8 Weed Management

8.1 Calibration to Ensure Correct Herbicide Rate

Herbicide labels indicate rate of application as amount of product per acre; that is, per acre actually treated. Only if you broadcast herbicide over the entire orchard floor will the treated acreage equal the orchard acreage. Follow the instructions below to assure application of the correct herbicide rate.

8.1.1 Calculating Nozzle Flow Rate

Travel Speed:
For most situations, 2–2.5 mph is best (176–220 ft. /min.).

Pressure:
Use low pressure (20–35 psi) to minimize formation of small droplets, because small droplets can drift off target.

Spray Volume per Treated Acre:
Generally, low rates (20–30 gals./acre or less) are more suitable for postemergence herbicides, where runoff from weeds would reduce effectiveness. Higher rates, 40–50 gals./acre, may provide better coverage and control when using preemergence herbicides.

Nozzles:
Avoid nozzles that produce fine mist. Generally, hollow cone nozzles produce the finest droplets, flat sprays are second, and full cone nozzles produce the coarsest spray. Use air-induction nozzles if available in the desired spray pattern.

A single boomless off-center flat spray nozzle, or a flooding nozzle, may be suitable for some orchards, but one or more regular flat spray nozzles on a boom may be better where branches are close to the ground.

Shields:
By adding a shield over the spray boom, thin, young bark of fruit trees may be protected when using glyphosate or other herbicides that can injure fruit tree bark. If weeds are tall when treated and spring back into the tree branches after application under a shield, glyphosate can still be picked up through the leaves of the trees.

Use the following formula to determine nozzle flow rate in gal./min., then consult a nozzle manufacturer's chart to select the proper nozzle.

8.1.2 Definition of Terms

1. **Gallons per Treated Acre (G/TA)** = Amount of herbicide spray you want to apply per treated acre.
2. **Swath (S)** = Width of the sprayed area in feet.
3. **Travel Speed (TS)** = Feet traveled per minute.
4. **Nozzle flow rate** (gallons per minute) = (Gallons per Acre x Swath x Travel Speed) divided by 43,560

Nozzle Flow Rate = (G/TA x S x TS) / 43,560

Example 1:

What nozzle flow rate do you need to apply 25 gallons of herbicide spray mix per treated acre, using a 3-foot-wide swath and a travel speed of 220 feet per minute (=2.5 miles per hour)?

Nozzle flow rate
= (25 x 3 x 220) divided by 43,560
= (16,500) divided by 43,560
= 0.38 gallons per minute.

If using 2 nozzles, select 2 that will give 0.19 gallon per minute each at the selected pressure.

8.1.3 Checking Herbicide Sprayer Output

Spray Pattern:
Check uniformity of spray pattern, using corrugated fiberglass roofing panels as a spraying surface. Spray from the same height as will be used in the orchard. Compare liquid volume collected in each trough.

Actual Spray Volume:
With proper nozzles installed, travel a measured distance at the selected speed and pump pressure. Use this formula to determine the actual spray volume in gallons per treated acre.

Gallons per Treated Acre:
= (Gallons sprayed during trial run x 43,560) divided by (Feet traveled during trial run x Swath width in feet).

Example:

You emptied a tank containing exactly 3 gallons in a distance of 1,200 feet. The treated swath was 3 feet wide. How many gallons of spray are you applying per treated acre?

Gallons per Treated Acre
= (3 x 43,560) divided by (1,200 x 3)
= (130,680) / (3,600)
= 36.3 gallons

If you want to apply 4 lbs. of herbicide per acre, then in this case you would add 4 lbs. of herbicide to each 36 gallons of water in the tank.

Agitation:
If herbicides are allowed to settle or separate in the sprayer tank, distribution in the orchard will not be uniform. Provide constant agitation when using wettable powders, or any other insoluble formulation (emulsions, emulsifiable

concentrates, dry flowables, liquid flowables, and suspensions). Use defoaming adjuvant when needed to control excessive foam.

8.2 Groundcover Management

Management of the orchard floor is an essential and often expensive piece of the overall orchard management scheme. A poorly designed and managed orchard floor will increase costs in several important ways, including increased mowing costs, reduced yield due to weed competition, and wear and tear on equipment. Several orchard floor management options to consider are:

1. Clean Cultivation/Fall Cover

This option can be effective with young trees, in particular as a management system that eliminates weed competition and encourages tree growth. These benefits do not come without cost. Soil erosion in particular is a real risk. Late summer seeding to a fall cover crop such as spring oats is essential to limit erosion. This fall cover must be planted early enough to allow ample autumn growth to protect soil from cold penetration in winter. Loss of organic matter with this system is another liability–soil organic matter is broken down quickly with repeated cultivation. In addition to these potential risks, calcium availability to trees may be reduced and soil compaction problems may develop.

2. Mulch

Mulching offers some attractive potential benefits, including improved soil moisture retention and weed suppression. Unfortunately, mulching also offers a couple of key liabilities that make it impractical as a general orchard practice. Perhaps most importantly, mulch provides an ideal habitat for voles (mice). Also, while the use of mulch will increase levels of organic matter and key nutrients including potassium and magnesium, its use will likely lead to reduced calcium levels.

The use of wood-based mulch such as wood chips and bark may be valuable on excessively drained soils

3. Permanent Sod

Permanent sod, often including an under-tree herbicide strip, is the orchard floor management system most commonly used. A permanent sod offers many important benefits. It reduces soil erosion; gives support (especially important when soils are wet) for heavy equipment needed for brush removal, pesticide application, and mowing; reduces dust and dust deposits on fruit; reduces tree rack or wobble during wind events; insulates against cold penetration in winter; increases movement of key nutrients including calcium into the tree root zone; and may provide winter refuge for a beneficial mite species.

A permanent sod also allows soil organic matter levels to increase over time, a condition which when coupled with proper soil pH management, eliminates the need to apply phosphorous throughout the life of the orchard.

The key to success with this system is establishment (preferably prior to planting) of a permanent sod floor. Combinations of slow-growing grass types such as low-growing hard fescues and perennial ryegrasses are preferable.

The process of establishing an orchard floor should include elimination of perennial weeds and grasses through use of an herbicide such as glyphosate (Roundup). In addition, correction of soil drainage deficiencies, soil pH and nutrient adjustment based on soil test recommendations, and preparation of a smooth, stone-free soil surface for seeding are all key elements for success. A 2-year soil preparation process that includes a full summer of cover cropping with a vigorous cover crop such as Sudan grass or Japanese millet is ideal. Seeding of a new orchard floor is best done in late summer or early autumn. In older plantings, the permanent sod is often a ‘wild’ mix of more vigorous grasses and herbaceous plants, a mix that requires extensive management including several mowings annually. In addition, the orchard floor is often rough and rutted from years of equipment traffic and dotted with rock outcroppings, adding to the management cost.

Some drawbacks are associated with permanent ground cover. Certain plant species such as alfalfa can promote pest populations (e.g., tarnished plant bug). Ground cover also provides competition for water and nutrients, especially to young trees. If not properly managed, it also provides habitat for voles. These drawbacks can be minimized with appropriate management of the orchard floor.

Mowing is the most important orchard floor management tool. Establishment of an orchard floor composed of slow growing grass species can reduce mowing requirements significantly. With an orchard floor composed of vigorous ‘wild’ species, several timely mowings will be required to prevent undue competition for trees and reduce vole populations by limiting their preferred habitat. A final mowing in late autumn (using a flail type mower) can reduce the potential apple scab infection risk the following spring.

Herbicides are generally used to manage groundcover around tree trunks and in that portion of the under-tree area that is difficult to mow. For mature trees on seedling or semi-dwarf rootstock, this herbicide strip may extend up to 6 feet or more out from tree trunks. With dwarf rootstock trees, the herbicide strip generally extends 2 feet or less out from the trunks. Maintaining herbicide strips as narrow as practical is important in reducing the risk of soil erosion and tree rack as well as cold penetration into the root zone of trees. Research has shown that if orchards are irrigated the herbicide strip can be more narrow. In addition, narrow strips may facilitate movement of mite predators from the orchard floor into trees in summer. Less total herbicide is used per acre when these strips are narrow, reducing risk for environmental problems including herbicide leaching and runoff.

