

CHEMICAL CONTROL OF WEEDS

ORCHARD WEED CONTROL

Controlling weeds in the orchard is a cultural practice integrated with other practices in an overall management strategy to obtain an optimum yield of quality fruit. An effective weed control program is the result of successfully integrating sound management strategies with the selection and application of the appropriate herbicide for specific weed problems throughout the life of the orchard.

The presence of weeds under young fruit trees decreases tree survival and growth and may result in reduced yields for several years. Grasses and broadleaf weeds effectively compete with young trees for moisture and nutrients, provide cover for rodents, harbor insects and disease organisms, and increase the risk of mechanical injury to trees from cultivation and mowing. Specific weeds may cause other management problems, such as the effect of dandelions on bee management in the spring and poison-ivy and bramble interference with worker efficiency during harvesting.

Maximum benefits can be expected from maintaining a continuous weed-free zone beneath the tree canopy. Additional benefits may be realized by the establishment and maintenance of a permanent grass sod between the vegetation-free strips in the tree row. The grass sod will need an occasional postemergence herbicide treatment to control broadleaf weeds.

APPLICATION EQUIPMENT

Equipment for the application of herbicides in the orchard is relatively easy to calibrate and operate compared with other orchard sprayers. The objective in using this equipment is to obtain accurate placement of the correct herbicide dosage to obtain uniform control of the weeds without causing tree injury.

Although a sprayer unit may be built from individually purchased components, it is economically feasible and more convenient to purchase a system from a reputable equipment dealer. This will eliminate the uncertainty of component availability and possible incompatibility of the individual components. There are several tractor units available that can be mounted on a three-point hitch platform.

When looking for an appropriate sprayer, there are some basic qualifications to be considered in selecting suitable components.

PUMPS

Roller pumps and piston pumps are both suitable for herbicide application in the orchard. Roller pumps are more economical to purchase, but the abrasive nature of wettable powders may necessitate the replacement of the rollers on an annual basis. Positive displacement piston pumps are more expensive initially but require less maintenance and generally have a longer useful life. Regardless of the type selected, the pump capacity should be adequate to deliver a range of volumes of 30 to 60 gallons per acre (GPA) necessary for preemergence herbicide applications. These demands, plus an additional requirement for agitation, may be met by pumps with a capacity of approximately 8 to 10 gallons per minute. The higher capacity pump is necessary for the sprayer to be utilized for broadcast spraying of field crops.

AGITATION

Continuous agitation after the initial mixing of water-soluble herbicides, such as paraquat (Gramoxone Extra) and glyphosate (Roundup), is not necessary; but, all wettable powder and flowable formulations require continuous agitation to maintain the herbicides in suspension. Hydraulic (by-pass) agitation is generally adequate for relatively small (100 gal) vertically-mounted tanks; but, larger horizontally-mounted tanks should be equipped with mechanical agitation. If spraying operations are interrupted, suspended materials will settle in the bottom of the tank and will require vigorous agitation to re-establish the suspension before resumption of spraying.

PRESSURE, SPRAY VOLUME

Relatively low pressures (25 to 40 psi) are adequate and desirable for most herbicide applications in the orchard. Higher nozzle pressures increase the drift hazard and should be avoided. The potential for tree injury from drift is much greater when the spray mix includes glufosinate, glyphosate, paraquat, or 2,4-D.

Spray volumes within the range of 25 to 50 GPA are adequate for most preemergence herbicide applications. However, volumes of 40 to 60 GPA may be desirable to ensure thorough coverage when applying postemergence herbicides to rank weed growth. Roundup and Touchdown, however, should be applied at lower spray volumes (Less than 40 gallons per acre).

BOOMS

A rigid boom system is necessary for the application of herbicides to the orchard floor. Some means of adjusting the width of the treated band will be required when changing from younger trees to mature trees. This might be most easily accomplished by constructing a boom suitable for the maximum desired band width for mature trees. For younger plantings, use individual nozzle 'plugs' to reduce the width of the sprayed band. Remember that the sprayer should be re-calibrated whenever such changes are made.

A handgun is an often overlooked but necessary item of equipment in the applicator's inventory. Effective, postemergence spot treatments of weeds can be made most efficiently with a handgun. The handgun should have the capability of delivering a variable spray pattern to facilitate the treatment of either isolated clumps of weeds beneath the canopy of mature trees or larger areas with a more uniform weed cover.

TANKS

Although stainless steel tanks are acceptable, fiberglass tanks are considered to be most economically feasible. Galvanized or other unlined metal tanks are not desirable, since some herbicides are quite corrosive to certain metals. Sumps with removable plugs in the bottoms of tanks facilitate the complete removal of unused pesticide solutions and rinse water. Although various tank sizes are available, a volume of 100 to 150 gallons is considered adequate, since about 10 acres of orchard can be treated with 100 gallons of solution when spraying a 6-foot band at 35 GPA. A large removable strainer to remove foreign matter should be located between the tank outlet and the pump.

NOZZLES

A single off-center nozzle is useful in treating a narrow strip under young trees, but a series of flat-fan nozzles of the same output capacity would be more appropriate for treating wider strips under large trees. The large orifice flood-jet tips are **not** suitable for band applications of herbicides in the orchard. A line strainer and individual nozzle screens (50 mesh) should be used to minimize clogging problems.

APPLICATION PRECAUTIONS

After selecting the appropriate herbicide, there are several precautions that should be observed during the application process.

Apply preemergence herbicides in early spring to take advantage of frequent rainfall necessary to move the herbicide from the soil surface to the zone of weed seed germination (activation). When treating narrow strips under young trees using postemergence herbicides, make a pass on each side of the tree row rather than attempting to treat the entire band in one pass. Immature stem tissues may be severely injured when sprayed with foliar-active materials.

Choose preemergence herbicide rates according to the soil type of the orchard. High rates of application on coarse soils (sand, gravel, and sandy loam) are likely to cause injury to young trees, especially the Golden Delicious variety.

ALWAYS read the ENTIRE PESTICIDE LABEL prior to use and follow the directions explicitly.

SPRAYER CALIBRATION

The importance of sprayer calibration cannot be over-emphasized, considering the cost of herbicides, the time invested in the purchase and application, and the importance of applying the correct rate of herbicide. The time invested in calibration is one of the most critical investments in the orchard. The fine line between effective weed control and tree injury is determined by the application of the correct herbicide at the correct rate.

There are many different methods or procedures that may be used to determine the output of a sprayer. Although the details of such procedures may vary, all methods will require at least some calculations, a container to measure spray volume, and a tape measure or yardstick.

The following method can be used for most types of field applicators:

1. Using the throttle and gear setting normally used when spraying, drop an object from the moving sprayer at the start of a minute. At the end of the minute drop another object on the ground. The distance between the objects will be the distance traveled in one minute. **IMPORTANT** - Perform this procedure under field conditions and **NOT** on a road.
2. Measure the distance traveled.
3. Measure the width of the spray swath.
4. Determine the area sprayed.

