

grower must carefully consider before using. The cost must be justified by the anticipated benefits. And the benefits must be reliable and predictable. Moreover, availability of fumigants may decline in the future due to EPA restrictions and voluntary withdrawal by manufacturers. With this in mind, it is advisable to implement effective crop rotation plans and other soil management practices in anticipation of reduced availability of fumigants.

Weed Management General Notice

Certain herbicides listed in this publication may be discontinued by the manufacturer and thus no longer available. Use of remaining stocks on dealers shelves or farm storage is encouraged and legal provided the label directions are followed.

The primary goal of weed management is to optimize yield by minimizing weed competition. Weeds can reduce yields by competing with the crop for water, light, and nutrients. Weeds also promote pest injury by acting as alternate hosts for plant pathogens and insects, inhibiting spray penetration, and maintaining a high humidity in the crop canopy. Timely cultivations, wise use of herbicides and mulches, and not allowing weeds to go to seed are integral parts of a good weed management system. Many of the weeds found in small fruit plantings are difficult-to-control perennials that are not common in other crops. Do not expect chemicals to completely control weeds. Every herbicide does not control every weed species and the selection of a given herbicide should be made on the basis of specific weed species present in the field.

Herbicide rates listed on the product label are for broadcast applications. Reduce rates proportionally for banded or strip applications. For best results with herbicides follow the manufacturer's application directions regarding rates, additives, soil type, soil moisture conditions, time of year, crop age, stage of weed growth, environmental conditions, and product limitations.

It is unlawful to use any pesticide for other than the registered use. **ALWAYS READ AND FOLLOW ALL LABEL DIRECTIONS.** The user assumes all responsibilities for use inconsistent with the label on the product container.

Trade names are used for identification. No product endorsement is implied, nor is discrimina-

tion intended against similar materials not mentioned. Cooperative Extension and the participating universities make no warranty or guarantee of any kind, expressed or implied, concerning the use of these products.

Weed Management

Herbicides

Herbicides are chemicals designed to control weeds. The use of these chemicals must be exact for satisfactory results. Proper rate selection, timing of application, activation, and observance of all precautions on the label must be followed to obtain optimum performance. Each herbicide controls certain weeds or families of weeds. Therefore, knowledge of the type of weed species present in the field is essential for good weed control (see the "Weeds of the Northeast" reference in the Resource Materials section). Once the weed problem is known, select the proper herbicide. Certain considerations should be made in this process.

- Restrictions on rates, timing and crops for which the herbicide is approved.
- Degree of susceptibility of each weed to a specific herbicide.
- Limitations and special requirements of the herbicide.

General Principles for Safe Use

- Know the herbicide. Read the label.
- Check the output of sprayer frequently.
- Replace worn nozzles. It may be necessary to replace them several times a season if the sprayer is used constantly.
- Avoid skips and overlapping.
- Rinse spray equipment immediately after use. If possible, use one sprayer for herbicides and another for insecticides and fungicides.

Rate Selection

Always check the label to determine the proper rate to apply. For most soil-applied herbicides, knowledge of the type of soil and the percentage organic matter usually determines the rate. Generally, the more clay and/or organic matter present in the soil, the higher the herbicide rate necessary for good weed control. For postemergence herbicides, the type of weed as well as its size will usually determine the rate.

Incorporation of Herbicides

Some herbicides must be incorporated into the soil to be effective. Herbicides are incorporated because they are volatile and evaporate into the air if left on the soil surface or they will decompose when exposed to sunlight. Herbicides differ in their incorporation requirements; check the product label for the manufacturer's requirements.

Weed Sprayer Systems

- Select a sprayer and pump that can deliver a volume of 20 to 50 gallons per acre. Most herbicides are applied at rates of 20 to 40 gallons of water per acre. Pressures of 20 to 40 p.s.i. at the nozzle are recommended for most herbicides. Higher pressures result in finer droplets and increase the chance for more drift. Lower pressures sometimes cause uneven spray patterns.
- Use 50-mesh screened filters for nozzles and suction lines.
- Select 80½ or 110½ flat fan nozzles. Because of wear, brass tips used exclusively for applying wettable powders should not be used on more than 30 acres before being replaced. Use stainless steel or hardened stainless steel tips for longer wear. Stainless steel nozzle tips are more than twice the cost of brass tips but last about 20 times longer. Hardened stainless steel tips are only slightly more expensive than stainless steel tips but last three times longer. Ceramic nozzles are the most durable.
- Calibrate sprayers frequently and check for wear, especially when wettable powders have been used.