It is important to use herbicides judiciously for maintenance of these strips. Ideally, the use of herbicides will leave a living groundcover and root system or a mat of killed ground cover to protect soil from erosion and cold penetration. The overuse of herbicides, even in narrow strip systems, will lead to a barren soil strip and a high risk of erosion, tree rack, and cold temperature injury to tree root systems, and storm-water runoff

Herbicide timing should be chosen so as to assure that live groundcover, or a matting of killed groundcover will be present when soil erosion is likely, especially during the dormant season, and when thunderstorms are likely. Practices that promote extensive moss growth have not been identified, but it is evident that some herbicides inhibit moss establishment and others do not.

Maintaining or increasing soil organic matter (humus) should be an objective of sustainable orchard groundcover management in New England. Soil organic matter is much more than the dead leaves, stems, and roots produced by the groundcover and orchard trees. As plant tissues decay, through the activity of soil microorganisms (bacteria, actinomycetes, fungi, algae, protozoa, and nematodes) they produce **humus**, a complex mixture of organic compounds that gives topsoil its characteristically dark brown color. The soil microbes themselves die, contributing to the total pool of biomass that forms humus. In sod-covered soils, humus typically constitutes the bulk of soil organic matter. But humus is not permanent. Its constituents undergo a slow, but continuing process of decay. If soil is kept bare, the major food source for soil microorganisms is eliminated, and humus can then be expected to disappear faster than it is formed.

Humus is a major source of nitrogen, phosphorous, and sulfur. These three essential elements are abundant in biological tissue, the source of humus. Humus also has a controlling influence on the availability of essential micro-nutrients, not because its parent biological tissues were high in micro-nutrients, but because humus can form "chelates" with copper, zinc, manganese, etc. that are released from soil minerals. Chelated micronutrients are held against leaching from the soil, and under the right conditions, are available to plant roots.

Another value of humus derives from its electrostatic attraction for oppositely charged nutrient elements, protecting them against leaching. This property, called cation exchange capacity, is also exhibited by clay particles. Cation exchange capacity, together with chelation, allows soils to hold nutrients until picked up by plant roots. Soils in which these properties are at a low level, as in soils with little clay or organic content, are naturally low in agricultural productivity, because they cannot supply as much mineral nutrition as the crops are capable of using.

Additional benefits of soil organic matter are:

- It increases moisture-retention in sandy soils. Organic matter can hold up to 20 times its weight in water.
- It acts as "glue" to hold very small soil mineral particles together in units called aggregates. Aggregation permits a loose, open, granular condition that aids penetration by water, air, and roots, and resists erosion.
- It has the ability to absorb many organic pesticides, holding them near the soil surface, where they are more likely to be degraded by biological activity and sunlight, rather than leach to groundwater.

8.3 Herbicides and Their Use

If you use herbicides, you are responsible for their safe and proper use. The label is the law. Be aware of the potential for contamination of waterbodies, groundwater, and food.

8.3.1 Types of Herbicides

Herbicides can be separated into two broad categories: those applied to the soil before weeds have emerged (pre-emergence or 'residual' herbicides) and those applied directly to visible weeds (post-emergence or 'contact' herbicides). A few pre-emergence herbicides also have some activity against emerged weeds.

Residual herbicides have a lasting effect on the soil. How long weed growth is prevented by an application of residual herbicide depends on how quickly it is broken down on the soil by sunlight, microbial activity, or soil chemistry, and whether the herbicide is volatilized or leached below the upper inch or so of soil. Non-residual herbicides have little or no effect except on weeds that are present at the time of application.

Finally, some herbicides are effective only on grasses; some only on broadleaf weeds, and others show degrees of activity against both types of vegetation. No herbicide is effective against all species in all categories of weeds. Some herbicides are effective on certain weed species outside of the indicated category. For a list of specific weeds controlled, see product labels. The use of residual herbicides in particular should be limited to specific needs. The routine use of residual herbicides may increase the chance of creating a bare soil environment around trees (with an increased risk of soil erosion, tree rack, and cold temperature injury to tree roots). And it may facilitate the development of weed populations that are difficult to control with currently available herbicide options.

8.3.2 Manage to Prevent Resistance

Repeated use of a single herbicide, or herbicides with a shared specific mode of action without rotation or the use of alternative tactics such as cultivation or weed suppressing cover crops, may lead to herbicide-resistant weed populations. The build up of weed species that are not

affected by the specific herbicide, creates a new complex of weeds species under the trees.

Herbicides for which the risk of resistance is greatest include: diuron (Karmex), oryzalin (Surflan), oxyfluorfen (Goal), paraquat (Gramoxone), and terbacil (Sinbar).

Combining pre-emergence herbicides with different modes of action is one technique that reduces the risk of weeds developing herbicide tolerance. The use of post-emergence herbicides such as glyphosate (Roundup) also helps, as do non-herbicide practices such as close-mowing and cultivation. Weed scouting before herbicide application is useful to identify which species are present. Scouting after herbicide application can reveal weed escapes or species shifts.

8.3.3 Herbicide Selection

No herbicide product is completely effective against weeds *and* always harmless to the trees. Good management requires choosing the proper product, or combination of products, to fit the situation. Give special attention to age of the trees and soil factors.

Age of the trees. Young trees have tender, green bark that can be damaged or penetrated by contact herbicides, both systemic and non-systemic. Damage to a high value perennial crop, like apples, can have major and prolonged financial impact. Pay close attention to the development of corky, dead outer bark on the portion of the trunk that will be contacted by a contact herbicide. Properly applied trunk paint or vole guards will help if they completely block the spray from contacting the green bark. However, the most important consideration is the careful application of herbicides, using shielded sprayers or wipe-on applicators where appropriate to minimize the risk of herbicide contacting the bark.

The most common and serious damage occurs on young fruit trees when unprotected bark is contacted by concentrated doses of herbicides that have both contact and systemic activity (e.g. glyphosate, sulfosate and 2,4-D). These products can be used in young orchards, but their use requires precautions to prevent significant exposure of the trees.

Non-systemic products can also damage young trees, usually by burning a dead area into the trunk within about a foot of the soil surface. This can occur if the product is overly concentrated in the spray solution, and/or mixed with higher rates of liquid nitrogen fertilizers.

Young trees have shallow root systems, and most of their roots are within the herbicide treated area. Young tree roots may be highly exposed to root active herbicides that leach into the upper foot of soil – simazine, diuron, terbacil (and to a lesser extent norflurazon and dichlobenil) all have the potential to damage trees in young or dwarf orchards, particularly on light sandy soils. Use caution and low rates when using these herbicides.

Soil Factors. Organic matter and increased binding sites that come with finer soil texture are important soil qualities that hold potentially mobile herbicides in the upper 2–4 inches of soil where they act to control weeds rather than affect fruit tree roots. If the product label suggests that you take these factors into consideration, do so. Orchards often have bands of lighter, shallower or gravelly soils running through them. Identify and record these poor soil areas. Use products and rates that are safe on the weakest soils, not the average.

8.3.4 Herbicides Can Damage Trees

To avoid tree injury, know the potential for injury, and follow label instructions carefully. Injury can be local (affecting only tissue directly hit by spray), or it may be systemic. Systemic injury can produce symptoms some distance from the site of contact, due to the ability of some herbicides to translocate within the plant.

Note the potential for tree damage by these herbicides:

- **glyphosate, sulfosate**: Are absorbed by foliage, root suckers, young-green bark and fresh pruning wounds, resulting in systemic injury. Do not apply after mid summer (July 15). Avoid contact with bark, foliage, and rootsuckers.
- **diuron, oxyfluorfen, terbacil:** Are absorbed by foliage and young bark, resulting in local injury. Shield bark of first- and second-leaf trees to prevent damage.
- **paraquat, glufosinate-ammonium:** Are absorbed by foliage, and bark, resulting in local injury.
- **2,4-D:** Is absorbed by foliage, bark, and roots, resulting in systemic injury. **Do not use 2,4-D near or in grapes!!!**
- **dichlobenil, diuron, simazine, terbacil, and 2,4-D** can, under some conditions, be taken up by roots, resulting in injury or other symptoms. Root uptake is most likely in soils containing very little clay or organic matter. In the case of 2,4-D, the chemical is highly water-soluble, so movement to roots is possible where groundcover is insufficient to absorb (trap) the 2,4-D.
- The presence of burr knots may increase the risk of herbicide uptake by trees if herbicide comes in contact with bark tissue.