Example: If the tractor traveled 353 feet in 1 minute, and the spray pattern was 30 inches wide, then the sprayed area would be calculated as follows:

$$\frac{30 \text{ inches}}{12 \text{ inches/ft}} \times 353 \text{ ft} = 882 \text{ sq. ft.}$$

There are 43,560 sq ft in an acre, therefore,

$$\frac{882 \text{ sq ft}}{43,560 \text{ sq ft/A}} = 0.02 \text{ acre sprayed}$$

5. Determine the sprayer output. Using the throttle setting selected in Step 1 and adjusting the pressure to 25 to 40 psi, collect the spray from all nozzles used to apply the spray pattern in number 4 above, and calculate the total output from all nozzles in ounces per minute.

Example: If the total output was 96 oz/minute, then

$$\frac{96 \text{ oz/minute}}{128 \text{ oz/gallon}} = 0.75 \text{ gallons per minute (GPM) rate of delivery}$$

6. Determine the output in GPA.

Example: In 1 minute the sprayer covered 0.02 acres and delivered 0.75 gallons of water. Therefore, the output would be:

$$\frac{0.75 \text{ gal/minute}}{0.02 \text{ acre/minute}} = 37.5 \text{ GPA}$$

A second method for calibrating the herbicide sprayer:

1. Fill the sprayer with water.
2. Spray an area under orchard conditions.
3. Return to same location when filling the sprayer and measure the amount of water required to refill the sprayer to original amount.
4. Use the following example to determine the amount of spray per acre and the amount of material (5.0 lb of 80DF norflurazon) to place in the spray tank.
 - a. Assume that a 5.0 foot band was sprayed for 1200 feet and 5.0 gallons of water was required to refill the sprayer tank.

$$\frac{\text{Gallons sprayed} \times \text{sq ft/acre}}{\text{Sq ft of area sprayed}} = \text{GPA} = \frac{5.0 \times 43560}{5.0 \times 1200} = 36 \text{ GPA}$$

$$\frac{\text{Size of tank (gallons)} \times \text{Rate of formulation/acre}}{\text{Gallons/sprayed acre}} = \frac{100 \times 5.0}{36} = 13.9 \text{ lb in tank}$$

- Examples of a sprayed acre:
- a. an 8 ft wide band 5,445 feet long or
 - b. a 5 ft x 5 ft square area under 1,742 trees.

HERBICIDE SELECTION

The grower must know the major weeds present in each orchard block and select a herbicide that will control the major problem weeds. These efforts should be initiated before planting an orchard, but scouting to identify weeds or other problems and keeping block records should be maintained for newly planted and established orchards. No preemergence herbicide will control perennial weeds such as poison-ivy or brambles. These weeds must be controlled with postemergence herbicides.

There are some practical limitations to matching problem weeds with a specific herbicide. For example: if morningglories were a problem in a new planting, simazine (Princep) or diuron (Karmex) could not be recommended because the use of these herbicides is limited to established orchards (see Table 15). Therefore, the most economical herbicide for annual grass control should be applied under the new trees, and postemergence treatments should be applied as needed during the season for morningglory control. Simazine or diuron could be applied in the second year to control morningglories. Notes on weed control and weeds not killed should be maintained each year to assist in the herbicide selection process. The herbicide selection decision is not a one-time event, but must be made every year to accommodate shifts in the weed population or other management practices.

Since no preemergence herbicide will control all weeds, herbicide combinations can be used to broaden the spectrum of weed control. The following discussion of individual herbicides can be used as a guide when choosing herbicide combinations. One example would be combining a compound which is effective on many annual broadleaf weeds [such as diuron, simazine or terbacil (Sinbar)] with one which provides long-lasting control of annual grasses [napropamide (Devrinol), norflurazon (Solicam) or oryzalin (Surflan), or pendimethalin (Prowl)]. Since most preemergence herbicides will not control emerged weeds, a contact herbicide should be added to the spray mixture to kill existing vegetation. Check the labels for restrictions on use.

Check herbicide label restrictions to rotational crops if the area to be treated will be rotated to vegetables, ornamentals or other crops within one or two years. Repeat application of certain preemergence herbicides to tree fruit over several years may lead to a buildup of soil residues. Soil residues of certain herbicides, such as simazine, diuron and terbacil, can injure sensitive crops like vegetables.

Listed below is one possible schedule for herbicide application in apples and peaches. This program is only listed as a general guideline - each grower should adapt this program to fit the weed problems and soil properties (% organic matter, texture) of the orchard.

Site preparation: Growers should attempt to eradicate perennial weeds, especially perennial broadleaf weeds, prior to establishing an orchard. Perennial broadleaves are harder to control after planting fruit trees. Check herbicide labels to determine registered treatments for the crop currently growing at the site.

If the site currently is in pasture, treatments such as 2,4-D or 2,4-D ester plus triclopyr ester (Crossbow) could be used to selectively control broadleaf weeds without injuring grasses such as tall fescue or orchardgrass. Allow at least one year between application of treatments such as Crossbow and planting of fruit trees. Glyphosate (Roundup) could be applied in strips in the fall to control perennial grasses and other weeds prior to planting fruit trees.

Year of planting: oryzalin (Surflan) plus paraquat* plus surfactant in spring. For fall treatment (if desired) - norflurazon (Solicam) plus paraquat plus surfactant

Year 2: norflurazon (Solicam) plus paraquat plus surfactant plus either simazine (Princep) or diuron (Karmex).

Year 3 and beyond: diuron (Karmex) plus terbacil (Sinbar) plus surfactant

or

simazine (Princep) plus norflurazon (Solicam) plus paraquat* plus surfactant

or

diuron (Karmex) plus terbacil (Sinbar) plus norflurazon (Solicam) plus surfactant.

*Paraquat (Gramoxone Extra) is only needed when live vegetation is present. Paraquat can be reapplied in the summer to control weeds that escape the spring application. Paraquat is not needed if diuron (Karmex) plus terbacil (Sinbar) plus surfactant are combined and applied to small weed seedlings.

SPLIT HERBICIDE APPLICATIONS

If herbicides are applied as a split fall and spring application (October/November and May/June) or a split spring and summer (March and July), improved length of control will be seen. A fall application of terbacil (Sinbar), diuron (Karmex), simazine (Princep), pronamide (Kerb), or norflurazon (Solicam) will provide improved control of certain perennial grasses. Since none of the residual herbicides control all of the perennial or woody weed species, the application of 2,4-D or glyphosate (various) or a combination of the two need to be applied before these weeds become a problem.

HERBICIDE-RESISTANT WEEDS

Herbicide-resistant weed biotypes may develop as a result of applying the same herbicide or herbicides with the same mode of action year after year. Smooth pigweed and common lambsquarters have developed resistance to the triazine herbicides in Virginia, for example. Where possible, the same herbicide should not be applied alone for more than 3 or 4 years in a row. Resistance to herbicides could be delayed or avoided by utilizing herbicide rotations and/or tank-mixes that employ chemicals differing in their mode of action. Rotating chemicals from different herbicide families that have the same mode of action may also delay development of herbicide resistance. However, some weed species can develop resistance to multiple herbicide families that have a similar mode of action. Consult the table below while determining a suitable herbicide rotation and/or tank-mixing program for orchard weed management.

