

2018 North Carolina Peach and Nectarine Disease and Pest Management Guide



Safety

No pesticide should be used until the label on the container has been read and all directions and safety precautions thoroughly understood. The label is the law; any use not consistent with a label is a violation of both state and federal pesticide laws.

Precautions should be observed when handling pesticides. Personal protective equipment must be used as noted on each label. Maintain a wardrobe of protective equipment, including coveralls, hats, boots, and an appropriate respirator that fits, to be used by anyone handling, mixing, or spraying chemicals in the orchard. No pesticide user should wear clothing that has been contaminated with pesticides. Always put on clean clothing before each day's spraying, and change to clean clothing before eating.

Always read (and follow) the label before each use of a pesticide. Never smoke while spraying. Avoid inhaling sprays or dusts and, when directed, wear a respirator. Wash hands and face after each spray operation. Avoid contaminating streams and ponds. Never apply fungicides and insecticides with the same spray equipment as is used for applying hormone-type herbicides. Store pesticides out of reach of children or domestic animals. Never store pesticides in the home, and always store them away from food, beverages, eating utensils, tobacco products, seed, fertilizers, etc.

Keep the name, address, and telephone number of the nearest poison control center posted near your place of business in case of accident.

Follow all label first aid directions in case of suspected poisoning. **Symptoms of pesticide poisoning include headache, blurred vision, weakness, nausea, cramps, diarrhea, and chest discomfort.** If any of these symptoms of poisoning occur during or after the mixing or application of pesticides, stop work at once and call a physician. Do not take chances. If a pesticide is spilled on the skin, immediately wash the area thoroughly with large amounts of soap and water. If the pesticide is in an eye, flush the eye with clean water according to label directions. If poisons are accidentally inhaled, immediately place the victim in the open air and transport the person to a physician. If a pesticide is swallowed, do not induce vomiting unless directed to do so on the label. Do not attempt to give liquids to an unconscious person. Immediately call your local or state poison control center (see telephone number below) for specific instructions. **Whenever a pesticide poisoning occurs, take the victim immediately to the nearest emergency medical center.** Be sure to tell medical personnel what pesticide caused the poisoning. If possible, **take a copy of the label, not the container,** with you to the doctor.

In addition to providing information on safety, pesticide labels give information and instructions about potential environmental hazards. Consult the label for information about such things as endangered species, prevention of surface water and groundwater contamination, and proper disposal of pesticides and empty pesticide containers.

POISON CONTROL CENTERS AND EMERGENCY FACILITIES

Nationwide (and Carolinas) Poison Control

Telephone: 1-800-222-1222

This number goes to an automated system that routes calls to the nearest Poison Control Center by area code.

Web Site: <http://www.aapcc.org/>

Additional Telephone Numbers and Contact Information on Back Cover Page

MISUSE OF PESTICIDES

It is **illegal** to use any pesticide in a **manner not permitted by its labeling.** To protect yourself and others, never apply any pesticide in any manner or for a purpose other than as instructed on the label, or in labeling accompanying the pesticide product that you purchase. Do not ignore the instructions for use of protective clothing and devices and for storage and disposal of pesticide wastes, including containers. **All recommendations for pesticide uses included in this publication were legal at the time of publication, but the status of registration and use patterns are subject to change by actions of state and federal regulatory agencies.**

2018 Peach and Nectarine Disease and Pest Management Guide

This publication is intended to help you manage diseases and pests of peaches. In choosing a management program, you must weigh the extent of pesticide use against the amount of risk of crop damage you are willing to accept. A rigorous spray program provides the least risk of loss, whereas a minimal spray program using less effective but possibly less hazardous pesticides involves a greater risk of loss. Before choosing a spray program, you should consider previous disease and pest problems in the orchard, cost of pesticides and their application, the possible hazard to the environment, the market in which you want to sell the fruit, and the quality of the fruit to be sold.

Although many pesticides and formulations of the same active ingredient are registered, the pesticides listed in this publication have performed well under North Carolina conditions. Growers should use the gallons of water per acre best suited for their orchard and equipment that provides **coverage throughout the tree**. Based on a tree 8 feet in height, peach trees currently are sprayed using 75 to 125 gallons per acre at a travel speed of 2.5 to 3.5 mph. Based on this, less than 75 gallons of spray mix per acre may not provide adequate coverage. The amount of pesticide used should be based on the label recommended **rate per acre**. Some reduced adjustments may be made for smaller trees. Where **complete coverage** of the tree is **essential** (eg, oil for scale insects and fungicide for leaf curl), a **larger volume** of water and a **slower speed** may be necessary. See page 11 for more information. Pesticide rates, uses, and restrictions may change frequently; read and follow label instructions before using a pesticide.

Effectiveness ratings in the following tables range from *, slightly effective, to ***, superior.**

IMPORTANT: Check labels for restricted entry interval (REI) and type of personal protective equipment (PPE) required for early entry into treated area.

DORMANT

After leaves drop in the autumn to before buds swell in the spring – usually mid-November to early February.

Diseases

Leaf curl is a fungal disease. The yeast-like fungus survives on twigs and branches. The years in which the disease occurs cannot be predicted reliably. Infection occurs in late winter and early spring as the buds swell and rainy periods occur. Some cultivars such as Candor, Clayton, Redhaven, Dixiland, Surecrop, Rubired, and Derby are among the less susceptible; however, none is immune. Less than 10 percent leaf infection should not cause significant damage. Once infection occurs (after buds swell and rainfall) and the disease is observed, fungicide applications will be of little to

no value. Captan cover sprays used the previous growing season may reduce leaf curl the following spring.

Letter & number(s) in ***[bold italic]*** immediately following fungicide chemical name is the Fungicide Resistance Action Committee Code, FRAC, (example: ziram ***[M3]***). Codes are on most fungicide labels. **See page 10 for discussion of fungicide resistance management.**

Controls	Effectiveness
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1. Use a single fungicide application before buds swell. Recommended fungicides that give adequate leaf curl control include:

- | | |
|---|------|
| chlorothalonil <i>[M5]</i> (Bravo Weather Stik 4.0 pt/acre, Equus 720 SST 4.0 pt/acre, Echo 720 4.0 pt/acre), | **** |
| ---OR: | |
| ziram <i>[M3]</i> (Ziram 76DF 4.0 lb/acre), | **** |
| ---OR: | |
| copper-containing <i>[MI]</i> fungicides (numerous formulations; see labels for rates and directions). Use higher rates if a history of leaf curl. | *** |

Bacterial Spot is a bacterial disease and thus few if any fungicides provide control. Spraying when leaves are wet may increase disease. Varieties developed in the dry climates should be considered highly susceptible when grown under conditions favoring the disease. Its occurrence and severity are very sporadic, varying from year to year. Occurrence and severity of the disease depend upon moisture. On fruit, the disease is most severe when frequent periods of rainfall occur at petal fall and during the following 3 to 4 weeks. Susceptible cultivars planted in sandy soils are more likely to be damaged than if planted in heavier soils.