Other listed herbicides may produce injury to trees if not used at appropriate label rates and timings, taking into account tree age, soil texture, and soil organic matter.

8.3.5 Leaching and Runoff Potential

Leaching (downward herbicide movement through soil) is influenced by characteristics of the soil (texture, compaction, organic content, pH, wetness, temperature). In

addition, certain soil microorganisms and living weeds can sometimes metabolize absorbed herbicides, rapidly or gradually altering them to non-phytotoxic forms that may have different leaching characteristics. Leaching potential is also affected by certain characteristics of the herbicide, including water solubility, electrostatic properties, vapor pressure, and photodecomposition.

Because numerous complex interactions can occur between herbicides and the soil environment, it is impossible to accurately generalize leaching behavior for a wide range of possible soil situations.

Downward movement is most likely with chemicals that do not degrade quickly and do not adsorb strongly to clay or organic matter. The potential for tree damage or groundwater contamination is greatest with such chemicals when heavy rain comes soon after application, or where spills occur. Special attention should be given to the mixing and loading operation, as spills can quickly overload detoxifying processes of soil and sunlight.

Runoff (surface loss of herbicides from treated areas) can be avoided by the same means used to avoid soil erosion. Sloping ground and absence of groundcover increase surface runoff. Living sod or other dense groundcover and organic mulches inhibit runoff. Where problems persist, grass strips and berms can be used to separate treated areas from sensitive borderlands. Practices that prevent concentration of rain water into narrow channels will help. Wheel ruts often become stream-beds during heavy rainfall, as do channels from previous rainfalls. Travel lanes should run across rather than with the slope. Maintain and operate equipment with caution to prevent spills.

8.3.6 Need for Rain or Irrigation

Herbicides used for pre-emergence weed control generally require 0.5–1 inch of rain or irrigation, or shallow cultivation to initiate herbicidal action. The need for prompt incorporation varies.

Warm bright days speed surface breakdown and evaporation of certain herbicides. Some herbicides must be incorporated within 24 hours after application, while other materials can be stable for 3–4 weeks or more. Specific information is provided on product labels if rapid incorporation is necessary.

8.3.7 Persistent Weeds

Perennial and biennial species that persist where pre-emergence herbicides have been used can often be killed by one or more treatments with glyphosate, 2,4-D, or a combination of these two. Such species include bindweed, brambles, Canada thistle, dandelion, dock, evening primrose, goldenrod, horsenettle, plantain, poison ivy, and vetch. Yellow nutsedge can be killed with glyphosate, glufosinate, or paraquat, properly timed. Mid-June to mid-July is the best time for paraquat and glufosinate, while August and September are best for glyphosate. These late summer applications also carry the greatest risk of damage to the crop if foliage or green tissue is contacted by improper application. Note that preharvest interval requirements may influence choice of timing. In stone fruit crops, clopyralid (Stinger) is also an option but it has a very specific weed spectrum. Weed identification is important in selecting this herbicide for perennial weed control.

8.3.8 Application Method

Regardless of which herbicides are chosen, proper application is essential to insure safety and efficacy. Take the time to set up and check the mechanics of the weed sprayer. This is too often neglected. Every time an herbicide sprayer is brought out for use, it needs to be checked, both for level application across the boom and rate per sprayed acre. There are many ways to calibrate orchard herbicide sprayers: use the one you are most comfortable with. If you do not already have a good method, try the procedure outlined at the end of this section.

Most orchards are sprayed with a single sided boom sprayer, with two, three, or four flat fan nozzles placed about a foot apart, starting at the distant tip of the boom. The boom is adjusted so that the spray from each nozzle over-laps about 1/3 of the pattern from the adjacent nozzles on either side at the level of the target. The “target” can be either weed growth if you are spraying contact herbicides, or the soil surface, if you are applying soil residual products.

Some growers use single “flood-jet” style nozzles to apply contact materials on both sides of a tree row with a single pass by the sprayer. This is somewhat effective, but not without problems, including injury to tree trunks. Most single nozzle band applications wider than a foot or two distribute herbicide unevenly. Single nozzle band application should not be used with most soil residual materials, or for products that may injure the young tree if applied to the trunk.

The use of anti-drift agent(s) is recommended, particularly for contact and systemic herbicides. With some herbicides and target weeds, addition of a surfactant, spreader-sticker, and or crop oil concentrate is also recommended. See label for details

8.3.9 Rate of Herbicide

For many pre-emergence herbicides, the lower recommended rate is the best choice for coarse texture orchard soils (sandy loam or loamy sand), provided moisture conditions are suitable. Some preemergence herbicides are strongly adsorbed onto soil organic matter and/or clay particles. Therefore, on relatively high organic soils (above 3.5 percent by Walkley-Black method) and on

clay loam soils, the higher label rate may be needed for pre-emergence control.

Soil texture and organic matter content can be determined by soil testing laboratories. Several different methods are used to estimate soil organic matter. For the same soil, different methods can give much different results. To properly interpret label recommendations regarding soil organic matter, ask your soil testing laboratory to indicate its estimate of organic matter as though it had been done by the Walkley-Black method.

Surface litter (non-decomposed organic tissues) can bond some herbicides, resulting in failure of the chemical to reach the soil where germinating seeds can be killed. Herbicides that are so affected will include a label recommendation for removal of surface litter, or clean cultivation prior to application of the herbicide.

Rates for post-emergence herbicides vary according to weed species and growth stage. Drought conditions that slow weed growth may make weeds more tolerant of post-emergence herbicides applied during that time.

Unless product labels suggest addition of surfactants or other adjuvants, their use is not likely to improve herbicide activity. Post-emergence herbicides should be used with enough water to avoid missing any plants or plant parts, while avoiding runoff, although systemic herbicides such as Roundup can be effective at low water volumes and incomplete plant contact.

8.3.10 Timing Herbicide Applications

Product labels limit timing of some herbicides to certain months, weed growth stage, temperatures, crop growth stage, or days to harvest. Detailed information is included on the product labels.

8.3.11 Tank Mixes

- If no statement concerning tank mixing of two or more herbicides is given on product labels, mixing is legal, though a test for compatibility will be necessary.
- Do a small-scale jar test as follows: Place one pint of water in a quart jar. Add each pesticide or a pre-mix of pesticide in water, one at a time, and shake well with each addition. Use each product in about the same proportion to water as it will be in the field mixture. One half of a measuring teaspoon of herbicide in a pint of water is approximately equivalent to one pint or one pound of herbicide in 25 gallons water. Unless labels indicate otherwise, add pesticides in this order: wettable powders, followed by flowables, emulsifiable concentrates, water solubles, and recommended adjuvants. However, when compatibility enhancers are used (tank mix adjuvants or spreader/stickers) these should be added first to the water. Invert the jar 10 times, then inspect the mixture immediately and again after 30 minutes. If a uniform mix cannot be made or if non-dispersable oil, sludge, or clumps of solids form, the mixture is incompatible and should not be used. Minor separation after 30 minutes (without sludge or clumps) that remixes readily with 10 jar inversions, is tolerable if spray tank agitation is good.
- When you tank mix in volume, put 2/3 of the water in the tank first. Then add pesticides one by one, with wettable powders first. Agitate for thorough mixing after each addition, before pouring in the next. Finish filling the tank with water.
- Maintain continuous agitation until the tank is empty.

8.3.12 Established Orchard Herbicide Program

A late spring and late fall application of herbicides to herbicide strips of established orchards is recommended. Specifically:

- Late fall herbicide application should include a translocated contact herbicide (2,4-D, or glyphosate if perennial weeds are present and trees can be shielded or missed) AND a residual herbicide (Kerb, Solicam, Surflan, Prowl, Chateau, Matrix).
- Late spring herbicide application should include a different residual herbicide (Karmex, Sinbar, Solicam, Surflan, Prowl, Chateau, Matrix) and a contact herbicide if perennial weeds are present or annual weeds have emerged.