Table 13. Herbicides used for weed management in tree fruit crops and their modes of action.

Herbicide (Common name)	Herbicide Family	Primary Mode of Action
Diuron	Substituted urea	Photosystem II inhibitor
Simazine	Triazine	Photosystem II inhibitor
Terbacil	Uracil	Photosystem II inhibitor
Norflurazon	Pyridazinone	Carotenoid synthesis inhibitor
Napropamide	Amide	Cell division inhibitor
Oryzalin	Dinitroaniline	Microtubule/spindle apparatus (Root growth) inhibitor
Clethodim	Cyclohexanedione	ACCase (lipid synthesis) inhibitor
Clopyralid	Pyridine	Auxin- type growth regulator
Carfentrazone	Triazolinone	Protox inhibitor
Oxyfluorfen	Diphenylether	Protox inhibitor
Flumioxazin	Phenylphthalimide	Protox inhibitor
Pronamide	Amide	Microtubule/spindle apparatus (Root growth) inhibitor
2,4-D	Phenoxy acid	Auxin- type growth regulator
Fluazifop	Aryloxyphenoxy propionate	ACCase (lipid synthesis) inhibitor
Sethoxydim	Cyclohexanedione	ACCase (lipid synthesis) inhibitor
Pendimethalin	Dinitroaniline	Microtubule/spindle apparatus (root growth) inhibitor
Glyphosate	Amino acid derivative	EPSP synthase (amino acid synthesis) inhibitor
Glufosinate	Amino acid derivative	Glutamate synthase inhibitor
Paraquat	Bipyridilium	Photosystem I inhibitor (Cell membrane disrupter)
Dichlobenil	Benzonitrile	Cellulose biosynthesis inhibitor
Rimosulfuron	Sulfonylurea	ALS inhibitor (amino acid synthesis)

HERBICIDES**Preemergence (Residual)**

DICHLORBENIL (Casoron 4G) is formulated as a 4% granular product and will control annual and certain perennial weeds. The use rate of this herbicide ranges from 4.0 to 6.0 lbs ai/A, which corresponds to 100 to 150 lbs of Casoron 4G per acre. Casoron should be applied between late fall and early spring for optimum weed control. Fruit trees must be established at least 4 weeks prior to application. The granules have to be distributed evenly to the soil surface, followed shortly by rain, irrigation or a shallow incorporation for optimum efficacy. Incorporation immediately after application is recommended if applied under warm conditions. The lower use rate is recommended for controlling annual weeds and the higher use rate is recommended for controlling certain perennial weeds.

DIURON (Karmex DF) is formulated as an 80% dry flowable and used at the rate of 4.0 lb formulation per acre. Diuron may be used around apple and pear trees established at least 1 year and around peach trees established at least 3 years. Apply once to the orchard floor in early spring (March-May) before fruit sets. Diuron (with added surfactant) may kill emerged weeds, but it should be used in combination with a contact herbicide for consistent results. Diuron controls several annual weed species, but does not control emerged perennials such as yellow rocket, dandelion, chicory, plantains, or purpletop. Diuron (1.0 to 2.0 lb of Karmex 80DF) may also be applied in a tank mixture with terbacil (1.0 to 2.0 lb of Sinbar 80W) around apple and peach trees established at least 2 years. This tank mixture will provide partial control of many non-woody perennials mentioned above. Do not replant the treated area to any crop within 2 years after last application. Do not use on soils with less than 1% organic matter content; use lower rates on soils with 1-2% organic matter content or light soils.

FLUMIOXAZIN (Chateau) is formulated as a 51% water dispersible granule and is applied at the rate of 6-12 oz formulation per acre. Use the 6 oz/A rate if the sand plus gravel content of the soil is over 80% and trees are less than 3 years old. Flumioxazin is a preemergence and early postemergence herbicide. For consistent control of emerged weeds, especially perennial ones, add a postemergence herbicide, such as glyphosate, paraquat, or glufosinate where registered. Flumioxazin may be tank-mixed with diuron, oryzalin, or simazine for broader-spectrum weed control. Do not apply to trees less than 1 year old unless protected by non-porous wraps, grow tubes, or waxed containers. Do not make a second application within 30 days of the first. Avoid applications to green bark. Apply when trees are dormant or avoid contact with tree foliage. Registered for bearing and nonbearing fruit trees, including apple, cherry, nectarine, peach, pear, and plum. Do not apply within 60 days of harvest.

NAPROPAMIDE (Devrinol 50-DF) is formulated as a 50% dry flowable and applied at the rate of 8.0 lb formulation per acre. Napropamide may be used on newly planted as well as established apple, pear, cherry, nectarine, peach, and plum trees. Apply napropamide to the soil surface in the fall through early spring prior to weed emergence. Since napropamide does not control emerged weeds, a postemergence herbicide should be added if weeds are present. Napropamide may be used with other herbicides such as diuron (Karmex DF) or terbacil (Sinbar) for improved control of annual broadleaf weeds. Observe precautions and time limitations for diuron and terbacil. Do not apply to trashy or frozen ground or when fruit is on the ground during harvest. Use as a directed spray and avoid contact with fruit or foliage. Apply only once per season. Spring application must have rainfall or irrigation within 24 hours to move the herbicide into the weed-seed germination zone.

NORFLURAZON (Solicam DF) is formulated as an 80% dry flowable and recommended for preemergence control of annual grasses and certain broadleaf weeds in newly transplanted and established apple trees. Delay application until 6 months after planting peaches or nectarines and one year after planting pears and plums and 18 months after treating cherry. Do not treat cherry when growing in a sand or loamy-sand soil. Recommended rates are 2.5 to 5.0 lb of formulated Solicam per acre. Norflurazon does not have postemergence activity and will not control emerged grasses. However, early spring applications will suppress the growth and spread of certain perennial grasses such as quackgrass, fescues, redtop, and paspalums. Complete control would be possible when used in combination with 1.5 qt per acre of glyphosate (Roundup); however, this practice is not recommended for young trees when used in combination with glyphosate. Improved broadleaf weed control is possible when tank-mixed with the recommended rate of such herbicides as simazine (Princep) or diuron (Karmex).

ORYZALIN (Surflan A.S.) is formulated as a 4 lb per gal aqueous solution (4AS). Recommended rates are 2.0 to 6.0 qt of the 4AS per acre. Use lower rates for short-term control (4 months) and higher rates for long-term control (6-8 months). Highest rates (4.0-6.0 lb ai) are for fall application only. Oryzalin may be used around newly transplanted apple, pear, cherry, nectarine, peach, and plum trees after the soil has settled and no cracks are present as well as around established trees. Trash should be removed or thoroughly mixed into the soil before application. Oryzalin is effective in controlling annual grasses and broadleaf weeds such as barnyardgrass, annual bluegrass, panicums, crabgrass, foxtails, goosegrass, seedling johnsongrass, carpetweed, common purslane, common lambsquarters, pigweeds, and common chickweed. Oryzalin may be tank-mixed with diuron (Karmex), simazine (Princep), or terbacil (Sinbar) to control many more broadleaf weeds. Observe precautions and time limitations for diuron, simazine, or terbacil.

