another one of the most serious pests for some growers in the state. There are two to three generations per year. The first generation causes damage to small-diameter twigs as the larvae bore through the succulent tissue. This injury often results in wilted and dead shoots. In later generations, the larvae infest the fruit, where they bore through the fruit to feed around the pit. Presence of larvae within the fruit is often denoted by copious amounts of gum on the fruit surface.

Oriental fruit moths overwinter as larvae in protected areas around the trees. In the spring the larvae pupate and moths emerge about the same time as the trees are blooming. The eggs are laid singly on leaves, twigs and fruit. In mid-Missouri, the moths of the first generation emerge in mid-April to early May, and the second generation moths are flying from mid June to early July. Growers typically target two sprays per generation. Insecticides specifically targeted for this insect pest typically begin with the first cover spray.

European red mite (*Panonychus ulmi*)

This is a sporadic pest in Missouri orchards, creating economic damage about once every 10 years. Frequency of infestation may be dependent upon the variety and the frequency with which the grower uses pyrethroid insecticides. Feeding damage to leaves may cause discoloration and result in premature defoliation. If defoliation occurs early in the season the crop yield may be reduced. Mite feeding on fruit results in poor color, reduced fruit size and diminished fruit quality. Large, damaging populations early in the season may also damage fruit buds and reduce the crop in the following year.

Mite eggs overwinter in the bark crevices beneath the buds and spurs. Mites hatch to coincide with the tight cluster stage. They crawl onto the newly emerge leaves to begin feeding. Development from egg to adult may take from 1 to 3 weeks depending upon temperatures. There may be as many as 8 overlapping generations per year in Missouri.

Secondary Insect Pests:
Green peach aphids, scale, shothole borer and plum cucurlio are not significant problems as their populations are kept below economic thresholds with the IPM tactics employed to manage the key insect pests

Insect Pest Management

Insect pests in peaches are managed primarily through suppression strategies. The use of insecticides and miticides dominates the IPM tactics employed by Missouri growers. An average 5.6 insecticide/ miticide applications are applied to 96 percent of the acreage each season (Figs. 1 & 2). The use of pheromones to monitor for key insect pests is increasing but still used on less than 5% of the acreage. However, growers are aware of the problems that can arise from overuse of a single chemistry and therefore they rotate chemical classes to target the appropriate pest.

Methyl parathion (Penncap-M) was banned from use on peaches in 1999. This insecticide was applied to

98% of acres by ground at the average rate of 0.75 lbs a.i. per acre or lower, which is at the minimum labeled rate or lower. The number of applications varied from 1 to 3.5 applications. The loss of this chemical will increase chemical costs for growers as they will substitute azinphosmethyl, phosmet and endosulfan for methyl parathion. If additional organophosphate and carbamate insecticides are lost, this will significantly impact the grower's ability to manage insect pests effectively with mite problems expected to increase.

Prevention Strategy:
The planting of insect-free transplants and field sanitation practices that remove alternate hosts and reduce overwintering sites are practiced on 100% of the acres. Wild prunes (alternate host for insect and disease pests) are removed from areas surrounding peach orchards.

Avoidance Strategy:
No avoidance tactics are used to control insect pests in Missouri peaches.

Monitoring Strategy:

Pheromone monitoring: While University of Missouri Extension encourages the use of pheromone traps to monitor adult emergence and peak flights of the lesser peachtree borer to time spray applications, less than one percent of the growers have adopted this practice. Similarly, few growers use pheromone trapping for oriental fruit moth to time insecticide applications.

Mating disruption: No insect pests are managed through mating disruption in Missouri peach orchards.

Suppression Strategy:
The insecticides included in the sprays that are applied at pink, petal fall, shuck split and some of the earlier cover sprays are primarily chosen for efficacy of catfacing insects since early damage can be most severe, however, many of these chemicals are also effective for oriental fruit moth control. Because of the concern for resistance development and the propensity of the synthetic pyrethroids to encourage mite populations, growers rotate chemical classes in these sprays (Table 1). Choices for effective oriental fruit moth control become limited as harvest approaches because of pre-harvest intervals and concern for mite outbreaks.

Chemical Controls:

- **Chlorpyrifos** (Lorsban 4E) is applied to 100% of peach acres for control of peachtree borers. It is applied at the average rate of 3 lbs active ingredient (a.i.) per acre with a typical pre-harvest interval (PHI) greater than the labeled 14 days. A single application is made in late May in the southeast and southwest, and in late June in the north, to trunk and scaffold branches. The foliage and fruit are not sprayed. Although other products are labeled for specific control of both species

of borers, the growers prefer to use this product because it is very effective and had a long residual. The long residual allows growers to skip a late-season spray for the peachtree borer. The cover sprays discussed for the control of other insects, while not specifically targeted by the growers for control of peachtree borers, also provide some protection.