Controls	Effectiveness
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1. Plant cultivars that have some resistance to the disease, especially if the trees are to be planted in light, sandy soils. ****

2. If leaf curl is not a concern, sprays for bacterial spot control may begin at 1 to 5% bud swell. However, it is essential that the first application be made before new leaf tissue emerges on which new infections can occur. The following chemical control program is suggested for use where bacterial spot has been a problem. Listed are some of the materials evaluated in North Carolina. Rate of elemental copper is expressed as **Metallic Copper Equivalent [MCE/acre]**:

Controls	Effectiveness
<i>Late dormant to early bud burst</i> Use Cuprofix ULTRA 40D 6.0 lb/acre, OR C-O-C-S 50WDG 4.5 lb/acre, OR Nordox 75WG 3.25 lb/acre. [2.5 lb MCE/acre] Agricultural-type oil may be added in dormant spray – see labels for details.	***
<i>Late bud burst to pink with ¼” green</i> Use Cuprofix ULTRA 40D 3.75 lb, OR C-O-C-S 3.0 lb/acre, OR Nordox 75WG 2.0 lb. [1.5 lb MCE/acre]	***
<i>Pink to first blossoms open (1 to 5%) ½” green</i> Use Kocide 3000 1.5 lb/acre OR Cuprofix ULTRA 40D 1.20 lb/acre, Nordox 75WG 0.67 lb/acre. [0.5 lb MCE/acre]	***
<i>Petal fall(50-75%) with fruit in the shuck</i> Use Kocide 3000 0.75lb/acre, OR Cuprofix ULTRA 40D 0.6/acre, OR Nordox 75WG 0.34 lb/acre [0.25 lb MCE/acre].	***
<i>Shuck-split</i> Use Kocide 3000 0.40 lb/acre, OR Nodox 75WG 0.20 lb/acre, [0.125 lb/acre MCE] OR oxytetracycline [4I] (FireLine 17WP or Mycoshield 17WP 0.75 lb/acre (in 100 gal of water so that concentration is 150 ppm)	***

Additional applications of oxytetracycline will be required for highly susceptible varieties and when environmental conditions are wet. Oxtetracycline has very poor residual. Low rates of copper (Kocide 3000 0.0625 lb to 0.50 lb/acre can be used in up to 6 post-bloom sprays **OR** Copper-Count-N at 4.0 to 6.0 fl oz/acre can be used in 1st and 2nd cover sprays) are effective when carefully used. Oxtetracycline can be alternated or tank-mixed with copper. Sprays are most effective if applied within a 24-hour period prior to anticipated rainfall but with sufficient time for pesticide to dry. **Avoid spraying when leaves are wet if spray material does not include a bactericide.** If weather is dry the **number** of applications and rates can be reduced.

Caution: Spotting and shot-hole of leaves and defoliation may (likely will) occur from use of copper sprays. Multiple copper applications during extended dry periods can cause excessive copper accumulation that increases the risk of leaf injury if light periods of moisture occur. **Always examine trees for unacceptable injury (leaf-spotting and defoliation) from previous copper sprays before making another application of a copper material.**

Arthropods

White peach scale and **San Jose scale** both overwinter as immatures (nymphs) on branches and limbs of the trees.

White peach scale is easily recognized by the male's fluffy white appearance on the trunk or scaffold limbs. Females are flat and grayish; they are usually found higher in the tree. San Jose scale is most apparent on fruit, where it causes red spots later in the season.

Controls	Effectiveness
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1. Application of dormant oil or a delayed dormant oil is highly effective against both white peach scale and San Jose scale. In orchards with severe white peach scale, two sprays of oil at 14 to 21 days apart are helpful. Apply the sprays before buds begin to break but when wind speed is low (less than 2 mph, tree coverage is very important), air temperatures remain above 45 F for 24 to 48 hours, and no rain is expected. Addition of an appropriate insecticide with oil at delayed dormant will improve control of scale insects. The window of opportunity for control of overwintering scales with insecticides extends to shuck split to first cover spray.

Oil, superior type (2.0 gal/100 gal)	***
OR	
Oil (2.0 gal/100 gal) plus buprofezin (Centaur 70WDG 2.1- 2.8 lb/acre) OR chlorpyrifos (Lorsban 4E 2.0 pt/acre) OR pyriproxyfen (Esteem 35WP 4.0 to 5.0 oz/acre)	*****

2. Eliminating winter annual weeds from the ground cover by disking or using herbicides (see the weed control section) is a good cultural control that helps reduce plant bug damage as well as twospotted spider mite. ****

BLOOM

From the time petals or other parts of the flower are visible until the petals begin to drop – usually early March to mid-April depending on the region in North Carolina.

Diseases

Blossom blight is a sporadic, but ever present fungal disease. The fungus survives in association with mummified fruit that remain in the tree and on brown rot twig cankers from the previous growing season. Orchards that had brown rot the previous season are more likely to be at risk for blossom blight if conditions are wet during bloom. Extended periods (more than 12 hours) of misty-type precipitation are very favorable for blossom blight. Infected blossoms can serve as a source of inoculum for the fruit rot phase (brown rot) of this disease as fruit ripen. Moisture must be present for spores to germinate and infection to occur.

Controls	Effectiveness
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1. Remove and discard all fruit that remain at the last harvest. **

Prune out any mummified fruit and diseased twigs **before bloom.** ***

When possible, remove alternate hosts (such as wild plums) adjacent to the orchard that can serve as inoculum sources. ***

2. A fungicide spray at 1-5% bloom and again at 25-50% bloom may reduce blossom blight when the bloom period is extended and weather conditions are wet. Demethylation inhibiting (DMI) fungicides [(Elite, Orius, Tebuzol); Indar, Quash, Rally, and (Bumper, Orbit, PropiMax)] are effective against blossom blight but are at **moderate to high risk for resistance** development if used regularly. Resistance to anyone of the DMI fungicides may result in cross-resistance to the others. **It is recommended that DMI fungicides be saved for preharvest sprays and that they not be used in bloom and cover sprays.** Recommended fungicides for blossom blight include:

chlorothalonil [M5] (Bravo Weather Stik, 3.5 pt/acre, or Equus 720 3.5 pt/acre, or Echo 720 3.5 pt/acre), ***

OR

cyprodinil [9] (Vanguard 75WG, 5.0 oz/acre), **OR** pyrimethanil [9] (Scala SC, 18 fl oz) ****

OR

iprodione [2] (Rovral 4 F 1.0 pt/acre). Rovral is **NOT** labeled for use after petal fall, ****

OR

captan [M4] + thiophanate-methyl [I] (Captan 50WP, 4.0 lb/acre, 80WP 2.5 lb/acre, Captec 4L, 2.0 qt/acre + Topsin M 70WSP, 1.25 lb/acre, or T-Methyl 4.5AG 1.25 pt/acre, or Thiophanate Methyl 85WDG 1.0 lb/acre). Fungicide containing thiophanate-methyl should be used only once. ****

Bacterial spot. See information under DORMANT.

Arthropods

Do **NOT** apply insecticides during bloom. Honey bees, native bees and other beneficial insects can be killed.

PETAL FALL

When petals begin to drop but before fruit are visible (shuck split).

Diseases

Including a fungicide in the petal fall spray may enhance peach scab control. Including sulfur at 8.0-10.0 lb/acre is suggested for use in the petal fall spray. A spray at this time is of greater importance in orchards not sprayed for scab the previous year.

Bacterial spot. See discussion under DORMANT.

Arthropods

Catfacing insects (tarnished plant bugs and stink bugs) use piercing-sucking mouthparts to feed inside the developing peach. Injury from these insects may cause deformity, scarring, or dimpling as the fruit grows. Catfacing insects are highly mobile and move into the orchard from nearby weeds.

Plum curculio are snout beetles (weevils) that lay eggs in the young peach. Developing larvae burrow through the fruit as they grow. There is usually only one generation per year but two generations are possible in some years. Overwintering adults feed on and lay eggs in fruit for several weeks after petal fall. Larvae hatching from eggs tunnel in the fruit resulting in wormy fruit. First generation adults emerge from late June through July; these adults can feed on and damage fruit, but only rarely do they lay eggs in fruit at this time. Good control after petal fall precludes potential for damage by adults in June or July. Overwintering adult emergence can be extended over several weeks, so the crop may require protection for two to three weeks. Infestations are most severe adjacent to woods, where adults overwinter.

Oriental fruit moths emerge as adults in early spring when new tree growth begins. First generation larvae feed as borers in the terminal shoots causing “flagging,” but later generations may enter the fruit and excavate shallow galleries under the skin or around the stem. Poor control of the first generation will lead to higher densities in later generations.