OXYFLUORFEN (Goal 2XL) is formulated as a 2 lb/gallon emulsifiable concentrate and registered as a dormant application for bearing and non-bearing peach, cherry, apple, nectarine, pear and plum. Oxyfluorfen, which controls most annual broadleaf weeds and certain annual grasses, can be tank-mixed with oryzalin (Surflan), napropamide (Devrinol) or norflurazon (Solicam) for improved annual grass control. Oxyfluorfen has postemergence activity on small weed seedlings but should be combined with glufosinate where registered, glyphosate, or paraquat for consistent control of emerged weeds. Application rates for Goal 2XL range from 2.0-8.0 pints per acre.

PENDIMETHALIN (Prowl 3.8 CS, 3.3 EC) is available as a 3.8 lb per gallon capsule suspension for use in bearing and nonbearing apple, pear, cherry, nectarine, peach, and plum under the name Prowl H20. Applications rates are 2 to 4 quarts per acre. Do not apply within 60 days of harvest. Check to see that this supplemental label is still current at the desired application time to bearing fruit trees. Pendimethalin is also available as a 3.3 pound per gallon emulsifiable concentrate for use in nonbearing apple, pear, cherry, nectarine, peach, and plums. Pendimethalin provides preemergence control of annual grasses and certain small-seeded broadleaf weeds. Check to see that this supplemental label is still current at the desired application time to bearing fruit trees. Apply to new plantings only after the ground has settled and no cracks are present. Apply as a direct spray, avoiding contact with leaves, shoots, or buds. Pendimethalin controls barnyardgrass, crabgrass, foxtails, goosegrass, johnsongrass (seedlings), fall panicum, and a few broadleaves including carpetweed, common chickweed, henbit, velvetleaf, pigweed, and Pennsylvania smartweed. Pendimethalin may be tank-mixed with a contact herbicide to control existing vegetation.

PRONAMIDE (Kerb 50W) is formulated as a 50% wettable powder. Rates of 2.0 to 8.0 lb formulation per acre are recommended for fall application for specialized weed problems in orchards and vineyards to control cool-season grasses such as fescues, orchardgrass, bluegrass, and quackgrass. Pronamide is absorbed by root systems of weeds, therefore it will control established cool-season grasses and certain broadleaf weeds. Pronamide also has preemergence activity to prevent the reestablishment of many weeds that normally emerge early in the spring. Pronamide does not provide full-season control of many summer annual weeds; therefore, it should be used in conjunction with other herbicides to obtain full-season control of most annual weeds. Use lower rates on coarse soils and higher rates on clay soils.

RIMSULFURON (Matrix) is formulated as a 25% dry flowable formulation. It can be applied to apple, pear, apricot, cherry, nectarine, peach and plum trees established at least one year. Matrix at 4 ounces per acre will provide preemergence control of certain annual grass and broadleaf weeds and will suppress dandelion and yellow nutsedge. It provides postemergence control of small seedlings of annual grass and broadleaf weeds with suppression of certain perennial weeds. It should be tank-mixed with other postemergence herbicides, such as glyphosate, glufosinate, or paraquat, for broader-spectrum control of emerged weeds. Combinations with other preemergence herbicides will also broaden the spectrum of weed control. Do not apply within 14 days of harvest.

SIMAZINE (Princep, Caliber 90 or 4L) is formulated as a 90% water dispersible granule and as a 4 lb/gallon liquid; it is recommended for use around apple, pear, cherry, and peach trees established at least one year. Princep 4L at 2.0 to 4.0 qt per acre, and Princep Caliber 90 at 2.2 to 4.4 lb per acre are recommended for all trees listed above. Simazine should be applied to the soil before weeds emerge or after removal of weed growth. It does not kill emerged weeds, but may be used in combination with paraquat or glyphosate. Simazine controls a wide variety of annual broadleaf weeds and grasses. Use lower rates on light soils and soils low in organic matter; higher rates on heavy soils and soils high in organic matter. Do not use on sandy or gravelly soils. The full rate of simazine may not be required when used in conjunction with other herbicides e.g. napropamide (Devrinol), oryzalin (Surflan), or norflurazon (Solicam) for season-long control of annual grasses. Avoid spray contact with crop foliage or fruit. Use tank-mixes with other preemergence herbicides if triazine-resistant pigweed or lambsquarters are present.

TERBACIL (Sinbar) is formulated as an 80% wettable powder and is recommended for use in apple and peach trees established at least 3 years. Apply 2.0 to 4.0 lb of Sinbar 80W per acre either in the spring or after harvest in the fall before weeds emerge or during early seedling stage of weed growth. Sinbar can be applied to trees established less than 3 years if lower rates (0.5 to 1.0 lb formulation per acre) are used and the soil has at least 2% organic matter and is not coarser than a sandy loam. Combinations with other herbicides would be beneficial when these lower rates of Sinbar are used. Check tree tolerance on a small scale prior to widespread use when treating young fruit trees. Terbacil controls seedling johnsongrass, barnyardgrass, annual bluegrass, chickweed, crabgrass, dandelion, dogfennel, foxtails, henbit, knotweed, common lambsquarters, mustard, black nightshade, orchardgrass, panicums, plantains, pigweeds, purslane, ragweed, and smartweed. The high rate is required for control of quackgrass, yellow nutsedge, horsenettle, and red sorrel. Apply terbacil plus surfactant at early stages of fruit development for control of horsenettle. Use lower rates on light soils and soils with low organic matter (1 to 2%); higher rates on soils with higher organic matter content. Do not use on soils with less than 1% organic matter or in areas with exposed tree roots. Do not replant treated areas to any crop within 2 years after application.

Postemergence

CARFENTRAZONE (Aim) is formulated as a 1.9 lb/gallon EW or as a 2 lb/gallon EC for the postemergence control of small annual broadleaf weeds. Application rates for this contact herbicide are 1 to 2 fluid ounces per acre. Apply when annual broadleaf weeds are less than 6 inches in height and actively growing. Carfentrazone does not control grasses. Carfentrazone can be tank mixed within other postemergence herbicides for broader-spectrum control or with preemergence herbicides since carfentrazone does not provide residual weed control. Adding a crop oil concentrate or nonionic surfactant may improve weed control. Do not allow spray to contact green stems, leaves, flowers, or fruit of fruit trees.