- **Phosmet** (Imidan 70WP) is applied on approximately 92% of the acreage for control of oriental fruit moth. It is applied at an average rate of 1.05 lbs a.i. per acre which is slightly below labeled rates. The labeled PHI of 14 days is observed. The number of applications varies with peach variety but ranges from 3 to 7 times per season. Growers generally will use phosmet to specifically target oriental fruit moth because of efficacy, pre-harvest interval and compatibility with mite predators. Growers also prefer spraying this instead of other chemicals due to safety reasons. Use of phosmet will increase with the loss of methyl parathion.

- **Permethrin** (Pounce 3.2EC, Ambush 2EC) is applied on approximately 92% of the acres for control of cat-facing insects. It is applied at the rate of 0.10 lb a.i. per acre with the labeled PHI of 7 days observed. An average of one to two applications per season is made. Permethrin has excellent efficacy for catfacing insects, however, since it is toxic to mite predators, mite outbreaks can occur and therefore it is used sparingly.

- **Superior Oil** (various products and formulations) is applied to 92% of the acres at various rates (depending on the product) as a dormant spray for control of European red mite.

- **Azinphosmethyl** (Guthion 50%WP) is applied on approximately 13% of the acres for control of catfacing insects and oriental fruit moth. It is applied at the average rate of 1.25 lbs a.i. per acre with a typical PHI of 21 days. The number of applications per season ranges from 1 to 3. The use of azinphosmethyl is higher in the north and southwestern regions of the state, where the primary crop of most growers is apple, since this chemical provides excellent control of many apple pests without the buildup of mites. While the efficacy of azinphosmethyl is not as good as the synthetic pyrethroid materials for the control of catfacing insects, most growers recognize the need for rotating chemical classes. The relatively long PHI limits late-season use against oriental fruit moth despite excellent control of this pest. Loss of this product would leave less efficacious materials and products that are toxic to mite predators. Use of azinphosmethyl is expected to increase with the loss of methyl parathion.

- **Endosulfan** (Thiodan 50% WP or 3 EC) is applied to about 20% of the acres for control of catfacing insects and stink bugs. It is applied at the average rate of 1.5 lbs a.i. per acre. The labeled PHI of 21-30 days is observed. Use of endosulfan is expected to increase with the loss of methyl parathion.

- **Carbaryl** (Sevin 50WP) is applied to about 8% of the acres for control of oriental fruit moth. It is applied at the average rate of 3 lbs a.i. per acre. The labeled PHI of 3 days is observed. Growers typically include this in the last cover spray before harvest. Growers are aware the toxic

properties of carbaryl to mite predators and use it judiciously.

- **Esfenvalerate** (Asana XL) is applied on approximately 6% of the acres by ground at the rate of 0.038 oz a.i. per acre with a typical PHI of greater than the labeled 14 days. On the average two applications are made during a season. Some growers reported choosing this chemistry over others when high number of tarnished plant bugs were observed early in the season. Growers are aware the toxic properties of the pyrethroids to mite predators and use these judiciously.

Diseases

Brown Rot (*Monilinia fructicola*)
This fungal disease is the most significant disease limiting production in Missouri. Although cultural controls are helpful in minimizing the severity of infections, fungicides are necessary to maintain levels of production. The fungus attacks blossoms, fruit spurs and branches, however, the blighted spurs are not very common in Missouri. Fruit infections begin as small, circular, light brown spots that later rapidly expand to encompass the entire fruit. Rotted fruit may stay on the tree and persist as mummies or fall to the orchard floor. The fungus overwinters in the orchard as mummies on the ground or in the tree. In the spring spores are produced and carried by wind and rain splash to susceptible tissue. Infections of blossoms, branches and fruit during the season provide secondary sources of inoculum for continual infection of new tissue. Infections are favored by warm and humid weather conditions.

Peach Scab (*Cladosporium carpophilum*)
This fungal disease is the second most significant disease problem encountered by Missouri peach growers. Twigs, leaves and fruit are infected, but the symptoms on the fruit are the most noticeable and problematic. Fruit infections begin as small greenish circular spots that later enlarge to form olive-green to patch patches, typically concentrated at the stem end. Lesions may coalesce and crack or lead to misshapen or stunted fruit. The cracking may also make the fruit more susceptible to brown rot or insect invasion.

The fungus overwinters in the orchard as mycelium on infected twigs. Beginning at shuck split, spores are produced but peak production does not occur until 2 to 6 weeks later. Fruit is the most vulnerable to infection during this period. Infections are favored by humid weather. Spores are carried to twigs, leaves and fruit by rain splash and wind. Symptoms of infection are not evident for 40 to 70 days later.