Controls

Effectiveness

1. Weed control and sanitation of orchard surroundings has a big impact on the level of catfacing injury caused by plant bugs and stink bugs early in the growing season. Because pests in the ground cover may be flushed up into the trees when disturbed, try to avoid unnecessary traffic in the orchard and mow the ground cover shortly after an insecticide application.	***
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2. Insecticide sprays are almost essential during petal fall to reduce injury by catfacing insects and to prevent establishment of plum curculio and oriental fruit moth populations. Two to three insecticide applications made at 10 to 14 day intervals will usually control pests in orchards where growers maintain good sanitation and weed control. Recommended insecticides include:

Controls

Effectiveness

phosmet (Imidan 70WSB, 3.0 lb/acre)	*****
OR	
indoxacarb (Avaunt) 30WG 5.0 oz	*****
Make no more than 4 applications/season	
OR	

thiamethoxam (Actara 25WDG, 5.0 oz/acre) *****
Do NOT apply more than 11 oz/acre/season.

OR

The following pyrethroids (Group 3A in efficacy table) provide good general insect control, but often aggravate mite and/or scale populations.

beta-cyfluthrin (Baythroid 1EC, 2.5 fl oz/acre) *****

OR

lambda-cyhalothrin (Karate 2.08EC, 2.0 oz/acre) *****

OR

fenpropathrin (Danitol 2.4EC, 15 oz/acre) *****

OR

Permethrin (Perm-Up 3.2EC, 7.0 fl oz/acre) *****

SHUCK SPLIT TO SHUCK FALL

When shucks begin to split, exposing the small fruit, until the shucks fall (shucks off).

Diseases

Peach scab. Start of shuck split is a very critical period for starting peach scab control. Apply a fungicide for scab control to nectarines at early shuck split. The peach scab fungus has an incubation period of 5 to 6 weeks after the infection occurs before the scab lesions become visible. Peach scab occurs every year in North Carolina unless an effective fungicide program is correctly used. This disease is most severe in orchards in which a good fungicide was NOT previously used and when frequent periods of moisture occur from shuck split to approximately 4 weeks (second to third cover, pit-hardening) after shuck split. First lesions are usually visible late May to early June.

Brown rot at this time is generally of little concern if blossom blight did not occur. Fungicides used for scab control normally provide adequate control of brown rot (green fruit rot) during this period.

Bacterial spot. See the discussion under DORMANT.

Peach scab can be adequately controlled only with the proper use of a fungicide, although scab control may be aided by factors such as adequate pruning and selecting orchard sites that allow for rapid drying of the foliage.

Controls

Effectiveness

Recommended fungicides include:

captan [M4] (Captan 50WP, 5.0 lb/acre, 80WP 3.2 lb/acre, Captec 4L 2.5 qt/acre) *****

In orchards where scab has been a problem or orchards not previously sprayed for scab, tank-mixing thiophanate methyl [I] (Topsin M 70WP, 1.25 lb/acre,

Thiophante Methyl 85WDG 1.0 lb/acre) with captan (Captan 50WP 4.0 lb/acre **OR** Captec 4L, 2.0 qt/acre) enhances scab control. When used for scab control early in the season, thiophante -methyl formulations should **NOT** be used later in the season for fruit brown rot control especially if it had also been used in bloom because of potential for resistance problems,

OR

chlorothalonil [M5] (Bravo Weather Stik 4.0 pt/acre, Equus 720 SST 4.0 pt/acre, or Echo 720 4.0 pt/acre). Do NOT use chlorothalonil after shuck split, *****

OR

Sulfur [M2] ---many wettable powder and flowable formulations are available. Regardless of the formulation, do not use less than 10 pounds of actual sulfur per acre. If frequent periods of rainfall occur, apply sulfur at 5- to 7-day intervals. These close spray intervals are especially important during the 4 week period after shuck split when risk of scab infection is greatest. ***

Arthropods

Same as for petal fall. Catfacing insect pests, plum curculio and oriental fruit moth populations all extend through the shuck fall period.

Controls

Same as for Petal Fall.

COVER SPRAYS

Some insecticides/miticides have lengthy preharvest intervals (PHI). Before application, check the label for the minimum number of days between application and harvest.

Cover sprays start at 7 to 14 days after shuck off. During this period sprays are normally applied every 2-3 weeks, or when the need is indicated by scouting and monitoring for insects and diseases, or as dictated by periods of precipitation.

Diseases

Peach scab. See comments for shuck split to shuck fall. Because of the 5- to 6-week incubation period for primary scab lesions to become visible, fruit that ripen before June 15 need only 1 or 2 cover sprays to control scab. Fruit that ripen later will require additional cover sprays depending on lateness of ripening.

Sooty peach. In orchards where this is a problem, use Ziram 76DF 4.0 lb/acre or Captan 50WP 4.0 lb/acre every 2 to 4

weeks starting no later than 15 June and until 14 days before harvest. Do **NOT** apply closer than 14 days before harvest.

Brown Rot. During cover spray period, brown rot is generally not a major problem. However, brown rot can become a problem if there are frequent periods of precipitation or if wounds occur in fruit such as those caused by hail or insects that may result in green-fruit rot. Fungicides used to control scab normally provide adequate brown rot control during the cover spray period. It is very important to control insects that wound fruit (eg, stink bugs).

Controls	Effectiveness
Properly prune trees to allow for rapid drying of fruit and foliage and good penetration of spray materials.	

Fungicides recommended for scab control in cover sprays include (See additional comments under Shuck Split to Shuck Fall):

captan [**M4**] (Captan 50WP, 4.0 to 5.0 lb/acre, or Captan 80WP 3.125 lb/acre, Captec 4L, 2.0 to 2.5 qt/acre), ****

OR

Sulfur [**M2**] ---there are many formulations. Use 9.0 to 10.0 lb/acre of actual sulfur. When sulfur is used, sprays must be applied more frequently (every 5 to 10 days if rainy) than when a fungicide like captan is used. ***

Arthropods

Spider mites that build up in the ground cover during early spring may migrate into the peach trees in midsummer when their spring host plants begin to dry up. This movement and buildup usually occurs during hot, dry conditions. Look for yellowing along the midrib of peach leaves near the tree trunk, and check the back of the leaf with a hand lens to find the silk webbing that is indicative of spider mites.

San Jose scale has three to four generations per year, depending on location. They overwinter as immatures on the tree, with first generation adults emerging near petal fall to shuck split. First generation crawlers are active for about 3 to 4 weeks beginning at first cover. The objective in SJS control programs is to prevent first generation crawlers from becoming established. This can be accomplished with a dormant application of oil + insecticide, or an insecticide at shuck split to first cover spray. Lorsban has long residual activity, but may be applied only prebloom.

White peach scale has three generations per year. Crawlers of the second generation are usually active during the last week of June and the first week of July. To determine when crawlers are active in your orchard, wrap an infested branch with black tape and coat the tape with petroleum jelly or stickum. Newly hatched crawlers become entangled in the adhesive and are visible as tiny pink or reddish dots on the black tape.

Plum curculio generally has one generation, although there are some individuals within the population that complete two, but this is not common. Two or three insecticide sprays beginning at petal fall are important in preventing damage.

Oriental fruit moth, which has multiple generations per year and is a potential pest of fruit later in the season. Although not typically a serious pest in North Carolina peaches, it has become more problematic in many eastern US states in recent years.

Stink bugs, can sometimes be a problem from May onward. The native brown and green stink bugs are common throughout NC, can be problematic in August and September. The invasive brown marmorated stink bug can be a serious season-long problem where it occurs in large numbers, which is primarily in the piedmont and mountain regions.

June and Japanese beetles, are common pests that can be important from late June into August. Both species congregate in large numbers and can feed on leaves and fruit. They are particularly attracted to ripened fruit.

Controls	Effectiveness
1. Pick up and destroy drops or thinned peaches that may be infested with first generation plum curculio.	**
2. Apply insecticides only as needed during the summer to suppress known insect populations. Product selection should be based on target pest. See Efficacy Table to match pest and insecticide.	