CLETHODIM (Select 2 EC) is formulated as an emulsifiable concentrate at 2 lb per gal (Select 2 EC) and is effective for controlling annual and perennial grasses in nonbearing apple, pear, cherry, nectarine, plum, and peach trees. Do not harvest within 1 year after application. The recommended rates of application are 6 to fl oz per acre for Select 2 EC. Add a crop oil concentrate at 1% vol/vol (1 quart per 25 gal spray solution). Visual symptoms appear only after 7 to 14 days after application. Grasses controlled by clethodim include barnyardgrass, crabgrass, fall panicum, foxtails, goosegrass, lovegrass, ryegrass, johnsongrass, shattercane, and witchgrass. Select 2 EC provides essentially postemergence control only. A preemergence herbicide could be applied to prevent reestablishment of annual grasses in a young orchard.

CLOPYRALID (Stinger) is formulated as a 3 lb per gallon liquid and is registered for use only in stone fruit. It provides postemergence control of certain broadleaf weeds, including white clover, red clover, vetch, common ragweed, and horseweed, with suppression of mugwort, Canada thistle, dandelion, and buckhorn plantain. It will not affect grasses. Apply at 1/3 to 2/3 pint per acre and do not apply within 30 days of harvest. Stinger can be tank-mixed with other herbicides registered for stone fruit to broaden the spectrum of control.

FLUAZIFOP-P (Fusilade DX) is formulated as a 2 lb active ingredient/gallon emulsifiable concentrate and is effective for controlling emerged annual and perennial grasses in newly planted and established orchards. Fluzifop-P-butyl can be applied to bearing and nonbearing cherries, nectarines, peaches and plums. Do not harvest within 14 days of application. Fluzifop-P-butyl can also be applied to nonbearing apples and pears - do not harvest within one year of application. The recommended rate is 12 fl oz per acre for Fusilade DX for stone fruits and 16-24 fl oz per acre for non-bearing apples and pears. Add 1 qt of crop oil concentrate or 1/2 pint nonionic surfactant per 25 gallons of water. Fluzifop-P-butyl selectively controls grasses and does not kill or injure broadleaf weeds or crops. Applications should be made to young (2 to 8 inch) actively growing annual grasses before seedhead development. Since fluzifop-P-butyl is systemic, visual symptoms may not appear in treated grasses for 7 to 14 days after application. Fluzifop-P-butyl leaves no soil residues, therefore, one of the preemergence herbicides used for grass control (napropamide, norflurazon, or oryzalin) should be applied to prevent the reestablishment of annual grasses in the young orchard. Fluzifop-P-butyl is also recommended for control of established perennial grasses such as bermudagrass, johnsongrass, nimblewill, paspalums, purpletop, quackgrass, or orchardgrass.

GLUFOSINATE (Rely) is formulated as a 1 lb per gallon liquid and is applied at the rate of 3 to 6 quarts per acre. Rely is only labeled for use on apples. Use the lower rate for control of annual weeds less than 6 inches tall and higher rates for control of taller weeds and for perennials. Rely is primarily a contact herbicide so repeat treatments may be required, especially for perennial weeds. It is a nonselective herbicide so avoid contact with the leaves or bark of apple trees. Use only on trees established at least one year. Thorough coverage of weeds is required for control. Rely does not provide residual control so a preemergence herbicide can be added to control weeds germinating after application. Additional surfactant is not needed for a Rely application.

GLYPHOSATE (Roundup UltraMax II, Roundup WEATHERMAX, Touchdown, others) is recommended for controlling emerged annual and perennial weeds around apple, pear, cherry, peach, plum, and nectarine trees; however, only wick applicators may be used around peach, plum, or nectarine trees. Application rates range from 0.75 to 3.75 lb glyphosate acid equivalent per acre. Commonly available formulations contain 3, 3.7, or 4.5 lb per gallon of glyphosate acid, the active ingredient. Check the label to see if addition of a surfactant is recommended. Do not allow spray to contact foliage, branches, suckers, open wounds, immature bark, or other green parts of the crop. Application rates are Roundup UltraMax II 22 fl oz - 3.2 qt/A, Roundup WEATHERMAX 22 fl oz - 3.3 qt/A, Touchdown 1.0-5.0 qt/A. Glyphosate is also formulated and sold under other trade names. Check the label for specific use instructions. Small annual weeds can be controlled using the lower end of the rate range. For most perennial weeds, glyphosate is best applied in late summer or early fall prior to frost when these weeds are in the flowering/fruitlet stage. Established perennial grasses such as fescues, orchardgrass, purpletop, paspalums (field paspalum, vaseygrass, dallisgrass) require higher use rates (middle to higher end of the rate range) while hard to control woody plants like poison ivy and brambles require rates at or near the high end of the rate range. For spot treatment use 1.3-2.6 fl oz Roundup UltraMax II or Touchdown/gallon and spray to wet but not the point of runoff. For wiper applications use 1 part Roundup UltraMax II or Touchdown/gallon to 2 parts water. Apply when weeds are actively growing and not under drought stress. **WARNING:** Do not mix, store, or apply spray solutions in galvanized metal or unlined steel tanks. Chemical reaction produces hydrogen gas, which is very explosive.

PARAQUAT is available as a 2.0 lb paraquat cation per gallon under the trade name Gramoxone Inteon and previously as a 3 lb paraquat cation per gallon as Gramoxone Max. Apply Gramoxone Inteon at 2.5 to 4.0 pints/A or Gramoxone Max at 1.7 to 2.7 pints/A. Paraquat can be applied to apple, pear, cherry, nectarine, peach, and plum trees. Apply this contact herbicide as a directed spray when weeds are small and actively growing. Add a nonionic surfactant at the rate of 8.0 to 32.0 fl oz per 100 gal. Repeated applications will be necessary to give sustained control. Do not allow spray to contact green stems, fruit, or foliage as injury may result. **WASH THE TANK AND SPRAYER THOROUGHLY WITH CLEAR WATER AFTER SPRAYING. PARAQUAT IS EXTREMELY TOXIC. HANDLE WITH CAUTION!**

SETHOXYDIM (Poast) available as a 1.5 lb active ingredient per gal liquid, is effective for controlling emerged annual and perennial grasses in bearing and nonbearing apples, cherries, nectarines, peaches, and pears - do not apply within 14 days of apple or pear harvest. Do not apply within 25 days of cherry, nectarine or peach harvests. Apply to nonbearing plums only. Recommended rates are 1.5 to 2.5 pt per acre on actively growing grasses. Apply 1.5 pt per acre to annual grasses up to 6 inches high and apply 2.5 pt per acre to annual grasses up to 12 inches high and to perennial grasses. A crop oil concentrate should be added at the rate of 1 quart per acre. Sethoxydim controls grasses and does not kill or injure broadleaf weeds or crops. Since sethoxydim is systemic, visual symptoms may not appear in treated grasses for 7 to 14 days after application. Sethoxydim leaves no soil residue; therefore, one of the preemergence herbicides used for grass control [napropamide (Devrinol), norflurazon (Solicam), or oryzalin (Surflan)] should be applied to prevent the reestablishment of annual grasses in the young orchard. Sethoxydim is also recommended for use in newly established peaches, nectarines and vineyards to control established grasses such as bermudagrass, quackgrass, johnsongrass, nimblewill, paspalums, purpletop, fescues, or orchardgrass.