Bacterial Spot (*Xanthamonas campestris* pv. *pruni*)

This is a sporadic, but potentially devastating bacterial disease for Missouri producers. Bacteria infect leaves, fruit and tender growing shoots. Infections cause severe defoliation and fruit spotting. Leaf lesions are small and generally angular. Lesions initially appear water-soaked and as they mature the centers fall out. Severely infected leaves turn yellow and drop from the tree. Infected fruit is rendered unmarketable due to cracks, brown spotting and deep pitting of flesh.

Bacteria overwinter on twigs and buds. In the spring, bacterial populations increase and infect susceptible tissues during periods of wet weather. Frequent periods of moisture during late bloom to a few weeks after petal fall are conducive to fruit and leaf infection. Wind-driven rain or abrasions injuries to leaves and fruit enhance bacterial infection. With proper environmental conditions, secondary infections continue throughout the season.

Peach Leaf Curl (*Taphrina deformans*)
This disease is a sporadic problem for Missouri growers. Incidence is related to failure to obtain good coverage and timing of the dormant season fungicide application and also spring weather conditions. This fungal disease infects the leaves and causes them to become distorted, thickened and curled before eventually turning brown and dropping. Premature defoliation reduces fruit yield, quality and tree vigor. On young trees, this can cause a significant amount of tree stress if left uncontrolled.

The fungus overwinters on bud scales and bark crevices beneath these areas. In the spring the spores infect young leaves while still in the bud. Spores of the fungus are produced on the surface of infected leaves. Rain splash and wind carry the spores to the susceptible tissue. Leaf curl is more severe when extended cool and rainy weather occurs from bud break until the young shoots and leaves develop. Older leaves become resistant to infection.

Post Harvest Pests

Because most of the crop is immediately sold within a few days of harvest, very few growers have serious post-harvest problems. Losses from brown rot and *Rhizopus* rot are minimal due to proper post harvest handling, sanitation and grading. Use of post harvest fungicides is not common among Missouri growers.

Disease Management

Peach diseases are managed primarily through suppression strategies but avoidance and prevention strategies are practiced on all acres because they enhance the efficacy of fungicide sprays. However, the use of fungicides dominates the IPM tactics employed by Missouri growers with an average 11.9

fungicide applications applied to 96 percent of the acreage each season (Figs. 1 & 2). Practically every in-season fungicide application is a mixture of two different fungicides with different modes of action. Growers are acutely aware of the problems that can arise from overuse of a single fungicide chemistry and therefore they combine chemical classes to target the appropriate diseases. Disease incidence in Missouri orchards, aside from weather conditions that favor the disease, is largely dependent variety susceptibility. Bacterial spot is primarily managed with resistant or tolerant variety selections. If growers have a particular variety that is continually infected, they with cull it and try another variety.

Prevention Strategy:
Missouri growers recognize that orchard sanitation plays a critical role in the management of this disease. Growers remove diseased branches during pruning and discard mummies during harvest operations. Orchards are mowed regularly to promote good air drainage and drying of foliage and to promote decay of plant residues that may harbor pathogens. Additionally, peach growers eradicate wild plums growing near orchards as they can serve as reservoirs for certain virus diseases and phony peach.

Avoidance Strategy:
Although crop rotation is not practiced it the traditional sense because peaches are a perennial crop, once an orchard is destroyed it will not be replanted to peaches for 3 to 4 years.

Monitoring Strategy:
Peaches are not scouted in the traditional sense for disease management. Currently there are no disease forecasting systems in operation in Missouri peach orchards.

Suppression Strategy:
Fungicides dominate the IPM tactics used to suppress diseases (Table 1). However, all growers alternate fungicide mode of action to prevent or delay the buildup of disease-resistant biotypes.

Chemical controls:

- **Fenbuconazole** (Indar 75WSP) is applied to 98% of the acres and provides excellent control of brown rot. It is applied at the average rate of 0.75 lbs. a.i. per acre, which is the labeled rate. The PHI is greater that than the labeled 0 days. Typically two applications are made during the season, once at or before the first cover and another application later in the season. Another fungicide with a different mode of action is usually alternated with sterol inhibitor fungicides such as fenbuconazole to minimize the development of brown rot-resistant biotypes.

- **Thiophanate methyl** (Topsin-M 70WSB) is applied to 98% of the acres for control of brown rot and scab. It is applied at an average rate of 0.80 lbs. a.i. per acre. The PHI is greater than the labeled 1 day interval. This fungicide is typically applied several times through the season. One to two applications are made before the first cover and several applications are made in the successive coverage sprays. Use during the cover sprays is largely dependent upon the prevalence

of wet weather. Growers prefer to use this during periods of wet weather because of the greater protection imparted due to systemic properties of the chemical. Thiophanate methyl use is greater than chemicals with similar properties because of its low cost and previous problems with plant phytotoxicities from benomyl applications. Because this is also subject to the development of brown rot resistance, it is often combined with Captan.