Mechanical Weed Control

Cultivation is an important component of weed control in small fruits, particularly when the use of herbicides and/or mulches is to be minimized or eliminated. The timing of cultivation should be based on the stage of weed growth that your equipment is best suited to control, as well as to the stage of crop development that is most sensitive to weed pressure. In general, weeds are most effectively cultivated shortly after they germinate, and crops are most sensitive to weed pressure during their early stages of growth. Thus, cultivation is most critical early in the growing season. To get good weed control with cultivation requires use of the proper machinery, driven by a competent operator, in a

timely fashion.

A variety of cultivation equipment is used by small fruit growers. These include **rotovators, multivators, rolling cultivators, rotary hoes, sweep cultivators and discs, S-tine or Danish S-tine cultivators, basket weeders, finger weeders, spring-hoe and spyder weeders, and spring-tine weeders**. For a full description of these cultivators, see references in resource materials section.

Stale Bed Technique

In many cases, choice of herbicides for use in newly planted small fruit crops is limited. Even when a herbicide is registered for use in the crop, certain weed species may be present which the herbicide cannot control. In many cases, it may be possible to use a method which utilizes Gramoxone, Roundup, Touchdown, Scythe or flaming. Except for cool early spring conditions, when weeds may be slow to germinate, this method, termed the stale bed technique, can mean the difference between good weed control and poor or no weed control. Here are the steps:

- Prepare the for transplanting. If a soil-incorporated herbicide is used, it must be applied and incorporated at this time. The soil should have good moisture (irrigate with 1/4" of water if necessary).
- Wait as long as possible so that weeds will germinate and emerge. Allow weed seedlings to grow to the third leaf stage, or at least to the first true leaf. On sandy, loamy or high organic matter soils, the soil should not crust and modern seeders should still work satisfactorily. On heavy clay soils, crusting could make this technique unusable.
- If you're using transplants, flame the soil or make an application of Gramoxone, Scythe, Touchdown or Roundup (if registered for the crop) to the soil surface before transplanting. Transplant the crop and then apply any preemergence herbicide, which you would normally use, to the soil surface.

The main idea with this technique is that most of the weeds that have the potential to germinate, because of their placement in the upper 1" to 2" of the soil, will usually do so within two weeks after the soil is prepared. Adequate soil moisture and temperature (at least 50½ F at a depth of 2") must be present. Gramoxone, Roundup, Touchdown, Scythe or flaming will kill these weeds. By not redistributing

the soil any more than is absolutely necessary during the seeding or transplanting process, no new weed seeds will be brought close to the soil surface. This technique, because it reduces the number of viable weed seeds near the soil surface after seeding or transplanting, will also help the residual herbicide, if any, to perform better than it normally would. Finally, any cultivation which is performed should be kept extremely shallow (3/4" to 1" maximum) so as not to reposition any additional weed seeds. Note: Check the current herbicide recommendations by crop to determine if Gramoxone, Scythe, Touchdown or Roundup is registered for use in that crop.

Finally, in cases where Roundup or Touchdown is registered, it can also be used for control of perennial weeds, such as quackgrass and dock, prior to soil preparation. After application, delay tillage for three to five days. There is no residual weed control. Rates vary considerably. See the label for directions. Gramoxone, Scythe and flaming will have minimal long-term effect on perennial weeds.

Flame Weeding

Flame weeding is the killing of weeds with intense, directed heat produced by a propane burning device, either hand-held or tractor-mounted. Flaming can be used as an alternative to non-selective herbicides for stale seedbeds. This involves preparing the soil as if for planting, without actually

planting the crop. Instead, weeds are allowed, even encouraged (with irrigation or row covers), to grow. Weeds are then killed. Because, like with contact herbicides, flaming kills weeds without soil disturbance, it is ideal for stale seedbeds. Some growers use hand-held units to flame just in the row, relying on cultivation for between-row weed control.

Prepared fields or beds may be flamed one or more times, depending on when weeds appear and when the crop is to be planted. Once broadleaf weeds reach the 3-leaf stage, they should be flamed to prevent them from growing too large. For the longest weed control effect, it is important that the final flaming be applied as late as possible prior to crop emergence or just prior to transplanting. Digging in the soil to check crop seeds for sprouting, or using a small piece of glass or row cover as an early warning system is one way to optimize the timing of flaming after direct seeding.

Flaming does not burn the weeds but "blanches" them. They will not collapse and die for several hours. There are exceptions. The growing points of grasses are usually below ground for some time and will not be affected by flaming. Purslane can take high temperatures without dying. These weeds require subsequent cultivation or hotter temperatures. When weeds are moist from rain or dew, more heat (a slower tractor or walking speed) will be necessary.

Safety is a big issue with flaming. Consult with a gas professional if constructing your own flaming unit. Do not mount propane tanks intended for stationary use onto tractors. Flame against the breeze and avoid areas with dry residues or dry hedgerows. Liability concerns may hinder the use of flaming.