2,4-D AMINE (Weedar 64, Orchard Master) is formulated as a 3.8 lb active ingredient per gallon liquid and is recommended for control of broadleaf weeds in apples, pears, and stone fruits. This treatment is particularly useful for controlling troublesome broadleaf weeds that escape preemergence treatments recommended for new plantings. Apply as a directed spray at 1.5 qt per acre to young actively growing weeds. 2,4-D will not control grasses and certain perennial broadleaf weeds. Do not allow spray to contact fruit, branches, or trunks of trees. Use a coarse spray and low pressure to avoid drift to susceptible crops. Addition of a surfactant may improve weed control. Do not apply within 14 days of apple or pear harvest, or within 40 days of cherry, peach, or plum harvest.

Orchard Master and Weedar 64 are also registered for use on peaches. Application can be made in fall or early spring for control of such weeds as dandelion but treatments should be made prior to bloom of peach. Better coverage of broadleaf weeds may be obtained in the spring because of lower grass cover.

Herbicide Recommendations

Tables 14, 15 and 16 should be utilized to assist in the selection and use of appropriate herbicides and/or their combinations. For Tables 14 and 15, herbicide effectiveness is rated as follows: E = 90-100% control, G = 80-90% control, F = 70-80% control, P = 30-70% control, and N = no control.

The first column in Table 16 gives a generalized statement about the type of weeds controlled.

The second column of Table 16 gives the common chemical name of the active ingredient followed by the trade name and formulation in parenthesis. There may be several trade names and formulations of a single active ingredient.

The amount of herbicide on a sprayed-acre basis is given in the third column of Table 16. Remember that a sprayed acre is not the same as an acre of orchard because herbicides are normally applied in a band within the tree row. The first figure represents the amount of active ingredient per acre, and the amount of commercial product is in parenthesis. Always consult the label to get specific directions for use.

Table 14. Relative Effectiveness of Preemergence Herbicides in Tree Fruits

(E=excellent; G=good; F=fair; P=poor; N=none)

	Dichobencil (Casoron)	Diuron (Karmex)	Flumi- oxazin (Chateau)	Napro- pamide (Devrinol)	Norflu- razon (Sollicam)	Oryzalin (Surflan)	Oxyfluor- fen (Goal)	Pendi- methalin (Prowl)	Pronamide (Kerb)	Rimo- sulfuron (Matrix)	Simazine (Princep)	Terbacil (Sinbar)
ANNUAL GRASSES												
Barnyardgrass	G	G	-	G	E	G	F	G	F	F	F-G	G
Cheat	G	G	-	G	G	G	-	G	G	-	G	G
Crabgrass	G	G	F-G	E	E	E	F	G	G	F	F-G	F-G
Fall panicum	G	F	-	G	E	G	-	G	F	-	F-G	F-G
Foxtails	G	G	F	E	E	E	F	G	G	-	G	G
Goosegrass	G	G	-	E	G	E	F	F	G	-	E	-
Johnsongrass (seedling)	F	P-F	P-F	P	G	F-G	P	F	-	-	P	-
ANNUAL BROADLEAF WEEDS												
Annual fleabane	E	G	-	G	F	G	-	-	F	-	G	E
Annual morningglory	G	G	G	N	F	P-F	F	P	F	P	G	G
Black nightshade	G	G	G	N	F-G	P-F	G	N	F	F	E	-
Carpetweed	G	E	-	G	G	G	G	G	G	-	E	E
Common chickweed	G	E	F-G	G	G	G	G	G	G	-	E	G
Common lambsquarters	G	E	E	F-G	G-E	G	G	G	F	F	E	G
Common ragweed	G	E	E	F	F	P	F	N	P	F	E	G
Hairy galinsoga	P	E	-	G	-	G	G	N	-	-	E	E
Henbit	G	E	-	F	-	P	G	G	G	-	E	G
Horseweed	G	G	-	P	G	F	F	P	P	G	E	G
Knotweed	G	G	-	G	F	G	G	P	E	-	G	G
Mustards	G	G	-	P	F	P-F	G	-	G	-	G	E
Pennsylvania smartweed	G	G	-	P	-	P-F	G	-	-	-	G	G
Pigweeds	G	E	E	G	F	G	G	P	-	E	E	G
Prickly lettuce	G	G	-	G	-	F	G	-	N	-	E	G
Prickly sida	G	G	G	N	P	P-F	E	N	-	F	G	-
Purslanes	G	E	-	G	G	G	G	G	-	-	E	G
Shepherd's-purse	G	G	-	F	G	G	-	G	G	-	E	-
Speedwells	G	-	-	-	-	-	G	-	P	-	-	-
Velvetleaf	P	F	E	N	-	P-F	G	G	P	-	-	G
Virginia pepperweed	G	G	-	F	G	G	-	-	P	-	E	-
PERENNIAL GRASSES AND SEDGES												
Fescues	G	F	-	N	F	N	N	N	G	-	P	F
Johnsongrass (rhizome)	-	P	N	N	P	N	N	N	P	-	P	P
Nimblewill	-	P	-	N	F	N	N	N	P	-	P	P

	Dichobencil (Casoron)	Diuron (Karmex)	Flumi- oxazin (Chateau)	Napro- pamide (Devrinol)	Norflu- razon (Solicam)	Oryzalin (Surflan)	Oxyfluor- fen (Goal)	Pendi- methalin (Prowl)	Pronamide (Kerb)	Rimo- sulfuron (Matrix)	Simazine (Princep)	Terbacil (Sinbat)
Orchardgrass	G	P-F	-	N	F	N	N	N	G	-	P-F	G-E
Quackgrass	G	F	-	N	P	N	N	N	G	-	P-F	G
Yellow nutsedge	P-F	P	N	N	P	N	N	N	N	F	N	F-G
Purpletop, Redtop	-	P	-	N	F-G	N	N	N	-	-	N	F-G
Dallisgrass	-	F	-	N	P	N	N	N	-	-	N	F-G
Bermudagrass	N	N	N	N	P	N	N	N	P	N	N	F
PERENNIAL BROADLEAF WEEDS												
Broadleaf plantain	G	P-F	-	N	P	N	N	N	F	-	G	F
Buckhorn plantain	G	P-F	-	N	P	N	N	N	F	-	G	F
Canada thistle	F	N	-	N	N	N	N	N	-	-	N	N
Chicory	G	G	-	N	N	N	N	N	-	-	P-F	G
Common mallow	G	F	-	N	N	N	N	N	-	-	N	-
Common milkweed	-	N	-	N	N	N	N	N	-	-	N	N
Common yarrow	-	N	-	N	N	N	N	N	-	-	-	N
Dandelion	G	P-F	-	N	N	N	N	N	P	-	P-F	G-E
Docks (broadleaf, curly)	G	F	-	N	N	N	N	N	F	-	N	F
Goldenrod	F-G	-	-	N	N	N	N	N	-	-	N	P-F
Ground ivy	E	N	-	N	N	N	N	N	-	-	N	N
Hemp dogbane	N	N	-	N	N	N	N	N	-	-	N	N
Horsenettle	N	P-F	-	N	N	N	N	N	-	-	P	F-G
Mugwort	G	P	-	N	N	N	N	N	-	-	N	P
Red sorrel	G	N	-	N	N	N	N	N	F-G	-	N	P
Thistles (bull, musk, plumeless)	G	N	-	N	N	N	N	N	P	-	N	-
White flowered aster	F	N	-	N	N	N	N	N	-	-	N	F
Wild carrot	G	P	-	N	F	N	N	N	-	-	N	N
Wild strawberry	G	G	-	N	P	N	N	N	-	-	N	N
Yellow rocket	G	P	-	N	F	N	N	N	P-F	-	P	G
Yellow woodsorrel	G	F	-	N	F	N	N	N	-	-	F	G
SPECIAL PERENNIAL WEED PROBLEMS												
Bigroot morningglory	-	N	-	N	N	N	N	N	N	-	N	N
Brambles (Rubus spp.)	N	N	-	N	N	N	N	N	N	-	N	N
Common greenbriar	N	N	-	N	N	N	N	N	N	-	N	N
Japanese honeysuckle	N	N	-	N	N	N	N	N	N	-	N	N
Poison-ivy	N	N	-	N	N	N	N	N	N	-	N	N
Virginia creeper	N	N	-	N	N	N	N	N	N	-	N	N
Wild garlic	N	N	-	N	N	N	N	N	N	-	N	N