Recommended materials include:
phosmet (Imidan 70WSB, 3.0 lb/acre). ***

OR

thiamethoxam (Actara 25WG, 5.5 oz/acre) low dermal toxicity to humans (REI = 12 hours) ***

OR

pyrethroids provide good general insect control but may aggravate mite and scale populations. See Group 3A in Efficacy Table for a list of products. ***

Mites:

bifenazate (Acrامة 50WS, 0.75 to 1.0 lb/acre). Only 1 spray per season, 3 day PHI and 12 hr REI. ****

OR

Abamectin (Agri-Mek 0.7SC, 2.2-4.2 oz/acre). Must be used with non-ionic adjuvant or horticultural oil. 21 day PHI (12 hr REI) ****

June beetles, Japanese beetles:

carbaryl (Sevin 80WSP, 2.5 lb/acre) **OR** imidaclorprid (Provado 1.6F, 6.0 fl oz/acre) ****

PREHARVEST

Before applying any pesticide at this time, check the pesticide label for the minimum number of days between application and harvest; preharvest interval (PHI).

Preharvest period usually begins about 3 weeks before expected harvesting of the fruit. Thus it is very important to know the expected ripening dates of each variety grown and whether ripening time during the current season may be normal, early, or late.

Diseases

Brown rot. This is the most critical period for losses from brown rot and also for control of this disease. As fruit ripen, susceptibility increases. If brown rot is present in or near ripening fruit and rainfall occurs during the preharvest period, the risk of brown rot is very high. Under such conditions, protecting fruit from infection is of utmost importance. If weather conditions are dry during the 3-week period before and during harvest, brown rot usually is not a problem. If weather conditions are wet during this period and/or green fruit rot or blossom blight occurred, it is important to begin using an effective fungicide 3 weeks (first sign of fruit color development) before anticipated harvest.

Rhizopus rot. Mostly a postharvest problem, rhizopus rot usually occurs in the field when fruit are allowed to become overripe and weather conditions are hot and wet.

Controls

Effectiveness

1. Preventing brown rot in or near the orchard is very important. A season-long program is necessary when cultivars of different ripening times are grown in the same orchard. Do not allow fruit to become overripe before harvesting. At the last picking, harvest all fruit regardless of quality and discard non-marketable fruit away from the orchard so it does not serve as a source of inoculum for later ripening fruit or for the next growing season. **

Number of sprays needed is based on weather and disease pressure. Recommended fungicides with preharvest intervals (PHI) and restricted entry intervals (REI):

21 days preharvest --

Captan [M4] (Captan 50WP 5.0 lb/acre, Captec 4L 2.5 qt/acre, Captan 80WDG 3.25 lb/acre) --- 0 day PHI and 24 h REI ***

OR

azoxystrobin [I1] (Abound 2.08F, 10.0 fl oz/acre) ***

PLUS

thiophanate methyl [I] (Topsin M 70WSP 1.0 lb/acre, thiophanate Methyl 85WDG 0.75 lb/acre) --- 1 day PHI and 48 h REI.

14 to 10 days preharvest --

pyraclostrobin [I1] + boscalid [7] (Pristine 38WG 12 to 14 fl oz/acre) --- 0 day PHI and 12 h REI, *****

OR

pyraclostrobin [I1] + fluxapyroxad [7] (Merivon 500SC 6.0 fl oz) --- 0 day PHI and 12 hr REI *****

OR

trifloxystrobin [I1] + fluopyram [7] (Luna Sensation 4.2SC 6.0 fl oz) --- 1 day PHI and 12 hr REI *****

7-1 day preharvest --

difenoconazole [3] + cyprodinil [9] (Inspire Super 2.82EW, 20 fl oz/acre) --- 0 days PHI and 12 hr REI *****

OR

fenbuconazole [3] (Indar 2F, 6.0 fl oz/acre) --- 0 day PHI and 12 h REI, *****

OR

flutriafol [3] + azoxystrobin [I1] (Topguard 4.3EQ 8.0 fl oz/acre) --- 7 days PHI and 12 hr REI ****

OR

propiconazole [3] (Tilt 3.6EC, PropiMax 3.6EC, Bumper 41.8EC, 4.0 fl oz/acre) --- 0 day PHI and 12 h REI ****

2. Rhizopus rot can be managed by practicing good sanitation in the orchard, storage, and at the sales stand. Do not allow fruit to become overripe.

AFTER HARVEST

Arthropods

Peachtree borers are active as adults in August and early September. The larvae of these moths burrow into the tree trunk near the soil line and excavate galleries under the bark. Infestations can be identified by jelly and frass oozing from the base of a tree.

Controls

Effectiveness

1. For control of peach tree borers, saturate the trunk and scaffold limbs with insecticide during the last week of August through the first week of September, the period of peak insect hatch.

Recommended insecticides for peachtree borers include chlorpyrifos (Lorsban 4EC 4.0 pt/100 gal) *****

RELATIVE EFFECTIVENESS OF VARIOUS INSECTICIDES FOR PEACH INSECTS

(-- = ineffective; +++++ = very effective; n/a = does not apply)

MOA ^a	Insecticide formulation and Product/acre	Days PHI and Hours or Days (REI) *	Plum Curculio	Oriental Fruit Moth	Peachtree Borer	Catfacing Insects (stink bugs)	Scales (White peach & San Jose)	Beetles (June, Japanese)	Thrips
1A	carbaryl (Sevin 80SP) 1.25 lb	3 (12 hr)	+	++	+	+	++	++++	---
	methomyl (Lannate 2.4L) 1 pt	4 (4 days)	+++	+++	+	+++	+	++	+++
1B	chlorpyrifos (Lorsban 4EC) 3 qt	Prebloom& postharvest only	na	na	+++++	na	+++++	na	na
	phosmet (Imidan 70WSB) 1.5 lb	14 (3 days)	++++	++++	+	+	+	+++	+
3A	beta-cyfluthrin (Baythroid XL) 1 oz	7 (12 hr)	++++	+++++	++	++++	---	++++	
	esfenvalerate (Asana XL) 5.8 oz	14 (12 hr)	++++	+++++	++	+++	---	++++	++
	fenpropathrin (Danitol 2.4EC) 16 oz	3 (24 hr)	++++	+++++	++	++++	---	++++	++
	gamma-cyhalothrin (Proaxis 0.5EC) 3.8 oz	14 (24 hr)	++++	+++++	++	++++	---	++++	++
	lambda-cyhalothrin (Karate 2.08CS) 1.9oz	14 (24 hr)	++++	+++++	++	++++	---	++++	++
	permethrin (Permethin 3.2EC,25WP) 6 oz	14 (12 hr)	++++	+++++	++	++++	---	++++	++
	Zeta-cypermethrin (Mustang Maxx) 2.0 oz	14 (12hr)	++++	+++++	++	++++	---	++++	++
4A	acetamiprid (Assail 30SG) 7 oz	7 (12hr)	++	++++	---	++	+++	++++	+
	chothianidin (Belay SL) 6 oz	21 (12 hr)	++++	+	---	++++	---	+++	++
	dinotefuran (Scorpion 35SL) 5.25 oz (Venom 70SG) 4 oz	3 (12 hr)	++++	+	---	++++	---	+++	++
	imidacloprid (Provado 1.6F) 3 oz	0 (12 hr)	+	---	---	++	---	+++	++
	thiamethoxam (Actara 25WDG) 2.5 oz	14 (24 hr)	+++++	++	---	++++	++	+++	++
5	spinetoram (Delegate 25WDG) 2.5 oz	7 (4 hr)	+	+++++	---	---	---	+	++++
7C	pyriproxyfen (Esteem 35WP) 5 oz	14 (12 hr)	---	++	---	---	+++++	---	---
16	buprofezin (Centaur 70WSB) 17 oz	14 (12 hr)	---	---	---	---	+++++	---	---
22	indoxacarb (Avaunt 30WG) 3 oz	14 (12 hr)	+++++	++++	+	+	+	++++	---
23	spirotetramat (Movento 2SC) 8 oz	14 (12 hr)	---	---	---	---	++++	---	---
28	chlorantraniliprole (Altacor 35WDG) 2.5 oz	10 (4 hr)	---	+++++	+++	---	---	---	++
	cyantraniliprole (Exirel 0.83 SEO) 15 oz	3 (12 hr)	++	+++++	++++	+	---	++	++

^aMOA is the Mode of Action classification established by the Insecticide Resistance Action Committee. Those pesticides grouped under the same category have the same mode of action.