These two applications may give effective season-long control, improve consistency of treatment, decrease risk of crop injury, and decrease competition by weeds in early spring.

('Groundcover Management and Herbicides' adapted from original New England Apple Pest Management Guide, by William Lord, University of New Hampshire. Adapted and edited for most recent version by George Hamilton, UNH Cooperative Extension, and Jon Clements, UMass Extension. Also from Cornell Pest Management Guidelines for Commercial Tree Fruit Production, Robin Bellinder and Deborah Breth.)

8.4 Herbicides for Tree Fruits

2,4-D is marketed in various formulations. *Weedar 64 and *2,4-D Amine are registered for use in APPLE, PEAR, and STONE FRUIT orchards at least 1yr old. Unison is a new formulation of 2,4-D acid for pome and stone fruit. 2,4-D is a selective herbicide that is effective on many annual and perennial broadleaf weeds when applied as a postemergence foliar spray. It is particularly effective in controlling dandelions on the orchard floor when applied in late fall. These materials should not be applied during the bloom period of fruit trees, i.e., from the time flower buds begin to expand until 4 weeks after

bloom. Combinations of 2,4-D plus glyphosate have been effective in controlling many difficult perennial broadleaf weeds. Do not apply to bare ground or light, sandy soil. Be careful with herbicide DRIFT! Grapes, many flowers, and vegetable are very sensitive to 2,4-D drift.

Carfentrazone-ethyl is registered as Aim 2EC and 1.9EW at 2 and 1.9 lb ai/gallon, respectively. It is a contact, post-emergent, desiccant herbicide for control of young broadleaf weeds only; it has no effect on grasses or sedges. Aim is most effective if used on weeds that are small (up to 4 inches high) in combination with glyphosate. Tank mix provides faster desiccation of weeds than glyphosate alone, but is not effective for long-term control of perennial weeds. Aim should always be mixed with crop oil concentrate or nonionic surfactant. Do not allow spray to contact green bark, fruit or foliage. Aim can be used for sucker control when tissue is soft and succulent.

*Clopyralid is registered as *Stinger, at 3 lb.ai/gallon. It is a selective, postemergence herbicide for control of some broadleaf weeds if applied while weeds are generally small and actively growing. Some of the weeds controlled include clover species, dandelion, nightshade, burdock, common groundsel, jimsonweed, horseweed, and many thistle species including Canada. Can be used in STONE FRUIT orchards but is not labeled for use in pome fruit. *Stinger is highly leachable in light soils.

Dichlobenil is available in 4% granular and 50% wettable powder formulations. Dichlobenil volatizes rapidly under warm, moist soil conditions and must be applied in late fall or very early spring before the soil temperature exceeds 45°F to minimize such loss. It is absorbed principally by the roots of established and germinating weeds and rapidly translocated to growing points. This material is effective against a wide range of annual and established perennial grasses and weeds including nutsedge and quackgrass. Applications of 100 lb of 4G/A are effective on many annual grasses and broadleaf weeds, whereas 150 lb/A are usually required for control of most established perennials. Dichlobenil is labeled for use on APPLE, PEAR, and CHERRIES.

Diuron is marketed in an 80% dry flowable formulation as Karmex or Diuron 80DF as well as Diuron 4L (4lb AI per gallon). Diuron is effective against germinating annual broadleaf weeds and some annual grasses. It is absorbed by roots and translocated to the leaves where it interferes with photosynthesis. For best results it must be present in the soil before weed seeds germinate. Diuron is best used in combination with materials that are more effective on grasses. It is not effective on established perennial grasses or broadleaf weeds. Diuron has been effective against triazine-resistant pigweeds. Rates must be determined in relation to soil texture and organic matter content. Use is limited to APPLES, PEARS, and PEACHES. Labels do not recommend treatment of trees on full dwarf rootstocks.

Fluazifop-p-butyl is available in a 2 lb AI/gallon formulation as Fusilade DX. Fluazifop is a selective postemergence herbicide effective on both annual and perennial grasses. Its best use is for control of grasses in newly planted orchards. Two applications are usually necessary with perennial grasses such as quackgrass. Spot treatments are suggested unless a severe grass problem exists. Inclusion of a nonionic surfactant enhances uptake by grass leaves. Can be used in STONE FRUIT ORCHARDS of any age and in NON-BEARING APPLE and PEAR ORCHARDS.

Flumioxazin is a herbicide with pre-emergent and post-emergent activity, formulated as Chateau WDG. It provides residual control and will also enhance the activity of the burndown program with glyphosate or paraquat. It is readily absorbed by leaves, and quickly causes bleaching and wilting of weeds. It is effective for post-emergence control of many broadleaf weeds while they are small, 2-6 inches high, depending on the weed species. It also provides effective pre-emergent control of many broadleaf weeds and grasses. The label gives a rate of 6 to 12 oz. per acre per application (24 oz. maximum per year). If the soil is sandy or gravelly (over 80% content), a maximum rate of 6 oz/acre should be applied in trees established less than 3 years. If applied to trees established less than 1 year, the tree trunks must be protected with non-porous tree wraps. Label restricts application to between final harvest and pink bud on apples and budbreak on stone fruit.

Glufosinate-ammonium is currently registered as Rely 280 formulated as a liquid with 2.34 lbs. AI per gallon. Rely280 is a non-selective herbicide for application as a directed spray labeled for control of a broad spectrum of annual and perennial grass and broadleaf weeds, and some woody species in APPLES only. Rootsucker control in APPLES is not allowed on the Rely 280 label. It has no residual activity. Avoid all contact with foliage and green bark tissue since injury to the trees can result, especially in young trees.

Glyphosate is distributed as an aqueous solution under various generic formulations and under the name Roundup Original or Roundup WeatherMax. Glyphosate is a nonselective broad-spectrum herbicide for controlling established annual and perennial grasses and weeds plus woody brush, vines, and trees. No residual soil activity is to be expected from this material. The best timing of applications varies with weed type but is usually after weeds have developed full foliage and/or have begun to flower. Greatest effectiveness against nutsedge is obtained after tuber formation begins. Inclusion of 2,4-D and/or a nonionic surfactant is suggested to increase effectiveness. Glyphosate is absorbed through foliage and bark and translocated

throughout the plant. Glyphosate may be applied as a directed spray or by wiper in APPLE, PEAR, and CHERRY orchards. Do not allow contact with foliage or bark on trunks of young fruit trees. Root-suckers or low branches that might be contacted by glyphosate should be removed at least 10 days before the glyphosate application. In APRICOT, PEACH, NECTARINE, PLUM, or PRUNE plantings, use wiper applications only. PEACHES and PLUMS are EXTREMELY SENSITIVE to glyphosate, and ANY contact with leaves or small branches or trunks of young trees may result in severe damage or tree death.

Halosulfuron-methyl (Sandea, Gowan Co.) has a supplemental label for APPLE only and has both pre- and post-emergent activity on broadleaf weeds and nutsedge. Do not apply to apple trees established less than one year.

Norflurazon is formulated as a dry flowable in Solicam 80 DF. Norflurazon at rates recommended provides control of most annual grasses and many annual broadleaf weeds plus suppression of quackgrass and nutsedge. It is absorbed by roots and translocated to growing points where it inhibits pigment formation. The material must be applied and moved into the soil by rainfall or irrigation before seed germination. Rates of application depend on organic matter and clay contents of the soil and crop. Norflurazon is most frequently used in tank-mix combinations that will increase effectiveness of broadleaf weed control. Established perennial weeds are not effectively controlled by norflurazon. Registered for use in APPLE, PEAR, APRICOT, CHERRY, NECTARINE, PEACH, PLUM, and PRUNE, depending on tree age.