Table 15. Relative Effectiveness of Postemergence Herbicides in Tree Fruits

(E=excellent; G=good; F=fair; P=poor; N=none)

CHEMICALS	Carfentrazone (Aim)	Clopyralid (Stinger)	Fluazifop-P (Fusilade DX)	Glufosinate (Rely)	Glyphosate (Various)	Paraquat (Gramoxone)	Sethoxydim (Poast)	2,4-D	Clethodim (Select)
Annual Grasses									
Barnyardgrass	N	N	E	G	E	G-E	E	N	E
Cheat	N	N	G	-	E	G-E	-	N	G
Crabgrasses	N	N	E	G	E	G-E	E	N	E
Fall panicum	N	N	E	G	E	G-E	E	N	E
Foxtails	N	N	E	G	E	G-E	E	N	E
Goosegrass	N	N	E	G	E	G-E	E	N	E
Johnsongrass (seedling)	N	N	E	-	E	G-E	E	N	E
ANNUAL BROADLEAF WEEDS									
Annual fleabane	-	G	N	-	E	E	N	G	N
Annual morningglory	F	N	N	G	F-G	G	N	E	N
Black nightshade	G	F	N	G	E	G	N	F-G	N
Carpetweed	-	-	N	-	E	E	N	E	N
Common chickweed	P	N	N	G	E	E	N	P	N
Common lambsquarters	G	P	N	G	E	E	N	G	N
Common ragweed	P	G	N	G	E	E	N	G	N
Hairy galinsoga	-	-	N	-	E	E	N	G	N
Henbit	G	-	N	G	E	E	N	P	N
Horseweed	-	G	N	G	E	G	N	P	N
Knotweed	-	-	N	-	E	F-G	N	F	N
Mustards	-	N	N	G	E	P-F	N	G	N
Pennsylvania smartweed	-	F	N	G	E	G	N	P	N
Pigweeds	G	P	N	G	E	G	N	G	N
Prickly lettuce	-	-	N	G	E	G	N	P	N
Prickly sida	-	-	N	G	E	E	N	G	N
Purslanes	-	-	N	G	E	G	N	G	N
Shepherd's-purse	-	-	N	G	E	F-G	N	G	N
Speedwells	-	-	N	-	E	P	N	P	N
Velvetleaf	E	P	N	G	E	E	N	G	N
Virginia pepperweed	-	-	N	-	E	G	N	G	N
PERENNIAL GRASSES AND SEDGES									
Fescues	-	N	P-F	F	E	F	F	N	F
Johnsongrass (rhizome)	-	N	G	-	E	P	G	N	G

CHEMICALS	Carfentrazone (Aim)	Clopyralid (Stinger)	Fluazifop-P (Fusilade DX)	Glufosinate (Rely)	Glyphosate (Various)	Paraquat (Gramoxone)	Sethoxydim (Poast)	2,4-D	Clethodim (Select)
Nimblewill	-	N	F-G	-	G-E	P	-	N	-
Orchardgrass	-	N	F	-	E	F	F	N	-
Quackgrass	-	N	G	P	G	P	G	N	G
Yellow nutsedge	-	N	N	G	G	P	N	N	N
Purpletop, Redtop	-	N	G	-	E	P	-	N	-
Dallisgrass	-	N	G	-	E	P	G	N	-
Bermudagrass	-	N	F-G	F	G	P	F-G	N	F-G
PERENNIAL BROADLEAF WEEDS									
Broadleaf plantain	-	F	N	-	E	P	N	G	N
Buckhorn plantain	P	F	N	F	E	P	N	G	N
Canada thistle	-	F	N	-	F-G	P	N	F-G	N
Chicory	-	-	N	-	E	P	N	G	N
Common mallow	-	-	N	-	E	P	N	-	N
Common milkweed	-	-	N	-	G	P	N	P-F	N
Common yarrow	-	-	N	-	G	P	N	F	N
Dandelion	P	F	N	G	E	P	N	G	N
Docks (broadleaf, curly)	P	-	N	-	G	P	N	F-G	N
Goldenrod	-	-	N	-	E	P-F	N	P-F	N
Ground ivy	-	-	N	G	G	P-F	N	P-F	N
Hemp dogbane	-	-	N	P	F	P	N	P-F	N
Horsenettle	-	-	N	G	F-G	P	N	P	N
Mugwort	-	P	N	-	F	P	N	P	N
Red sorrel	-	-	N	G	G	P	N	P	N
Thistles (bull, musk, plumeless)	-	G	N	-	G	P	N	F-G	N
White flowered aster	-	-	N	-	E	P-F	N	N	N
Wild carrot	-	-	N	-	E	P	N	G	N
Wild strawberry	-	-	N	-	E	P-F	N	P-F	N
Yellow rocket	-	-	N	-	E	F	N	P-F	N
Yellow woodsorrel	-	-	N	G	E	P	N	F	N
SPECIAL PERENNIAL WEED PROBLEMS									
Bigroot morningglory	-	N	N	-	F-G	P	N	F-G	N
Brambles	-	N	N	G	G	P	N	P	N
Common greenbriar	-	-	N	-	P	P	N	N	N
Japanese honeysuckle	-	-	N	-	F-G	P	N	P-F	N
Poison-ivy	-	-	N	-	G	P	N	P-F	N
Virginia creeper	-	-	N	-	F-G	P	N	P-F	N
Wild garlic	-	-	N	G	F	P	N	F	N

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APPLES AND PEARS

Table 16. Herbicides and Rates Recommended for Use in Apple and Pear Orchards.

