WEED MANAGEMENT CONSIDERATIONS FOR PEACH ORCHARDS

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Weeds compete with peach trees for water, light, and nutrients. The primary goal of weed management is to optimize yield by minimizing weed competition. Weed control is a key component of integrated orchard management. Weeds impact orchard productivity and health by competing with trees and by acting as hosts for a variety of pests. Weeds are hosts for catfacing insects, which damage and distort fruit. Winter annual broadleaf weed control is a key part of managing catfacing insects in peach. Weeds may also act as hosts for nematodes that vector viral diseases and nematodes that contribute to premature orchard decline. In areas where voles contribute to tree loss, maintenance of clean, bare orchard floor beneath the trees is a key part of vole control. Maintaining a bare soil surface under peach trees can also minimize crop losses associated with spring frosts. Bare soil surfaces, free of weeds or plant residue, absorb more heat during the day. The release of the absorbed heat at night can increase orchard temperatures by a few degrees. This is commonly referred to as the radiant heat benefit. Although temperature changes are modest, they can be enough to prevent fruit loss during spring freeze events.

IMPACT OF COMPETITION

Weeds compete with trees for light, water, and nutrients. Weed competition for light is normally not a problem with established trees. However, large weeds in newly planted orchards can shade and severely stunt young trees. Vining weeds like poison ivy or Virginia creeper can climb mature trees and compete for light. Conversely, trees use shading as a competitive advantage over emerging weeds. Once mature peaches leaf out, they shade a large portion of the orchard floor. Shade from trees minimizes weed seed germination and reduces the competitiveness of emerged weeds.

The primary competition between weeds and peach trees is for water. North Carolina State University research showed that for every week an orchard is weed-free, yields increase by as much as 120 pounds/acre. Water is essential for maximizing fruit size. Many southeastern peach sites are on sandy loams or coarser textured soils with limited drought tolerance. Soaking rains or irrigation offer relief for short periods of time; however, for optimum fruit size and yield, rainfall is needed every 10 days. Weeds growing in the tree row reduce available water for trees. Insufficient soil moisture can also greatly reduce tree growth, especially in newly planted orchards, and in extreme situations can be a primary cause of tree mortality.

Weed control in young orchards is critical. In a Rutgers University study, competition from smooth pigweed reduced tree growth of newly established trees by more than 40%. Research by Weller et al. showed considerable reductions in tree growth where bermudagrass was present (Table 1). Regardless of the stage of growth, peaches are affected by weed competition for water and nutrients.

Table 1. Effects of bermudagrass competition on newly established peach trees.*

Bermudagrass ground cover	Reduction in tree fresh wt.	
	after 1 yr.	after 2 yrs.
(%)	*(%)*	*(%)*
0	0	0

25	19	28
50	43	44
75	64	62
100	86	87

Weller, S. C., W. A. Skroch, and T. J. Monaco. 1985. Weed Science 33: 50-56.

WEED CLASSIFICATION

Weeds, like animals and other plants, can be separated into groups. Weed groups are often referred to in general recommendations for control. Weeds are frequently grouped according to life cycle and form. Groupings include annuals, biennials, or perennials; grasses and broadleaf weeds; and seed size categories include large-seeded and small-seeded species.

Annuals complete their life cycle within a year. They germinate from seed, grow vegetatively, flower, produce seed, and die — all in one year. Annuals can be further divided into winter annuals or summer annuals, depending on germination time. For example, summer annuals germinate in the spring, grow vegetatively during the summer, and produce seed by late summer or early fall. Annual weeds can also be subdivided into grasses or broadleaf weeds, large-seeded or small-seeded species.