* PHI = preharvest interval (time between last spray and harvest); REI = reentry interval (time between last spray and reentry without using personal protective equipment (PPE)). **ALWAYS CHECK/READ LABELS BEFORE USE OF A PESTICIDE.** Relative Toxicity (Safety) Signal Words on Pesticide Labels: D=Danger (most toxic to humans) C=Caution (least toxic to humans) W=Warning R=Restricted (restricted-use compound, may be bought and applied only by licensed pesticide operator).

RELATIVE EFFECTIVENESS OF DISEASE CONTROL CHEMICALS FOR PEACHES AND NECTARINES

(--- = ineffective; ++++++ = superior; +++++ = very effective; n/a = does not apply)

[FRAC code*] Fungicide or Bactericide and Product/Acre (using 100 gal water/acre)	DAYS for** PHI and HOURS (REI)	Leaf Curl	Blossom Blight	Brown Rot	Scab	Rhizopus Rot	Bacterial Spot
[II] azoxystrobin (Abound 2.08F) 12 fl oz	0 (4)	n/a	+++	+++	+++	n/a	n/a
[II] azoxystrobin+[3]difenoconazole (Quadris Top) 14 fl oz	0 (12)	n/a	++++	+++++	+++	n/a	n/a
[M4] captan (Captan 50WP, 80WP, Captec 4L) 5 lb, 2.5 qt	0 (24)	n/a	++	+++	++++	---	n/a
[M5] chlorothalonil (Bravo Weather Stik, Equus, Echo 6F) 4.0 pt	n/a (12)***	++++	+++	n/a	++++	n/a	n/a
[M1] copper (Kocide 2000, 3000, Cuprofix Ultra 40D, Nordox 75WG, Badge 2.27SC) 4-6 lb, 8 pt****	n/a (48)	+++	n/a	n/a	n/a	n/a	++++
[9] cyprodinil (Vangard 75WG) 5.0 oz	n/a (12)	n/a	++++	n/a	---	n/a	n/a
[9] cyprodinil+[3] difenoconazole (Inspire Super) 18 fl oz	0 (12)	n/a	++++	+++++	+++	n/a	n/a
[3] fenbuconazole (Indar 2F) 6.0 fl oz	0 (12)	n/a	++++	+++++	+++	n/a	n/a
[3] flutriafol + [11] azoxystrobin (Topguard 4.3EQ) 8.0 fl oz	7 (12)	n/a	++++	++++	n/a		
[2] iprodione (Rovral 50WP, 4L) 1.5 lb, 1.5 pt	n/a***** (24)	n/a	++++	n/a*****	---	n/a	n/a
[3] metconazole (Quash 50 WDG) 3.5 oz	14 (12)	n/a	++++	+++++	+++	?	n/a
[3] myclobutanil (Rally 40WP) 6.0 oz	0 (24)	n/a	++++	+++	---	n/a	n/a
[4I] oxytetracycline (FireLine, Mycoshield 17WP) 0.75 lb	21 (12)	n/a	---	---	---	---	+++
[7] penthiopyrad (Fontelis) 20 fl oz	0 (12)	n/a	+++	++++	++	n/a	n/a
[3] propiconazole (Tilt, PropiMax, Bumper 3.6EC) 4.0 fl oz	0 (12)	n/a	++++	+++++	+	n/a	n/a
[II] pyraclostrobin+[7] boscalid (Pristine 38WG) 14.5 oz	0 (12)	n/a	++++	+++++	++	n/a	n/a
[II] pyraclostrobin+[7] fluxapyroxad (Merivon) 6.0 fl oz	0 (12)	n/a	++++	+++++	+++	++	n/a
[9] pyrimethanil (Scala SC) 18 fl oz	30 (12)	n/a	++++	n/a	---	n/a	n/a
[M2] sulfur (numerous formulations) 10 lb	0 (24)	n/a	++	++	+++	---	n/a
[I] thiophanate-methyl (Topsin M 70WP, WSP) 1.5 lb	1 (48)	n/a	++++	++++	+++++	n/a	n/a
[II] trifloxystrobin (Gem 500SC) 3.8 fl oz	1 (12)	n/a	+++	n/a	+++++	n/a	n/a
[11] trifloxystrobin + [7] flupyrom (Luna Sensation 4.2SC) 6.0 fl oz	1 (12)	n/a	++++	+++++	+++	++	n/a
[M3] ziram (Ziram 76DF) 4.0 lb	14 (48)	++++	+	+	+	---	+

* Fungicide Resistance Action Committee (FRAC) codes. Numbers and letters distinguish the fungicides according to their potential for cross-resistance behavior. Fungicides having the same FRAC code are prone to cross resistance, thus not good mixing or alternating partners.

** PHI = preharvest interval (DAYS between last spray and harvest); REI = reentry interval (HOURS between last spray and reentry without using personal protective equipment (PPE). ALWAYS CHECK/READ LABELS BEFORE USE.

*** REI is 12 hours for chlorothalonil, but see label for precautions related to risk for eye damage and required protection.

**** This rate of copper is for use only as a dormant spray. See information on copper (Dormant Spray) for use against bacterial spot. ***** Rovral is not registered for use after petal fall.

Reducing the Risk of Fungicide Resistance

Of the fungicides registered to control diseases on peaches and nectarines, several have different mechanisms of action. This allows for the development of resistance management strategies based on proper alternation of fungicides with different mechanisms. Some fungicides, although different in name and formulation, have similar mechanisms of action. Pathogens (i.e., fungi and bacteria) if continually exposed to fungicides with one mechanism of action, may develop resistance to that entire group of chemicals. To reduce the risk of developing resistance, fungicides with one mechanism of action should be alternated or tank-mixed with fungicides having a different mechanism of action. To aid the grower to make these decisions, fungicides have been assigned a Mode of Action (MOA) Code. Numbers and letters are used to distinguish the fungicide groups according to their MOA and thus potential for cross-resistance behavior. Thus, fungicides having the same MOA and potentially resistance to one may mean resistance to others having the same MOA code. Therefore, alternations or

mixing partners should involve fungicides having different MOA Codes. It should be noted, however, that even if two fungicides do not have similar mechanisms of action they may not necessarily be appropriate mixing companions or rotational materials.

Nematode Control on Peaches

Rootstock

Trees propagated on Guardian™ rootstock have been very productive under North Carolina conditions when compared with other rootstocks such as Lovell. Guardian™ is resistant to root-knot nematodes and survives well in orchard sites prone to the peach tree short life complex.

Preplant Soil Fumigation

In light, sandy soil where root-knot and ring nematodes are present, preplant soil fumigation is imperative. If the nematode assay indicates the presence of root-knot or ring

nematodes and Guardian™ is NOT being used as the rootstock, it may be advantageous to fumigate the entire orchard site in October to mid-November before planting the trees in late winter to early spring. If the nematode assay does not indicate the presence of root-knot or ring nematodes, a 6- to 8-ft strip to be used for the tree row may be fumigated. If trees on Guardian™ rootstock are to be planted into a site that was in peaches within the last 5 years, strip-fumigation is beneficial.

Materials for preplant fumigation	Rate/treated acre*
RESTRICTED USE PESTICIDES 1,3-dichloropropene (Telone II)	27 to 35 gal
OR sodium methylthiocarbamate (Vapam HL, Sectatgon II) tarped	50 to 75 gal

*Rate will vary depending on soil type. Follow manufacturer's directions for rate and application procedure on current product label.