Oryzalin is available as an aqueous suspension (Surflan A.S. or Oryzalin 4A.S.) containing 4 lb AI per gallon. It provides effective control of most annual grasses and some annual broadleaf weeds. Oryzalin has controlled triazine-resistant pigweed, but has not been sufficiently effective on ragweed or Pennsylvania smartweed. It is not effective against established weeds or grasses. Oryzalin is absorbed by roots of germinating seedlings and interferes with cell division. To be effective, it must be applied and moved into the soil by 1/2 - 1 inch of rainfall-before seed germination. Oryzalin can be used in newly planted orchards as soon as the soil settles around the roots and no open cracks are present. It can be used in all tree fruit crops.

Oxyfluorfen is available as a 2 lb AI per gallon formulation in Goal 2XL or Galigan 2E. Oxyfluorfen has preemergence and post-emergence activity as a contact herbicide. Uptake can be through leaves, stems, or roots, but very little translocation occurs in the plant. Destruction of membranes occurs when treated plant parts are exposed to light. Oxyfluorfen is primarily effective against seedling broadleaf weeds. It does not control established perennial weeds or grasses and is best used in tank-mix combinations with other appropriate herbicides. Applications of oxyfluorfen must be made while trees are dormant, before buds begin to swell, to avoid possible damage from vapors. Registered for use on all tree fruit crops of any age.

*Paraquat, as the dichloride salt, is marketed as *Gramoxone Inteon, which is a 2 lb/gallon formulation that has been formulated to prevent acute toxicity and has replaced most *Gramoxone Max (3 lb/gallon formulation) on the market. The rate for *Gramoxone Inteon is 2.5-4.0 pts/acre. *Gramoxone Inteon is registered for use in all the same crops as *Gramoxone Max. There are 2 generic products now registered, *Firestorm and *Parazone 3SL, which are both 3 lb/gallon materials. *Paraquat is a nonselective contact herbicide that is effective in killing emerged annual broadleaf weeds and grasses and top-kills and suppression of perennials. It is rapidly absorbed into foliage and green bark where it is effective in destroying cell membranes. *Paraquat is strongly adsorbed onto soil colloids where it is degraded by microbial activity. Contact with foliage, branches, and green bark on trunks of young trees can result in damage to the trees. Observe all worker safety cautions specified on labels when mixing, handling, or applying *paraquat. It is registered for use on all tree fruit crops.

Pelargoinic acid is sold as Scythe (Gowan) and is a contact herbicide with moderate burn-down action (depending on rate) on annual and perennial broadleaf weeds and grasses. Somewhat effective at burning leaves on rootsuckers, and only herbicide specifically labeled for rootsucker 'control.' Use higher rates for greatest effect, however, quite expensive at higher rates.

Pendimethalin, formulated as an emulsifiable concentrate containing 3.3 lb AI/gal, is sold as Prowl 3.3EC. Pendimethalin is effective in controlling most annual grasses and some annual broadleaf weeds when used in preemergence applications. Primary mode of action is through root uptake and subsequent inhibition of cell division. Pendimethalin can be used in newly planted orchards. Combination with a contact herbicide is necessary to control emerged or established weeds. Use of Prowl 3.3EC is limited to NONBEARING TREES, for all tree fruit crops. Prowl H2O is registered for use in BEARING pome and stone fruits. It should be applied at 2-4 qts/acre; it has a 24-hr REI and a 60-day PHI. The lower the rate, the shorter the weed control duration. It is effective for pre-emergent control of many grasses as well as some broadleaf weeds such as pigweed and lambsquarters.

*Pronamide is available in water-soluble pouches as *Kerb 50WP. It is effective in controlling winter annual and perennial grasses and chickweed. It is absorbed by roots and translocated throughout the plant. *Pronamide

must be applied in late fall, before soil freeze-up, and moved into the soil by water to be effective. The range of activity on broadleaf weeds is limited, requiring additional measures for their control. Rates of application are determined by the type of grass being controlled and by soil texture. Registered for use on APPLE, CHERRIES, NECTARINE, PEACH, PEAR, PLUM, APRICOT and PRUNE.

Pyraflufen ethyl (Venue) is a nonselective contact herbicide for post-emergence control of broadleaf weeds in tree fruit crops. Its mode of action resembles that of Aim, as it speeds the burndown of weeds. It is registered for use in both bearing and non-bearing tree fruit. It works best if weeds are small – 2-4 inches; control will be better in larger weeds if tank-mixed with 2,4-D or glyphosate. The label restricts use to the postharvest to pre-bloom season only.

Rimsulforon (Matrix FNV) is a preemergence herbicide effective on many annual grasses and broadleaf weeds. One or two applications, either spring and early summer, or fall and late spring are appropriate. Tank-mix with another herbicide with different mode of action as rimsulfuron is susceptible to resistance development.

Saflufenacil (Treevix, BASF) is a Group 14 (WSSA)/Group E (HRAC) postemergence directed broadleaf herbicide labeled for apple and pear only. An adjuvant system consisting of MOS (Methylated Seed Oil) PLUS AMS (Ammonium Sulfate) or UAN (Urea Ammonium Nitrate) must be used with Treevix for best results. Do not use year of planting.

Sethoxydim is marketed as Poast, which contains 1.5 lb AI/gal. Sethoxydim is a selective grass herbicide for use in controlling established annual and perennial grasses. It does not control broadleaf weeds or sedges. A crop-oil concentrate must be used with sethoxydim. Suggested rates depend on height of grasses being treated. Sethoxydim can be used in APPLE, PEAR, APRICOT, CHERRY, NECTARINE and PEACH orchards of any age and in NONBEARING PLUM and PRUNE ORCHARDS.

Simazine is available in several formulations including Princep 4L, Simazine 4L and 90DF, and Princep Caliber 90 for use in orchards. Simazine is effective in controlling a wide range of annual broadleaf weeds and grasses. It does not control established perennial weeds or grasses. Simazine is taken up by roots and translocated to the leaves where it interferes with photosynthesis. It must be applied and moved into the soil before weeds germinate to be most effective; therefore, late fall or very early spring applications are suggested. Activity is reduced in soils of low pH. Resistant weeds such as pigweeds and lambsquarters have been found where simazine has been the principal herbicide used. Control of these weeds has been achieved by using tank-mix combinations with diuron, oryzalin, or pendimethalin. Rates of simazine application and crop tolerance depend on soil texture and organic-matter content as well as crop and tree age. Registered for use in APPLE, PEAR, TART CHERRY, SWEET CHERRY, PEACH, and PLUM.

Terbacil is formulated as an 80% wettable powder under the name *Sinbar. It is effective in controlling most annual grasses and broadleaf weeds and in providing partial control or suppression of such perennials as quackgrass, horsenettle, and nutsedge. Terbacil is absorbed by plant roots and is translocated to the leaves where it interferes with photosynthesis. Residual activity of terbacil in the soil is relatively long-lived. This material is frequently used in tank-mix combinations with diuron or simazine. Application rates and crop tolerance depend on soil texture and organic-matter content as well as crop and tree age. Use is limited to APPLES and PEACHES. Terbacil is also registered for newly-planted fruit trees after the soil has settled and young and non-bearing apple, peach, plum, apricot and cherry trees at very low rates, but these uses have not yet been fully tested.

Table 8.4.1. Minimum time between planting and herbicide use.

None = no time limit noted on label NB = Nonbearing trees only; —= not labeled for use on crop.

Sample Trade Names (*active ingredient*)	**Apple**	**Pear**	**Apricot**	**Tart Cherry**	**Sweet Cherry**	**Nectarine**	**Peach**	**Plum**	**Prune**
Aim 2EC, 1.9EW (*carfentrazone-ethyl*)	None[4]	None	None	None	None	None	None	None	None
Casoron 4G (*dichlobonil*)	4 wk	4 wk	—	4 wk	4wk	—	—	—	—
Casoron 1.4CS (*dichlobonil*)	1 year	1 year	—	1 year	1 year	—	—	—	—
Chateau WDG (*flumioxazin*)	1 yr[3]	1 yr[3]	1 yr[3]	1 yr[3]	1 yr[3]	1 yr[3]	1 yr[3]	1 yr[3]	1 yr[3]
Fusilade DX (*fluazifop*)	NB	NB	NB	NB	NB	NB	NB	NB	NB

Table 8.4.1. Minimum time between planting and herbicide use.