1. Annual grasses are ubiquitous. Annual grasses produce many small, lightweight seeds that are readily dispersed by wind, flowing water, and birds. Annual grasses typically germinate from the top two to three inches of soil and form a fibrous root system. Large crabgrass, field sandbur, goosegrass, and barnyardgrass are common warm season annual grasses. Little barley and annual ryegrass are common cool season annual grasses.
2. Annual small-seeded broadleaf weeds are similar to annual grasses in life cycle and reproductive capacity. Seed size is 1/16 inch or less in diameter. They germinate from shallow depths in the soil, develop a distinct taproot system, and are prolific seed producers. Examples of warm season, annual, small-seeded broadleaf weeds include common lambsquarters, redroot pigweed, Florida pusley, and common ragweed. Cutleaf eveningprimrose is a cool season, annual, small-seeded broadleaf weed.
3. Annual large-seeded broadleaf weeds have seeds measuring greater than 1/8 inch in diameter that may germinate and emerge from depths of up to eight inches in the soil. Large-seeded broadleaf weeds frequently escape pre-emergence herbicide treatments. Susceptibility to pre-emergence herbicides varies considerably among species. Examples of warm season, large-seeded, broadleaf weeds include common cocklebur, sicklepod, bristly starbur, and tall morningglory.

Biennials require two years for completion of their life cycle. They germinate from seed, grow vegetatively to form rosettes (radial clusters of leaves lying close to the soil surface), and store food reserves in roots during the first year. In the second year, biennials flower, produce seed and die. Camphorweed is an important biennial in peaches.

Perennials, which survive for three or more years, may reproduce and spread by seeds, tubers, rhizomes (underground stems), stolons (surface creeping stems), bulbs, and/or roots. Their varied means of propagation and competitiveness make many perennials very difficult to eliminate from orchards. Repeated herbicide applications are often necessary for effective control of perennial species. Johnsongrass, bermudagrass, yellow nutsedge, and wild garlic can be important perennial weeds in peach.

ORCHARD FLOOR MANAGEMENT SYSTEMS

Tillage was, and still is, used by some to control weeds in peach. The practice is uncommon today. Although it eliminates weeds, tillage is time consuming, as it may be necessary every two to three weeks. Operating tillage equipment near trees can result in tree loss due to equipment contact with trees above and below ground. Tillage too close to trees destroys roots near the soil surface that are responsible for absorbing water and nutrients. Michigan State research has shown that where tillage is used for weed control, rather than pre-emergence herbicides, tree root numbers in the tilled area of soil decrease greatly. In addition to tree health concerns, tillage can encourage soil erosion by wind or water.

Sod/Herbicide Strip. The preferred orchard floor management system uses herbicides to maintain a 10 to 12 foot wide vegetation-free strip in the tree row with a ground cover in the middles between tree rows. The vegetation-free strip eliminates in-row weed competition with trees. The sod or ground cover prevents erosion and serves as an alley to facilitate equipment movement through the orchard during wet weather. The ground cover of choice varies with geographical location. In cooler regions of the Southeast, like north Georgia or western North Carolina, creeping red fescue might be preferred. In middle Georgia and South Carolina's Ridge, a warm season perennial grass like bermudagrass could be used. Some growers prefer to establish a cover crop like winter rye annually in the row middles as opposed to using bermudagrass, which often grows into the herbicide strip. Regardless of the region, middles need to be mowed several times during the summer.

HERBICIDE CONSIDERATIONS

University of Georgia grower surveys indicate that more than one herbicide application is required for acceptable weed control in peach orchards. Herbicides are grouped into two categories, pre-emergence (PRE) or post-emergence (POST).

PRE Herbicides control germinating weed seeds, but do not usually give acceptable control of emerged weeds. Some herbicides (i.e., Karmex® and Goal®) provide PRE and POST weed control. PRE herbicides provide residual control capable of lasting several months. Duration of residual control is affected by herbicide selection, application rate, soil texture, organic matter, and environmental conditions following application. Rainfall or overhead irrigation is needed after application to activate PRE herbicides. Generally 0.5 to 0.75 inches of water is enough to activate PRE herbicides. Best control results when activation occurs within a few days of application. The desired interval between application and activation varies with material. Refer to the herbicide label for specific information. Lack of rainfall or overhead irrigation within the desired time frame following application will result in reduced herbicide performance. Degradation from sunlight and volatilization are two processes associated with poor PRE herbicide performance related to inadequate moisture for activation.