Postplant Nematode Chemical Treatment (none available)

Spray Application

The objective of spraying is to distribute a fungicide, insecticide, miticide, or growth regulator over the entire above-ground surface of the tree. Water and air are usually the materials used to carry these to the tree. The amount of water applied to a tree or an acre of trees is related to the nozzle size, the pump pressure, and the ground speed of the sprayer. Thus, simply putting a certain amount of pesticide in the spray tank does not necessarily mean that the pesticide will be applied at the correct rate per acre. To determine the appropriate amount of water and pesticide to put into the tank, the amount of water used per acre must be known.

Pesticides are applied using either a dilute or low-volume (concentrate) spray mixture. **Dilute (1X) spraying** means applying a pesticide with a sufficient amount of water to wet the foliage to the point of runoff. **Concentrate spraying** is the application of a pesticide in an amount of water such that runoff does not occur; this condition is usually met when less than 100 gallons of water per acre are used for mature trees. Thus, with concentrate spraying less water per acre is used to apply the same amount of pesticide per acre as would be applied with dilute spraying.

In North Carolina, mature trees pruned to a height of 8 feet, a spray mixture of 100-150 gallons per acre may be considered dilute. For example, if 1 acre is sprayed at dilute (1X = 150 gal per acre) using 4 pounds of pesticide per acre, spraying at 3X would use 50 gallons of water per acre with the pesticide rate per acre, 4 pounds, remaining the same.

The **advantages** of concentrate spraying are that it requires less water, labor, and time; fewer refills; and possibly less

pesticide. **Disadvantages** are the greater care required to accurately calibrate the sprayer, the need to maintain a constant ground speed, and the necessity to spray when conditions are optimal. Remember: as spray volume is reduced, errors become more critical. **For control of some pests such as scale, mites, and the leaf curl fungus, or when severe brown rot, scab, or bacterial spot pressure occurs, best results are achieved with dilute applications.**

Regardless of whether a dilute or concentrate spray is used, best spray coverage is achieved if the ground speed does not exceed 3 mph.

Orchard Weed Management

Prior to Orchard Establishment

Prior to planting a young orchard take time to evaluate the site for problem weeds. Woody perennial weeds, like blackberry, can be difficult to control in peach orchards. Glyphosate may be used the summer and fall prior to planting for woody perennial weed control the following spring. August and September is a good time to apply glyphosate for controlling many woody perennial weeds. Weed species specific information is available on glyphosate product labels.

Newly Planted Orchards

A good weed management program during the first three years after planting is important for total tree development and yield. The development of Chateau and expansion of the Sinbar label to allow use in newly planted orchards has greatly improved preemergence weed control in newly planted orchards. Both Chateau and Sinbar provide better control of large seeded broadleaf weeds than the traditional standards oryzalin or Prowl. Using Sinbar (0.5 lb/A) or Chateau (6 to 8 oz/A) followed by a second application once control from initial application deteriorates provides excellent preemergence weed control in newly planted and non-bearing orchards. To avoid tree injury, the immature bark of newly planted trees must be protected if Chateau or paraquat is used. Trees can be shielded by painting trunks with white latex paint. Using a physical structure around the trunk like a wax coated milk carton is also an option. Fusilade, Poast, or Select can be used for postemergence annual and perennial grass control.

Established Orchards

Traditional peach orchard weed management programs have consisted of a single application of a herbicide in the spring followed by one or two applications of paraquat. However, the ideal weed management program begins in the fall with a preemergence herbicide application. The fall preemergence herbicide controls winter annual weeds, which host cat-facing insects. The fall application maintains the herbicide strip bare through spring, maximizing radiant heating during

freeze events. It delays the need for a spring preemergence herbicide application for several weeks, extending residual weed control later into the summer. With the migration of camphorweed into the southern piedmont of North Carolina, a fall preemergence herbicide is necessary for its control. Camphorweed germinates in mid-October to Mid-April and will overwinter in peach orchards.

A 2,4-D amine application (in row middles – areas not affected by fall preemergence herbicide application) 6 weeks prior to bloom eliminates winter annual weeds growing on the orchard floor. This is recommended as part of an integrated approach to managing cat-facing insect populations over-wintering on winter annual broadleaf weeds. In areas where row middles do not have an established ground cover glyphosate or glyphosate + 2,4-D amine may be used to control winter weeds. However this practice should only be used in orchards where all vegetation in the row middles can be killed and growers have appropriate application equipment for applying glyphosate in peach orchards (see label for details). When residual weed control from the fall preemergence application ends, follow with another preemergence herbicide application. The spring application will provide residual weed control into the

summer. Tank mixing preemergence herbicides will broaden the summer weed control spectrum.

Perennial Grass Weeds

Perennial grasses, like bermudagrass, cause significant reductions in yield, fruit size, and tree growth. These species can be controlled with timely applications of Fusilade, Poast, or Select (nonbearing only). Regardless of the herbicide choice, the initial application should be applied to bermudagrass having 4 to 6 inch runners. A second application should be applied when **REGROWTH** occurs. Refer to product labels for rate and adjuvant information. These products also control johnsongrass and annual grass weeds. See labels for details.

Yellow and Purple Nutsedge

Nutsedge is an increasing problem in orchards. In established orchards Solicam or Sinbar can be used to suppress yellow and purple nutsedge. Paraquat will burn down above ground growth, however, regrowth will occur. Herbicides containing rimsulfuron (Matrix and others) will suppress emerged yellow nutsedge.

CHEMICAL WEED CONTROL IN PEACH ORCHARDS

W.E. Mitchem, Horticultural Science Extension
Preemergence and Directed Underneath Tree

Weed	Herbicide, MOA*, and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Annual grasses and some broadleaf weeds	diuron, MOA 7 (Direx, Diuron) 4L (Diuron, Karmex DF) 80 DF	1.6 to 2.2 qt 2.0 to 2.75 lb	1.6 to 2.2	Apply in spring to trees at least 3 years old. Rate is soil texture dependent. May be tank-mixed with Sinbar, Solicam, glyphosate, or paraquat. Karmex DF, Karmex XP, and Direx 4L have a 20-day PHI. Other formulations of diuron have a 90-day PHI.
	flumioxazin, MOA 14 (Chateau) 51SW (Tuscany) 51WG	6.0 to 12 oz	0.19 to 0.38	Chateau is for newly planted and established orchards. Shield trees established less than 1 year from contact with spray solution. Tank mix with paraquat for non-selective POST weed control. Do not apply more than 6.0 oz per acre to trees planted less than 3 years in soil having a sand plus gravel content more than 80%. Sequential applications are very effective. Due to the potential for crop injury, Chateau should not be applied in bearing orchards after budbreak until after final harvest. Do not apply within 60 days of harvest. Do not use more than 24 oz per acre per year. In non-bearing orchards Chateau may be applied after bud break, however application equipment should be hooded.
	indaziflam, MOA 29 (Alion) 1.67SC	3.5 to 6.5 oz	0.046 to 0.085	Use in orchards established 3 years or longer. See label for details regarding the management of replants in established orchards. Use rate cannot exceed 3.5 fl oz/acre per application on soils having less 1% organic matter. On soils with an organic matter content from 1 to 3%, no more than 5.0 fl oz/acre can be applied in a single application and the total use rate for the year cannot exceed 8.5 fl oz/acre. In order to apply more than 5.0 fl oz/acre in a single application soil organic matter must be >3%. Do not use on soils with 20% or more gravel content. Allow at least 90 days between applications. Research has shown Alion applied in the fall followed by a late spring application will provide summer long control of annual broadleaf and grass weeds. Do not treat soil around trees with cracks or channels, or with depressions. Tank mix Alion with glyphosate or paraquat for nonselective POST weed control. Alion has a 14-day PHI.
	norflurazon, MOA 12		2.0 to 4.0	Can be tank-mixed with Karmex, Goal, paraquat, Prowl,