None = no time limit noted on label NB = Nonbearing trees only; —= not labeled for use on crop.

Sample Trade Names (*active ingredient*)	Apple	Pear	Apricot	Tart Cherry	Sweet Cherry	Nectarine	Peach	Plum	Prune
Goal 2XL, Galigan 2E, Goaltender (*oxyfluorfen*)	None	None	None	None	None	None	None	None	None
*Gramoxone (*paraquat*)	None	None	None	None	None	None	None	None	None
Karmex 80DF, Diuron 4L, 80DF (*diuron*)	1 yr	1 yr	—	—	—	—	3 yr	—	—
*Kerb 50 W[1] (*pronamide*)	None	None	None	None	None	None	None	None	None
Matrix 25 DF (*rimsulfuron*)	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr
Poast (*sethoxydim*)	None	None	None	None	None	None	None	NB	NB
Princep 4L, Simazine 4L, 90DF, Caliber 90 (*simazine*)	1 yr	1 yr	—	1 yr	1 yr	—	1 yr	1 yr	—
Prowl 3.3E (*pendimethalin*)	None	None	None	None	None	None	None	None	None
Prowl H_2O (*pendimethalin*)	None	None	None	None	None	None	None	None	None
Rely280 (*glufosinate-ammonium*)	1 yr[3]	—	—	—	—	—	—	—	—
Roundup, Touchdown (*glyphosate*)	None	None	None	None	None	None	None	None	None
Saflufenacil (Treevix)	1 yr	1 yr	—	—	—	—	—	—	—
Sandea (*halosulfuron-methyl*)	1 year	—	—	—	—	—	—	—	—
Scythe (*pelargonic acid*)	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]
*Sinbar 80WP[2] (*terbacil*)	3 yr/NB	NB	NB	NB	NB	NB	3yr/NB	NB	NB
Solicam DF (*norflurazon*)	None	1 yr	1 yr	18 mo	18 mo	6 mo	6 mo	1 yr	1 yr
*Stinger (*clopyralid*)	—	—	None	None	None	None	None	None	None
Surflan AS (*oryzalin*)	None	None	None	None	None	None	None	None	None
*Unison (*2,4-D*)	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr
Venue (*pyraflufen-ethyl*)	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]	None[4]
*Weedar 64, Amine 4, *2,4-D Amine (*2,4-D*)	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr	1 yr

* Sinbar + Karmex tank mix at lower rates - Apples and peaches established at least 2 yr.
* Restricted-use pesticide; may be purchased and used only by certified applicators or used under the supervision of a certified applicator.
[1] Kerb. Not less than 6 mo after fall transplanting nor less than 1 yr after spring transplanting of labeled crops.
[2] Low rate for newly planted and young, non-bearing fruit trees (except apple).
[3] Can be applied to trees less than 1 year old if non-porous wraps, grow tubes, or waxed containers are used.
[4] Do not allow contact with green bark areas of newly planted trees.

Table 8.4.2. Effectiveness of herbicides in tree fruit crops.

Trade Name(s) (*active ingredient*)	AG	AB	PG	PB	WBV	YN	BW	HN	CT	SB	PW	RW
2,4-D (multiple trade names)	—	G	—	G	F	—	G	F	F	-	G	G
Aim EC, Aim EW (*carfentrazone-ethyl)*	—	G	—	P	—	—	P	—	—	—	G	G
Casoron 4G (*dichlobenil*)	G	G	G	G	—	G	—	G	G	—	G	G
Chateau WDG (*flumioxazin*)	G	G	P	P	P	P	P	P	P	P	G	G
Fusilade (*fluazifop*)	G	-	F	—	—	—	—	—	—	—	—	—
Goal (*oxyfluorfen*)	F	G	—	—	—	—	—	—	—	—	G	G

Table 8.4.2. Effectiveness of herbicides in tree fruit crops.

Trade Name(s) (*active ingredient*)	AG	AB	PG	PB	WBV	YN	BW	HN	CT	SB	PW	RW
*Gramoxone Inteon (**paraquat*)	G	G	F	F	F	G[3]	F	F	F	—	G	F
Karmex (*diuron*)	G	G	F	—	—	—	—	—	—	—	G	G
*Kerb (**pronamide*)	G	—	G	—	—	—	—	—	—	—	—	—
Matrix (*rimsulfuron*)	G	G	P	P	P	F	P	P	F	P	G	F
Poast (*sethoxydim*)	G	—	F	—	—	—	—	—	—	—	—	—
Princep (*simazine*)	F	G	—	—	—	—	—	—	—	—	G[4]	—
Prowl, Prowl H20 (*pendimethalin*)	G	F	—	—	—	—	—	—	—	—	G	—
Roundup, Touchdown (*glyphosate*)	G	G	G	G	G[1]	G[2]	G	G[1]	G[1]	F	G	G
Treevix *(saflufenacil)*	—	G	—	F	—	—	F	—	F	G	G	G
Sandea (halosulfuron-methyl)	—	G	—	—	—	G	F[6]	G	F[6]	—	G	G
Scythe (pelargonic acid)	G	G	F	F	P	—	F	F	F	F	F	F
*Sinbar (*terbacil*)	G	G	F	F	—	F	—	F	—	—	F	G
Solicam (*norflurazon*)	G	F	F	—	—	F	—	—	—	—	F	—
*Stinger (**clopyralid*)	—	F[5]	—	F[5]	—	—	—	F	G	—	—	F
Surflan (*oryzalin*)	G	F	—	—	—	—	—	—	—	—	G	P
Venue (*pyraflufen-ethyl*)	—	G	—	F-P[6]	—	—	P	—	P	F	G	G

Key: G = good; **F** = fair; **P** = poor

***** Restricted-use pesticide; may be purchased and used only by certified applicators or used by someone under the supervision of a certified applicator.

[1] Combination with 2,4-D amine has improved effectiveness.
[2] Best results with late-summer (after August 1) applications.
[3] Best results with early mid-summer (before July 15) applications.
[4] Resistant types may require use of alternative materials.
[5] Not broad spectrum; see label for specific weed targets.
[6] Requires tank mix.

Abbreviations:
AG = Annual grasses; **PG** = Perennial grasses;
AB = Annual broadleaves; **PW** = Pigweeds;
BW = Bindweeds; **RW** = Ragweed;
CT = Canada thistle; **SB** = Smooth bedstraw;
HN = Horsenettle; **WBV** = Woody brush, vines;
PB = Perennial broadleaves; **YN** = Yellow nutsedge.

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						*Tree Age*				
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	**PRODUCT NAME** (*active ingredient, weight of active per unit of herbicide*) *Notes:*
X	X	X	X	X	X		X	X		***2,4-D AMINE, *WEEDAR 64, or other labeled formulation** (*2,4-D, 3.8 lb/gal*) *Weeds Controlled:* broadleaves, *Rate (per acre):* 3 pt. *AI per acre (lbs/acre):* 1.4 *Days to harvest:* Apples and pears: 14; apricots, cherries, peaches, and plums: 40 *REI (hours):* 48
										***2,4-D AMINE, *WEEDAR 64, or other labeled formulation** (*continued*) *Comments:* Established perennials, woody brush and vines can also be controlled by using in tank mix with glyphosate. To control dandelions and other broadleaf weeds in sod cover under cherry trees, apply in the fall (best) or early spring BEFORE TREES OR DANDELIONS BEGIN TO BLOOM. Yearly application is needed to control dandelions. Avoid contact with fruit, foliage, stems, or limbs of trees. Not all products labeled for all crops. See labels.