In extreme cases, vegetation on the soil surface can interfere with PRE herbicide performance. Vegetation intercepts spray, thus reducing the amount of herbicide reaching the soil. Such situations may require delaying PRE herbicide applications until POST herbicides have had time to affect the needed burn down of existing vegetation. An example of such a situation might be attempting to direct PRE herbicides under trees when a grass sod has grown into the herbicide strip. Combining PRE and POST herbicides can, however, give effective residual control along with good post-emergence activity when emerged weeds are relatively small or do not form a sod.

POST Herbicides. Emerged weeds require the use of a POST herbicide for their control. POST herbicide performance can be affected by weed size, growth stage, and environmental conditions. In general, small weeds are easier to control than large weeds. Some systemic herbicide labels list optimum growth stage or size for herbicide application to maximize control of a specific weed species. Environmental conditions such as drought, frost or freeze, or stress associated with mowing can reduce herbicide performance. Typically, POST herbicide performance is optimum when weeds are in the appropriate growth stage or size, actively growing, and free of stress. Because growing conditions are seldom ideal, optimum growth stage or size should be the primary consideration when controlling weeds with POST herbicides. Some POST herbicides require the addition of a surfactant or crop oil concentrate to improve herbicide activity. Labels

give very specific directions regarding spray additives. Remember, surfactants and crop oil concentrate differ from one another and may not be interchangeable.

THINGS TO CONSIDER

Prior to Application. Prior to using any pesticide, carefully read the label. Labels are legally binding documents and all statements on labels take precedence over any recommendation in university or extension publications.

It is important that application equipment be properly calibrated. Calibration verifies expected sprayer output and application at the correct rate. Over or under application can be costly.

Spray volume can demonstratively impact herbicide performance, especially POST herbicides. Systemic herbicides (Fusilade®, Poast®, Roundup UltraMax®, Select®, and Touchdown®) should not be applied in spray volumes greater than 20 or 30 gal/acre. High spray volume reduces concentration of the herbicide, which can impede herbicide performance. Contact herbicides (Gramoxone Max®) should not be applied in spray volumes less than 20 gal/acre. Spray coverage is critical, and volumes less than 20 gal/acre do not provide adequate coverage. A spray volume of 20 gal/acre is a good volume for applying contact and systemic POST herbicides, as well as most PRE herbicides.

Spray tips influence application uniformity, spray volume, and droplet size. The most commonly recommended herbicide spray tip produces a flat fan spray pattern. The flat fan pattern provides excellent spray coverage and comes in sizes capable of applying a range of volumes. Flat fan nozzles that minimize spray drift should be considered in order to decrease the risk of off-target herbicide movement.

Surfactants. POST herbicides commonly require a surfactant. Some herbicide formulations (Roundup UltraMax®, Touchdown®, etc.) have surfactant included, whereas others require the addition of a surfactant (Gramoxone®) when mixing. Surfactants modify surface properties of water to improve the spreading, sticking, wetting, and/or emulsifying characteristics. Spray additives are recommended for most POST herbicides.Proper mixing procedure is an important part of herbicide applications. The initial step is to fill the tank approximately one-half full with water and begin agitation. Herbicide products are then added in a sequence of least soluble to most soluble. For example, dry materials such as wettable powders or dry flowables should be added first, then flowables, emulsifiable concentrates, soluble concentrates, and finally surfactants. For dry materials, best results are obtained by forming a slurry (1:1 mix of water and dry product) and adding it to the tank. To prevent settling of materials and ensure uniformity of the spray solution, good agitation must be maintained throughout the mixing and spraying process.

WEED MANAGEMENT / HERBICIDE SYSTEMS

Establishment and First Year. Orchards are often planted into herbicide-killed perennial sod. After tree rows have been marked off, and prior to planting, glyphosate can be used to kill vegetation. Allow four weeks prior to planting to control cool season grasses and perennial weeds. In warmer production areas where bermudagrass or bahiagrass are common ground covers, a late summer or fall application to marked rows is appropriate.