(Cont'd) Annual grasses and some broadleaf weeds	(Solicam) 80WDG	2.5 to 5.0 lb		rimsulfuron, glyphosate, Sinbar, or oryzalin. Rate is soil texture dependent. See label for details. Do not apply within 6 months of transplanting. PHI is 60 days. Multiple applications can be made per season so long as total does not exceed maximum use rate for soil texture and crop.
	oryzalin, MOA 3 (Oryzalin or Surflan) 4AS	2.0 to 6.0 qt	2.0 to 6.0	Allow soil to settle around newly transplanted trees before application. Oryzalin may be tank-mixed with Goal, glyphosate, paraquat, simazine, or Solicam. Sequential applications permitted as long as there is 2.5 months between applications. See label for details. In newly planted orchards, may be tank-mixed with Gallery for broad spectrum pre-emergence control. Sequential applications may be used if total rate does not exceed 12 qt per acre per year.
	pendimethalin, MOA 3 (Prowl H ₂ O) 4AS	2.0 to 4.0 qt	2.0 to 4.0	Most effective when adequate rainfall or irrigation is received within 7 days after application. Do not apply to newly transplanted trees until ground has settled around roots. Apply with paraquat to control emerged weeds. Prowl has a 60-day preharvest interval (PHI). May be applied as sequential applications so long as total amount does not exceed 4.2 qt/A. Allow at least 30 days between applications.
Broadleaf and some grass weeds	penoxsulam + oxyfluorfen, MOA 3 (Pindar GT) 4	1.5 to 3.0 pt	0.75 to 1.5	Pindar GT can be applied after harvest in the fall to late winter/early spring until budswell. DO NOT use after bud break until completion of final harvest or in orchards established less than 4 years. DO NOT use in soils that contain less than 20% clay or greater than 70% sand. For non-selective POST control mix tank mix with glufosinate, glyphosate, or paraquat. For extended residual control of annual grass weeds tank mix with oryzalin or Solicam.
	rimsulfuron, MOA 2 (Matrix) 25WG (Solida) 25WG (Pruvin) 25WG	4.0 oz	0.063	For broad spectrum PRE control, tank mix with diuron, Sinbar, oryzalin or Prowl H ₂ O. For nonselective POST control, apply with glyphosate or paraquat. Rimsulfuron does have POST activity on certain broadleaf weeds (see label for list). Rimsulfuron will control emerged horseweed less than 3 inches tall when applied in combination with a non-ionic surfactant and a spray grade ammonium sulfate (2 lb/A). DO NOT treat orchards established less than 1 year. Rainfall within 2 to 3 weeks of application is necessary for herbicide activation. Spray solutions having a pH less than 4.0 or higher than 8.0 will result in herbicide degradation. Rimsulfuron has a 14-day PHI for stone fruits and sequential applications can be applied as long as total use rate does not exceed 4.0 oz/A per year and application if made in a band on less than 50% of orchard floor. Allow at least 30 days between applications.
Broadleaf and grass weed control for NEWLY PLANTED NON- BEARING ORCHARDS	terbacil, MOA 5 (Sinbar) 80WDG	0.5 to 1.0 lb	0.4 to 0.8	Apply once soil has settled after transplanting. Apply no more than 1.0 lb per acre per year. For best results, apply 0.5 lb in spring followed by another 0.5 lb when control from initial application fails. Do not apply on soils coarser than sandy loam having less than 1% organic matter.
Annual broadleaf and grass weeds	simazine, MOA 5 (Princep, Simazine) 4L 90WDG	1.6 to 4.0 qt 1.8 to 4.4 lb	1.6 to 4	Apply in early spring before weed emergence. Use only on trees established 1 year or more. Do not use on sand or loamy sand soils. Tank-mixing simazine with oryzalin, Prowl H ₂ O, or Solicam will improve residual control of annual grasses and certain broadleaf weeds.
Annual broadleaf and grass weeds plus many perennial grasses	terbacil, MOA 5 (Sinbar) 80WDG	2.0 to 4.0 lb	1.6 to 3.2	Use on trees established 3 years, however, when tank mixed with Karmex XP, Sinbar may be applied in orchards established 1 year or longer. Sinbar may only be used on soils with at least 1% organic matter. Unless soil organic matter is greater than 2%, do not exceed 3 lb/A. Do not use on sand or loamy sand soils. Sinbar is an excellent choice for tank mixing with diuron or rimsulfuron for extended broad spectrum residual control of those products. Sinbar has a 60-day PHI.

Preemergence Tank Mixes

Weed	Herbicide and Formulation	Amount of Formulation Per Acre	Pounds Active Ingredient Per Acre	Precautions and Remarks
Many annual and perennial grasses and broadleaf weeds	diuron, MOA 7 (Diuron or Karmex DF or XP) 80 WDG + terbacil, MOA 5	1.0 to 2.0 lb +	0.8 to 1.6 + 0.8 to 1.6	Use only under trees established in the orchard for at least 1 year. Apply to soils having at least 1% organic matter. See label for details.

(cont'd) Many annual and perennial grasses and broadleaf weeds	(Sinbar) 80 WP	1.0 to 2.0 lb		
	oryzalin, MOA 3 (Oryzalin or Surflan) 4AS + simazine, MOA 5 (Princep, Simazine) 4L 90WDG	2.0 to 4.0 qt + 1.6 to 4.0 qt 1.75 to 4.4 lb	2.0 to 4.0 + 1.6 to 4.0	Tank mix for use before weed emergence. Trees must be established at least 1 year.
	norflurazone, MOA 12 (Solicam) 80WDG + simazine, MOA 5 (Princep, Simazine) 4L 90WDG	2.5 to 5.0 lb + 2.0 to 4.0 qt 2.2 to 4.4 lb	2.0 to 4.0 + 2.0 to 4.0	See labels for details.
	norflurazon, MOA 12 (Solicam) 80WDG + diuron, MOA 7 (Diuron or Karmex DF) 80WDG	2.5 to 5.0 lb + 2.0 to 4.0 lb	2.0 to 4.0 + 1.6 to 3.2	See labels for details. Trees must be established at least 3 years.
	rimsulfuron, MOA 2 (Matrix) 25WG (Solida) 25WG (Pruvin) 25WG + terbacil, MOA 5 (Sinbar) 80WP	2.0 oz + 1.0 to 2.0 lb	0.063 + 0.8 to 1.6	See labels for use precautions and details.
	rimsulfuron, MOA 2 (Matrix) 25WG (Solida) 25WG (Pruvin) 25WG + diuron, MOA 7 (Diuron or Karmex DF or XP) 80WDG	4.0 oz + 2.0 to 4.0 qt	0.063 + 1.6 to 3.2	Tank-mix with glyphosate or paraquat for non-selective POST weed control.
	rimsulfuron, MOA 2 (Matrix) 25WG (Solida) 25WG (Pruvin) 25WG + oryzalin, MOA 3 (Oryzalin, Surflan) 4AS	4.0 oz + 2.0 to 4.0 qt	0.063 + 2.0 to 4.0	Tank-mix with glyphosate or paraquate for non-selective POST week control.