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				PRODUCT NAME (*active ingredient, weight of active per unit of herbicide*) *Notes:*
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	
X	X	X	X	X	X	X	X	X		**AIM EC** (*carfentrzone-ethyl, 2 lb/gal*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1.9 oz *AI per acre (lbs/acre):* 0.03 *Days to harvest:* <u>All tree fruits:</u> 3 *REI (hours):* 12 *Comments:* Apply in tank mix with paraquat or glyphosate for broadleaf and grass control, but avoid contact with green bark and foliage.
X	X	X	X	X	X	X	X	X		**AIM EW** (*carfentrazone-ethyl, 1.9 lb/gal*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1.9 oz *AI per acre (lbs/acre):* 0.03 *Days to harvest:* <u>All tree fruits:</u> 3 *REI (hours):* 12 *Comments:* Apply in tank mix with paraquat or glyphosate for broadleaf and grass control, but avoid contact with green bark and foliage.
X	X	X					X	X		**CASORON 1.4CS** (*dichlobenil, 1.4 lb/gal*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1.4 – 2.8 gals. *AI per acre (lbs/acre):* 2.9-4.3 *Days to harvest:* None listed *REI (hours):* 12 *Comments:* November to March when soil temp is below 45˚. Controls many annual and perennial grasses and weeds.
X	X	X					X	X		**CASORON 4G** (*dichlobenil, 0.4 lb/lb*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 100-150 lb *AI per acre (lbs/acre):* 4.0-6.0 *Days to harvest:* none listed *REI (hours):* 12 *Comments:* November to March when soil temp is below 45˚. Controls many annual and perennial grasses and weeds.
X	X	X	X	X	X	X	X	X		**CHATEAU 51 WDG** (*flumioxazin, .51 lb/lb*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rate (per acre):* 6-12 fl. oz. *AI per acre (lbs/acre):* 0.188-0.38 *Days to harvest:* <u>Apples:</u> pre-bloom; <u>apricots, cherries, peaches, pears, and plums:</u> budbreak *REI (hours):* 12 *Comments:* 12 fl. oz is maximum rate for an application; with 24 fl. oz maximum for the season. If soil is covered with weeds at the time of application, apply with paraquat. Can only be applied prior to the 'pink bud' stage or in the fall after harvest. **<u>DO NOT APPLY TO TREES ESTABLISHED LESS THAN 1 YEAR UNLESS PROTECTED FROM SPRAY CONTACT BY NON-POROUS TUBES OR WAX CONTAINERS.</u>**

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				PRODUCT NAME (*active ingredient, weight of active per unit of herbicide*) *Notes:*
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	
X	X	X	X	X	X	X	X	X	X	**FUSILADE DX** (*fluazifop-p-butyl, 2 lb/gal*) *Weeds Controlled:* Annual and perennial grasses *Rate (per acre):* 1-1.5pts *AI per acre (lbs/acre):* 0.25-0.375 *Days to harvest:* 14 (nonbearing apples and pears) *REI (hours):* 12 *Comments:* Grasses 2-8 in tall. Repeat before regrowth is 10 in tall. Use surfactant or crop oil according to label directions.
X	X	X	X	X	X	X	X	X		**GALIGAN 2E** (*oxyfluorfen, 2 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rates (per acre):* Pre-emergence: 5-6 pts; Postemergence: 2-6 pts *AI per acre (lbs/acre):* Pre-emergence: 1.25-1.5; Postemergence: 0.5-1.5 *Days to harvest:* Do not apply between budswell and final harvest. *REI (hours):* 24 *Comments:* Apply as soon as soil has settled and no cracks are present. Oxyfluorfen applications limited to dormant trees (before buds on trees begin to grow).
X	X	X	X	X	X	X	X	X		**GOAL 2XL,** (*oxyfluorfen, 2 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rates (per acre):* 3.2-4 qt *AI per acre (lbs/acre):* 1.6-2.0 *Days to harvest:* Do not apply between budswell and final harvest *REI (hours):* 24 *Comments:* Apply as soon as soil has settled and no cracks are present. Oxyfluorfen applications limited to dormant trees (before buds on trees begin to grow).
X	X	X	X	X	X	X	X	X		**GOALTENDER,** (*oxyfluorfen, 4 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rates (per acre):* Pre-emergence broadcast:2.5-3 pts; pre-emergence banded: 2.5-4 pts; postemergence broadcast: 1-3 pts; postemergence banded: 1-4 pts. *AI per acre (lbs/acre):* Pre-emergence broadcast:1.25- 1.5; pre-emergence banded: 1.25- 2; postemergence broadcast: .5-1.5; postemergence banded: .5-2. *Days to harvest:* Do not apply between budswell and final harvest *REI (hours):* 24 *Comments:* Apply as soon as soil has settled and no cracks are present. Oxyfluorfen applications limited to dormant trees (before buds on trees begin to grow).
X	X	X	X	X	X	X	X	X		***GRAMOXONE INTEON** (**paraquat, 2 lb/gal*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 2.5-4.0 pt. *AI per acre (lbs/acre):* 0.63-1.0 *Days to harvest:* Apples and pears: none listed; apricots, cherries, and plums: 28; peaches: 14 *REI (hours):* 24 *Comments:* Apply to emerged weeds as needed. Avoid contact of *paraquat with foliage or trunks of trees. SEE LABEL FOR WORKER SAFETY CAUTIONS.

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				PRODUCT NAME (*active ingredient, weight of active per unit of herbicide*) *Notes:*
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	
X	X		X				X	X	X	**KARMEX 80DF, DIURON 80DF, other labeled formulations** (*diruon, 0.80lb/lb*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1.25-2.5 lb *AI per acre (lbs/acre):* 1.0-3.0 *Days to harvest:* Apple and pear: apply March through May; peaches: 20 *REI (hours):* 12 *Comments:* Apply early spring before weeds emerge. For apples and pears, do not apply to varieties grafted on full-dwarf rootstocks. For peach, only – apply to trees 3 full years old or older. See label for soil-texture and organic matter rate limitations. Add *paraquat to help control established weeds. Addition of oryzalin has improved late-season annual grass and broadleaf weed control. **NOTE:** Karmex may be applied in apple and pear plantings established for at least 1 year and peach plantings established at least 3 years.
X	X	X	X	X	X		X	X		***KERB 50W** (*pronamide, 0.5 lb/lb*) *Weeds Controlled:* Established perennial grasses *Rate (per acre):* 4.0-8.0 lb *AI per acre (lbs/acre):* 2.0-4.0 *Days to harvest:* post harvest in fall *REI (hours):* 24 *Comments:* Apply late fall before soil freezes. Spring-planted trees must be established at least 6 mo; fall-planted trees at least 1 yr. Use other materials for broadleaves and late-summer annual grasses.
X	X	X	X	X	X		X	X		**MATRIX 25DF** (*rimsulfuron, 0.25 lb/lb*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 4 oz. *AI per acre (lbs/acre):* 0.0625 *Days to harvest:* Apples and pears: 7; Apricots, cherries, peaches, and plums: 14 *REI (hours):* 4 *Comments:* Can be applied once a year as a single application or two times if a banded application of 50% is used. Rainfall or irrigation is necessary for activation.
X	X	X	X	X	X	X	X	X		**POAST** (*sethoxydim,1.5 lb/gal*) *Weeds Controlled:* annual grasses *Rate (per acre):* 1.5-2.0 pt *AI per acre (lbs/acre):* 0.28-0.47 *Days to harvest:* Apples and pears: 14; apricots, cherries, and peaches: 25; plums/prune: 1 year (non-bearing application) *REI (hours):* 12 *Comments:* Apply to actively growing grass before tillering or seedhead formation. Use a crop-oil concentrate when applying to plum and prune (see label).
X	X	X	X		X		X	X	X	**PRINCEP 4L** (*simazine, 4 lb/gal*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1-2 qt *AI per acre (lbs/acre):* 1.0-2.0