Tillage should not be done within three weeks of herbicide application. Prior to planting, sub-soiling or other tillage operations can be performed. Once soil has settled around tree roots after planting, a PRE herbicide labeled for use on newly planted peaches can be applied.

POST herbicides will be necessary for controlling escaped weeds throughout the summer. However, young trees must be shielded from paraquat or injury will occur. Growers have used corrugated drainage pipe cut in short pieces with one side slit for easy placement around the tree. Cardboard milk cartons have been used in some areas. Another option is painting the base of the tree with a white latex paint. The paint acts as a

barrier to the herbicide, protecting the tender, green bark from injury. Perennial grasses can be very competitive. Poast®, Fusilade®, and Select® are registered for use in newly established orchards. They are safe, effective options for POST grass control.

Established Orchards. In established orchards, growers have a broad range of herbicide options. The herbicide program of choice begins with a fall PRE application in combination with paraquat. This application maintains a bare soil surface under trees through the winter, minimizing winter annual weed competition in the spring and maximizing the radiant heat benefit. A winter (six weeks prior to bloom) 2,4-D application applied to the drive alley between tree rows is recommended to control winter annual broadleaf weeds not impacted by the PRE herbicide in the tree row. Eliminating winter annual broadleaf weeds from the entire orchard floor reduces catfacing insect populations and is part of an integrated approach to their management. In the spring, after weeds emerge, a PRE herbicide with paraquat or glyphosate should be applied for residual summer annual weed control.

One very reliable approach for managing orchard weeds in southeastern peaches makes use of two PRE herbicide applications each year. A fall PRE application is made post-harvest. In North Carolina, the spring PRE herbicide will often not be needed until mid-May (depending upon environmental conditions, geographical location). Beware that some pre-emergence herbicides have long pre-harvest intervals, which prevents their use that late in the spring on early maturing varieties. Those varieties will require an earlier application if a herbicide with a long pre-harvest interval is used.

PERENNIAL GRASS WEEDS

Perennial weeds like bermudagrass and johnsongrass are very competitive with peach trees. Poor perennial grass control in newly planted orchards can significantly reduce tree growth and increase mortality. In established orchards, perennial grasses reduce fruit yield and size. In North Carolina, a one-quarter inch increase in fruit size has been gained with bermudagrass control. Selective grass herbicides provide excellent annual and perennial grass control. For maximum control, Fusilade®, Poast®, or Select® can be applied to bermudagrass with 4" to 6" long stolons or johnsongrass 15" to 18" tall. A second application should be applied when regrowth occurs. Refer to product labels for rates, spray additive details, and use restrictions.

TANK MIXING AND HERBICIDE ROTATION

Tank mixing, combining herbicides, is commonly used to expand the weed control spectrum. The most common tank mix combines a PRE with a non-selective POST herbicide to burn down existing weeds and provide residual control of annual weeds. Combining more than one PRE herbicide in a tank mix with a non-selective POST herbicide can lengthen and expand residual control spectrum. An excellent example is increased residual grass control from combining Surflan® with Princep®. Princep® alone provides residual grass control for about six weeks. The addition of Surflan® can result in season-long residual control.

Orchard herbicides should be used on a rotation. No matter how good or inexpensive a herbicide program might be, *DO NOT* use it continuously. Continuous use of the same herbicide year after year selects for, or favors, weed species not controlled by that herbicide or herbicide program. Rotating herbicides yearly and tank mixing PRE herbicides are ways to ensure the long-term effectiveness of your preferred programs.

Resistant weeds are another concern that reiterates the importance of herbicide rotation. Resistance occurs when a weed bio-type is no longer controlled by a herbicide known to control that weed species. Weed resistance can be forestalled by rotating herbicides, tank mixing PRE herbicides, and using non-selective POST herbicides to prevent seed production following poor control with residual herbicides.

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