Postemergence and Directed Underneath Tree

Broadleaf weeds including morningglory, pigweed, lambsquater, cocklebur, smartweed, and dayflower	carfentrazone-ethyl, MOA 14 (Aim) 2EC	0.5 to 1.6 oz	0.008 to 0.025	Apply alone or tank-mix with other herbicides. Apply in a minimum spray volume of 20 gpa. Applications can be made with boom equipment, hooded sprayers, or shielded sprayers. Do not allow Aim to contact green bark, flowers, or fruit of the crop. Contact with fruit or foliage will result in spotting and leaf necrosis. The trunks of trees established less than 2 years must be protected. Do not apply within 3 days of harvest. Best results are obtained when applied to weeds in the 2- to 3- leaf stage. Sequential applications may be used so long as there is at least 14 days between applications and total use rate for year does not exceed 7.9 oz/A per year. Apply in combination with a non-ionic surfactant (1 qt/100 gal spray solution) or crop oil concentrate (1 gal/100 gal of spray solution).
Kill all green foliage on contact	paraquate, MOA 22 (Gramoxone SL) 2SL (Firestorm) 3SL (Paraquat Concentrate) 3SL (Parazone) 3SL	2.5 to 4.0 pt 1.7 to 2.7 pt	0.66 to 1.0	Apply when grass and weeds are 1 to 6 in. high and succulent for best results. Direct spray with low pressure to avoid contact with tree foliage or bark. Add surfactant at 0.25% by volume (2 pt per 100 gal) or 1% crop oil concentrate (1 gal per 100 gal) for best results. Paraquate may be tank-mixed with Goal, Karmex, simazine, Sinbar, Solicam, or oryzalin. Paraquate is a restricted use pesticide. Newly planted trees can be severely injured by paraquate, use a shield or wrap to protect the tree from spray. Do not make more than 3 applications per year. Paraquat has a 14 PHI for peach and 28-day PHI for nectarine.
Non-selective weed control	glyphosate, MOA 9 (various brands and formulations)	See labels	1.0	Do not apply in orchards established less than 2 years. Applications must be made with shielded sprayer. Low hanging limbs and suckers must be removed at least 10 days prior to application. DO

Cont'd				NOT use glyphosate 90 days past bloom. DO NOT allow glyphosate to contact foliage or bark. EXTREME care must be taken to prevent injury. See labels for details. Some glyphosate formulations may require addition of a surfactant.
Most annual broadleaf and grass weeds plus many perennials	glufosinate, MOA 10 (Cheetah) 2.34SL (Lifeline) 2.34L (Reckon 280SL) 2.34L (Rely 280) 2.34L	48 to 82 oz	0.88 to 1.5	DO NOT SPRAY GREEN BARK, UNCALLED BARK OR DESIRABLE FOLIAGE UNLESS TREES ARE PROTECTED. Glufosinate should not be used on trees within 1 year of transplanting. Apply in a minimum of 20 gallons of water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Glufosinate can be tank-mixed with diuron, Sinbar, Solicam, oryzalin, Devrinol, rimsulfuron, and simazine. Glufosinate has a 14 day PHI. DO NOT make more than 2 applications per year. There must be at least 28 days between applications. Glufosinate formulations contain surfactant therefore additional nonionic surfactants or crop oils are not necessary and may increase potential for injury.
Grasses	clethodim, MOA 1 (Arrow, Clethodim, Intensity, or Select) 2EC (Select Max or Intensity One) 1EC	6.0 to 8.0 oz 12 to 16 oz	0.09 to 0.125	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. When using 2EC formulation chemicals, add crop oil concentrate at 1% by volume (1 gal per 100 gal). When using 1EC formulations, use a nonionic surfactant at 0.25% by volume rather than crop oil. Select Max has a 14-day PHI for peach. Unless otherwise stated on the label, all other clethodim products are for non-bearing orchards ONLY.
	fluazifop, MOA 1 (Fusilade DX) 2EC	8.0 to 24 oz	0.125 to 0.38	Apply to actively growing grasses not under stress. See label for rate and optimum grass size to treat. Multiple applications may be necessary to control perennial grass weeds. Add crop oil at 1% by volume (1 gal per 100 gal). Do not apply within 14 days of harvest. Do not apply more than 72 fl oz per acre per year.
	sethoxydim, MOA 1 (Poast) 1.5EC	1.0 to 2.5 pt	0.19 to 0.47	Apply to annual grasses up to 12 inches tall. For perennial grasses apply early in the growth cycle at the high use rate. Multiple applications may be necessary for perennial grass weeds. Add Dash adjuvant at 1 pt per acre or crop oil concentrate at 1 qt per acre. Do not apply within 25 days of harvest. Do not apply more than 5 pt per acre per year.
Broadleaf weeds	2,4-D amine, MOA 4 (Weedar 64) (various brands) 3.8SL	1.0 to 3.0 pt	0.95 to 1.4	Do not apply within 40 days of harvest. Do not apply more than twice a year and allow 75 days between applications. Trees must be at least 1 year old. Use when trees are dormant. Some formulations limit rate to 2 pt per acre. See labels for details.
	2,4-D amine + flumioxazin, MOA 4 and 14 (Panther D) SL	3.0 pt	1.5 to 0.1	Panther D is premix of 2,4-D amine and flumioxazin. The amount of flumioxazin in this formulation only enhances the POST activity of the 2,4-D amine and will provide very limited residual control. Orchards must be at least 1 year old and trees in vigorous condition. Panther D has a 40 day PHI for peaches. Use ONLY when trees are dormant. DO NOT allow contact with foliage, fruit, stems, trunks or exposed roots.
Broadleaf weeds including clover, horseweed, dock, thistle and mugwort	clopyralid, MOA 4 (Stinger) 3EC	0.33 to 0.66 pt	0.125 to 0.25	Multiple applications can be used as long as amount does not exceed maximum rate. The total use rate cannot exceed 2/3 pint per acre per crop year. Use at least 10 gpa of spray solution. Stinger may be tank-mixed with pre-emergence herbicides. Do not apply within 30 days of harvest. Do not apply more than twice.

* MOA = Mode of Action group. MOA describes the mode by which an herbicide kills susceptible plants. Consistent use of herbicides having the same MOA (designated by having the same MOA group number, eg MOA 1) within a crop increases the risk of resistance to a group of herbicides.

For more detailed information about “Weed Response to Herbicides” refer to the **2018 Southeastern Peach, Nectarine and Plum Pest Management and Culture Guide** (www.ent.uga.edu/peach/peachguide.pdf). This will update to the 2018 edition.

Recommendations of specific chemicals are based on information on the manufacturer's label and performance for some chemicals in a limited number of trials. Because environmental conditions and methods of application by growers may vary widely, performance of the chemical may not always conform to the safety and pest control standards indicated by experimental data.

Recommendations for the use of agricultural chemicals are included in this publication as a convenience to the reader. The use of brand names and any mention or listing of commercial products or services in this publication does not imply endorsement by North Carolina State University nor discrimination against similar products or services not mentioned. Individuals who use agricultural chemicals are responsible for ensuring that the intended use complies with current regulations and conforms to the product label. Be sure to obtain current information about usage regulations and examine a current product label before applying any chemical. For assistance, contact your county North Carolina Cooperative Extension Service.

You can locate your county center's address and phone number from web site <http://www.ces.ncsu.edu/>

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Additional information on peach culture and production and disease and pest management also may be found in "The Southeastern Peach Growers' Handbook", the electronic version is located at

<http://www.ent.uga.edu/peach/peachhbktoc.htm>

"2018 Southeastern Peach, Nectarine and Plum Pest Management and Culture Guide"

www.ent.uga.edu/peachguide.pdf

Web site that provides many pesticide labels and MSDS information:

<http://www.cdms.net/Label-Database>

SOME USEFUL TELEPHONE NUMBERS:

Carolinas Poison Center -- 1-800-222-1222

P.O. Box 32861, Charlotte, NC 28232-2861

Carolinas Poison Center can provide advise on diagnosis and treatment of human illness resulting from toxic substances.

Chemical Transportation Emergency Center (CHEMTREC) -- 1-800-262-8200

CHEMTREC offers 24-hour information and help to aid in responding to emergencies involving hazardous chemicals. (www.chemtrec.com)

National Pesticide Information Center -- 1-800-858-7378

NPTN provides information by phone about pesticides Monday through Friday, 8:00 AM to 6:00 PM, Central Time. (npic.orst.edu)

Pesticide Disposal Assistance Program -- 1-919-733-3556 (Raleigh, NC)

PDAP gives information in disposal of unwanted pesticides. (ncarg.gov/SPCA/pesticides/PDAP)