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	**PRODUCT NAME** (*active ingredient, weight of active per unit of herbicide*) *Notes:*
										PRINCEP 4L (*continued*) *Days to harvest:* Apples: 150; pears, tart cherries: not listed; peaches, plums, sweet cherries: applied late fall to early spring *REI (hours):* 12 *Comments:* Apply early spring before weeds emerge. See soil-texture rate limitations on label. Add *paraquat to help control established weeds. Addition of napropamide, pendimethalin, or oryzalin have improved late-season annual grass and broadleaf control.
X	X	X	X	X	X	X	X	X		**PROWL 3.3 EC** (*pendimethalin, 3.3 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rates (per acre):* 4.8 qts. *AI per acre (lbs/acre):* 4 *Days to harvest:* Non-bearing use only. *REI (hours):* 24 *Comments:* Prowl 3.3 EC use limited to NONBEARING TREES ONLY.
X	X	X	X	X	X	X	X	X		**PROWL H2O** (*pendimethalin, 3.8 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rate (per acre):* 2-4 qts. *AI per acre (lbs/acre):* 1.9-3.8 *Days to harvest:* 60 (for all tree fruit) *REI (hours):* 24 *Comments:* Prowl H2O can be used in non-bearing and bearing trees. No more than 4.2 qts/acre/year of Prowl H2O may be applied.
X							X			**RELY 280** (*glufosinate-ammonium, 2.34 lb/gal*) *Weeds Controlled:* broadleaves and grasses *Rate (per acre):* Weeds less than 3": 48 fl oz; weeds less than 6" high pre-tiller grasses: 56 fl oz; weeds greater than 6" and/or grasses that have tillered: 56-82 fl oz *AI per acre (lbs/acre):* Weeds less than 3": .8775; weeds less than 6" high pre-tiller grasses:1.02; weeds greater than 6" and/or grasses that have tillered: 1.02-1.5 *Days to harvest:* 14 *REI (hours):* 12 *Comments:* Sucker control is not listed on Rely 280 label.
X	X	X	X	X	X	X	X	X		**ROUNDUP, OTHER FORMULATIONS** (*glyphosate,4 lb/gal*) *Weeds Controlled:* all *Rates (per acre):* 1-3 qts. *AI per acre (lbs/acre):* 1-3 *Days to harvest:* Apples and pears: 1; apricots, cherries, peaches, and plums: 17 *REI (hours):* 12 *Comments:* Timing varies with weed type. Apply to emerged weeds as needed. Avoid contact of glyphosate with foliage, branches, suckers or trunks of trees.
X	X	X	X	X	X					**SCYTHE** (*pelargonic acid*) *Weeds Controlled:* annual broadleaf and grasses mostly; rootsuckers *Rates (per acre):* 3-10% by volume

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				PRODUCT NAME (*active ingredient, weight of active per unit of herbicide*) *Notes:*
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	
										SCYTHE (*continued*) *Days to harvest:* 0 *REI (hours):* 12 *Comments:* Can be used as a directed/shielded spray and/or rootsucker control. Avoid contact with green bark or desirable foliage. Use 5% for control of annual broadleaf weeds and grasses, 10% for maximum vegetation burndown.
X							X	X	X	**SANDEA** (*halosulfuron-methyl*) *Weeds Controlled:* broadleaf weeds and nustsedge *Rates (per acre):* 1/2 to 1 ounce *Days to harvest:* 14 *REI (hours):* 12 *Comments:* Apply uniformly with ground equipment in a minimum of 15 gals of water pe acre. For best results use a NIS with post-emergence applications. Avoid spry drift or contact with fruit and foliage. Avoid application when temperature above 85 F. Do not apply more than 2 ounces Sandea per acre per year.
X	X	X	X		X		X	X	X	**SIMAZINE 90DF, other labeled formulations** (*simazine, 0.9 lb/lb*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 1.1-2.2 lbs *AI per acre (lbs/acre):* 1.0-2.0 *Days to harvest:* Apples, pears, sour cherries:depends on the product label; peaches, sweet cherries, plums: apply late fall to early spring. *REI (hours):* 12 *Comments:* Apply early spring before weeds emerge. See soil-texture rate limitations for simazine and norflurazon. Add *paraquat to help control established weeds. Addition of napropamide, pendimethalin, or oryzalin have improved late-season annual grass and broadleaf control. **NOTE:** Tank mixes will alter the days to harvest. See product label for details.
X	X		X			X	X	X	X	***SINBAR 80 DF** (*terbacil, .8 lb/lb*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 0.5-1.0 lb. (High rate is 2 lb for 2+ year old peaches) *AI per acre (lbs/acre):* 0.4-0.8 *Days to harvest:* Apples and peaches: 60; All other tree fruit: non-bearing *REI (hours):* 12 *Comments:* For non-bearing, young, newly-planted trees, make the first application after a significant rainfall or irrigation that will settle the soil around the base of the tree. Rate varies with tank mix combination, age of tree, and soil texture/organic matter content.
X	X	X	X	X	X		X	X		**SOLICAM** (*norflurazon, 0.8 lb/lb*) *Weeds Controlled:* annual grasses and broadleaves *Rate (per acre):* 2.5-3.0 lb *AI per acre (lbs/acre):* 2.0-2.4 *Days to harvest:* All: 60 *REI (hours):* 12

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				PRODUCT NAME (*active ingredient, weight of active per unit of herbicide*) *Notes:*
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	
X	X	X	X	X	X		X	X		**SOLICAM** (*continued*) *Comments:* Apply early spring before weeds emerge. See soil-texture rate limitations. Add *paraquat to help control established weeds. Additions of napropamide, pendimethalin, or oryzalin have improved late-season annual grass and broadleaf weed control.
		X	X	X	X	X	X	X	X	***STINGER** (*clopyralid, 3 lb/gal*) *Weeds Controlled:* Established perennial broadleaf weeds *Rate (per acre):* 1/3-2/3 pt *AI per acre (lbs/acre):* 0.12-0.24 *Days to harvest:* 30 *REI (hours):* 12 *Comments:* Apply for post-emergence control of specific problem weeds such as Canada thistle, clover, vetch, dandelion, in row and row middles. Not to exceed 2/3 pt/A/year.
X	X	X	X	X	X	X	X	X		**SURFLAN AS** (*oryzalin, 4 lb/gal*) *Weeds Controlled:* annual grasses and broadleaf weeds *Rate (per acre):* 3-6 qts. *AI per acre (lbs/acre):* 3-6 *Days to harvest:* None listed *REI (hours):* 24 *Comments:* Additional measures may be needed to control later emerging weeds. Add *paraquat to help control established perennial grasses and weeds.
X	X						X	X	X	**TREEVIX** (*saflufenacil, 0.7 lb a.i. per lb*) *Weeds Controlled:* Weeds Controlled: postemergence broadleaf *Rate (per acre):* 1 oz *AI per acre (lbs/acre):* *Days to harvest:* 0 *REI (hours):* 12 *Comments:* Do not apply more than 1 oz Treevix in a single application; do not apply more thant 3 oz Treevix in a single season; do not use in tree nurseries or year of planting; 2nd, 3rd leafe trees should have trunk shields or care taken to not spray trunks
X	X	X	X		X		X	X		***UNISON or other labeled formulation** (*2,4-D, 1.74 lb/gal*) *Weeds Controlled:* broadleaves *Rate (per acre):* 3 pt. *AI per acre (lbs/acre):* 0.6525 *Days to harvest:* Apples and pears: 14; cherries, peaches, plums: 40 *REI (hours):* 48 *Comments:* To control dandelions and other broadleaf weeds in sod cover under cherry trees, apply in the fall (best) or early spring BEFORE TREES OR DANDELIONS BEGIN TO BLOOM. Yearly application is needed to control dandelions. Avoid contact with fruit, foliage, stems, or limbs of trees.
X	X	X	X	X	X	X	X	X	X	**VENUE** (*pyraflufen-ethyl, 0.177 lb/gal*) *Weeds Controlled:* annual or perennial herbaceous broadleaves *Rate (per acre):* 0.7-4.0 fl. oz.

Table 8.4.3. Weed control guidelines for tree fruit.

Refer to back of book for key to abbreviations and footnotes.

Crop						Tree Age				**PRODUCT NAME** (*active ingredient, weight of active per unit of herbicide*)
Apples	Pears	Cherries	Peaches	Apricots	Plum/Prune	Planting Year	1 year plus	2 years plus	3 years plus	*Notes:*
										VENUE (*continued*)
										AI per acre (lbs/acre): .000098-.0055
										Days to harvest: Non-bearing and postharvest through before bloom
										REI (hours): 12
										Comments: Non-bearing use: Do not allow spray to contact green bark of trunk area. Bearing use: Apply postharvest through before bloom. Do not allow spray to contact green bark of trunk area.

*Restricted-use pesticide.