- **Captan** (Captan 50WP) is applied to 98% of the acreage for control of brown rot and scab. It is applied at an average rate of 3 lbs. a.i. per acre. The PHI is greater than or equal to the labeled rate of 0 days. The number of applications varies from 3 to 6 times during the season. Often used in combination or alternated with sulfur, a sterol-inhibitor fungicide, or with benomyl or thiophanate methyl to reduce the development of brown rot resistance. When used alone, it provides the standard cover spray for the remainder of the season.

- **Sulfur** (various formulations) is applied to 92% of the acreage, typically in combination with another fungicide through the first cover spray. Rates vary depending upon formulation. Advantage to some growers is that it is cheaper than captan, but has the disadvantage of burning foliage in hot humid weather.

- **Chlorothalonil** (Bravo 720F) is applied to 91% of the acreage, primarily during bloom, for blossom blight (brown rot) control. It is applied at the average rate of 1.9 lbs. a.i. per acre. The PHI is greater than the labeled 0 days.

- **Copper** (various formulations) is applied to 85-90 % of the acres for control of peach leaf curl. One dormant season application (Spring or Fall) is typically applied.

- **Carbamate** (Ferbam 76WP) is applied to 85% of the acres for control of peach leaf curl. It is applied at a average rate of 3.4 lbs a.i. per acre. One dormant season application (Spring or Fall) is typically applied.

- **Benomyl** (Benlate 50WP) is applied to 13% of the acres and provides excellent control of brown rot. It is primarily applied before the second cover spray at the average rate of 1.0 lbs. a.i. per acre. A length greater than the labeled 3 day PHI is observed. Another fungicide with a different mode of action is usually alternated or combined with benomyl to prevent brown rot-resistant biotypes from developing.

Nematodes

(*Meloidogyne* spp.)

While there are several different genera of plant parasitic nematodes found in the major peach production areas of the state, none have caused significant problems for the growers. The most notable of these nematodes , root knot nematode (*Meloidogyne* spp.), which occurs in the sandier soils, occasionally affects growers in Southeast Missouri. No growers reported taking control measures for this pest.

Weeds

A broad number of annual and perennial grasses and broadleaf weed species must be managed in peach orchards. Some key annual and perennial grass weeds include crabgrass, fall panicum, barnyardgrass, and fescue. Some key annual broadleaf weeds include pigweeds, nettles, wild garlic, and lambsquarter. Some perennial broadleaf weeds include trumpet creeper and bindweeds. Noxious weeds such as johnsongrass and musk thistle require periodic control.

Weed Management

In general, management of weeds is accomplished through a burndown application of herbicide after bloom, spot treatments of weed infestations as needed through the growing season and mowing. The burndown treatment includes a contact herbicide to kill existing vegetation and a pre-emergent herbicide to provide residual control of grass and broadleaf weeds. It is applied in a strip (widths vary with operation) to either side of the trees. The areas between rows of trees (alleys) are typically sodded, most often with fescue, and all orchards receive frequent mowing of the alleys and trimming weeds around trunk of trees to minimize competition.

Prevention Strategy:
Missouri growers recognize that orchard sanitation plays a role in the management of weeds and other pests. Orchards are mowed regularly for weed control and to promote good air drainage and drying of foliage and to promote decay of plant residues that may harbor pathogens.

Avoidance Strategy:
None for weeds

Monitoring Strategy:
Scouting for weeds is practiced in an arbitrary manner as part of a grower's overall orchard management program. Perennial and noxious weeds are identified and removed as required.

Suppression Strategy:
Approximately 87% of orchards are treated with herbicides to suppress weed competition in orchards.

Chemical Controls:

- **Paraquat** (Gramoxone Extra) is applied to 98% of acres by ground at an average rate of 0.7 lbs a. i. per acre. Typically included in the spring burndown. Also used as needed in spot applications.

- **Simazine** (Princep 4L, Princep Caliber 90) is applied to 98% of acres by ground at an average rate of 2.7 lbs a.i. per acre. Lower rates are used on sandier soils. Typically used in the spring burndown for preemergence control of grass and broadleaves.

- **Diuron** (Karmex DF) is applied to 98 % of acres by ground at an average rate of 1.6 lbs. a.i. per acre. Also one of the selections for pre-emergence control of grass and broadleaves included in spring burndown applications.

- **Glyphosate** (Roundup Ultra) is applied to 90% acres by ground at an average rate of 1.0 lb. a.i. per acre. Typically used in spot applications.

Table 1. Pre-harvest and Restricted Entry Intervals, and Strengths and Weaknesses of Critical Pesticides on Peaches in Missouri

* used sparingly due to mite flare-ups
** not applied alone due to resistance problems
*** applied once in season after crop is assured

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