For more complete information see discussion on individual herbicides.^a

Year of Planting

Weeds Controlled Preemergence	Herbicide Chemical Name (Trade Name)	Amount Per Acre Sprayed Active Ingredient (Formulated Product)
Annual grasses and some broadleaf weeds	napropamide (Devrinol 50DF)	4 lb ai (8 lb)
Annual grasses and some broadleaf weeds; suppression of some perennial grasses	norflurazon (Solicam DF)	2.0-4.0 lb a.i. (2.5-5.0 lb)
Annual grasses and some broadleaf weeds	oryzalin (Surflan 4AS)	2.0-6.0 lb a.i. (2.0-6.0 qt)
Annual grasses and some broadleaf weeds	pendimethalin (^o Prowl 3.3EC, Prowl H2O)	1.9-3.8 lb a.i. (2.4-4.8 qt Prowl 3.3EC, 2-4 qt Prowl H2O)
Annual broadleaves and some annual grassy weeds	oxyfluorfen (Goal 2XL)	0.5-2.0 lb a.i. (2.0-8.0 pt)
Annual grasses and broadleaves and some perennial grasses and broadleaves	dichlobenil (Casoron 4G)	4-6 lb a.i. (100-150 lb)

Postemergence

Weeds Controlled	Herbicide Chemical Name (Trade Name)	Amount Per Acre Sprayed Active Ingredient (Formulated Product)
Annual and perennial grasses	^b fluazifop-P (Fusilade DX)	0.25-0.37 lb a.i. (16-24 fl oz) + 1 qt crop oil concentrate or 1/2 pt of a nonionic surfactant per 25 gal
Annual and perennial weeds	^b clethodim (Select 2EC)	0.1-0.125 lb a.i. (6-16 fl oz and 1 qt crop oil concentrate/25 gal)
Annual and perennial weeds	glyphosate (various)	0.75-3.75 lb a.e. (Roundup UltraMax II 22 fl oz - 3.3 qt, Roundup WeatherMax 22 fl oz - 3.3 qt, Touchdown 1.0-5.0 qt, or other label formulation) (For spot treatment use 1.3-2.6 fl oz/gallon) (For wiper applications use a 33% solution)
Annual weeds upon general contact	paraquat (Gramoxone Inteon, Gramoxone Max)	0.64-1.0 lb a.i. Gramoxone Inteon 2.5-4.0 pt/A, Gramoxone Max 1.7-2.7 pt/A + 8-32 fl oz of nonionic surfactant per 100 gal
Annual and perennial grasses	sethoxydim (Poast)	0.5 lb a.i. (1.5-2.5 pt) + 1 qt crop oil concentrate per acre
Annual broadleaf weeds	carfentrazone (Aim EC, Aim EW)	1.0-2.0 fl oz/A + 0.25% v/v nonionic surfactant or 1% v/v crop oil concentrate

Trees established one full year

Any of the Treatments for Bearing Trees Listed Previously or One of the Following

Postemergence

Broadleaf weeds	2,4-D (Weedar 64, Orchard Master)	1.4 lb a.i. (1.5 qt.)
Annual and perennial weeds	glufosinate (Rely)	0.75-1.5 lb a.i. (3-6 qt)

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Weeds Controlled	Herbicide Chemical Name (Trade Name)	Amount Per Acre Sprayed Active Ingredient (Formulated Product)
Trees Established One Full Year		
Preemergence		
Most annual and some perennial weeds	diuron (Karmex DF)	3.2 lb a.i. (4.0 lb)
Annual and perennial grasses	pronamide (Kerb 50W)	Annuals: 1.0-2.0 lb a.i. (2.0-4.0 lb) Perennials: 2.0-4.0 lb a.i. (4.0-8.0 lb)
Annual grasses and broadleaf weeds	rimosulfuron (Matrix)	0.66 lb a.i. (4 oz)
Most annual weeds	simazine (Princep, Caliber 90 or 4L)	2.0-4.0 lb a.i. (2.2-4.4 lb or 2.0-4.0 qt)
	flumioxazin (Chateau WDG)	0.19-0.38 lb ai (6-12 oz)
Trees Established Two Full Years		
Any of the Treatments for Bearing Trees Listed Previously or One of the Following:		
Most annual and some perennial weeds	diuron (Karmex DF) plus terbacil (Sinbar) (apples only)	0.8-1.6 lb a.i. (1.0-2.0 lb) 0.8-1.6 lb a.i. (1.0-2.0 lb)
Trees Established Three Full Years		
Any of the Treatments for Bearing Trees Listed Previously or One of the Following:		
Annual and many perennial weeds	terbacil (Sinbar) (apples only)	1.6-3.2 lb a.i. (2.0-4.0 lb)
Trees Established Four Full Years		
Any of the Treatments for Bearing Trees Listed Previously		

^a Pesticide applications must be made according to the manufacturer's label directions. Always read and follow the pesticide label directions prior to use. Some herbicides require a waiting period between application and replanting and/or harvesting.

^b Labeled for non- bearing trees only.

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STONE FRUITS

See introductory discussion and specific remarks under “Apples and Pears”. The same principles of safe and effective herbicide use apply to other tree fruit crops as well. An “X” in any block of the table below indicates that the herbicide in the left column is registered and may be used for weed control in that crop at the same rate(s) and under the same conditions as recommended for use in apples and pears. If the space is blank, the herbicide is not registered for use in that particular crop.

Most research on the herbicide performance and safety to fruit crops at Virginia Tech and West Virginia University has been conducted on apples and peaches. However, the use of herbicides and their combinations mentioned for other tree fruits is also believed to be valid, based on the best information available from other sources and limited experimentation in Virginia and West Virginia.

Table 17. Herbicides for Use in Stone Fruit Orchards¹

Herbicide	Cherries	Nectarines	Peaches	Plums
clethodim ⁵	X	X	X	X
clopyralid	X	X	X	X
dichlobenil	X			
diuron ³			X	
fluzifop-P	X	X	X	X
flumioxazin ²	X	X	X	X
glyphosate ⁴	X	X ⁴	X ⁴	X ⁴
napropamide	X	X	X	X
norflurazon ⁶	X	X	X	X
oryzalin	X	X	X	X
oxyfluorfen	X	X	X	X
paraquat	X	X	X	X
pendimethalin	X	X	X	X
pronamide ²	X	X	X	X
rimosulfuron ²	X	X	X	X
sethoxydim	X	X	X	X
simazine ²	X		X	
terbacil ³			X	
2,4-D (Orchard Master)	X		X	X
2,4-D (Weedar 64)	X	X	X	X

¹ For recommended rates of herbicides and directions, see Table 16, “Herbicides and Rates Recommended for Use in Apple and Pear Orchards”. See p. 121 for oxyfluorfen.

² Use on trees established at least one year.

³ Use on trees established at least three years. A diuron-terbacil combination may be applied to peach trees established at least two years. See label for maximum combined rates.

⁴ Use with wick applicator only.

⁵ Nonbearing trees only.

⁶ Apply at least 18 months after planting cherries, 6 months after planting nectarines or peaches or at least 12 months after planting plums.