WEED CONTROL IN PAPAYA

R. K. Nishimoto, Horticulturist
C. L. Chia, Extension Specialist, Horticulture

INTRODUCTION

Uncontrolled weeds can destroy papaya in the establishment phase, reduce yields of established trees, and hinder other farm practices. Weed control is a vital part of papaya crop management. Although many types of weed control are useful, this fact sheet will emphasize chemical control, particularly the properties and uses of herbicides for papaya.

Nonchemical control may involve hand-pulling, which is particularly important close to young seedlings on Aa lava soil. This soil makes hand or mechanical tillage equipment impossible to use, or at best, extremely difficult.

Black plastic mulches are useful on mineral soils in Hawaii but not on Aa lava soils, mainly because of the difficulty in laying the plastic. Black plastic mulch is very effective against annual broadleaf weeds but is virtually useless against perennial grasses or sedges such as purple nutsedge (Cyperus rotundus).

Mowing is another way to reduce rank growth of weeds. Under nonirrigated conditions and during periods of low rainfall, however, this practice may cause severe competition for water and mineral nutrients, resulting in lower yields.

Herbicides are an effective and safe means of weed control, when used properly. Five herbicides are registered with the Environmental Protection Agency (EPA) for use with papaya (Table 1). Four are postemergence herbicides (dalapon, paraquat, glyphosate, and fluazifop), and one (diuron) is for preemergence use. The proper choice depends on the characteristics and limitations of each chemical. The postemergence herbicides are effective on emerged weeds. Preemergence herbicides primarily control newly sprouting weeds.

POSTEMERGENCE HERBICIDES

Dalapon
Sold as Dowpon M, dalapon will control many grassy weeds. Perennial grasses such as California grass (Brachiaria mutica), however, will often resprout after several months. Dalapon is virtually ineffective on broadleaf weeds. This systemic herbicide is absorbed slowly and should not be applied if rain is imminent. Dalapon is generally more active when applied to vigorously growing weeds.

You must obtain a Special Local Need label from the Hawaii Department of Agriculture before using Dowpon M in papaya plantings.

Paraquat
Paraquat, available as Paraquat+Plus and Gramoxone, will control nearly all broadleaf and grassy weeds and will kill top growth of many perennials. Some perennials, such as thunbergia (Thunbergia fragrans), guava (Psidium guajava), and lantana (Lantana camara), tolerate paraquat treatment. With repeated applications, the populations of these and other tolerant weed species will increase.

A contact herbicide, paraquat is rapidly absorbed. Rainfall shortly after application does little to reduce its activity. Thus, it can still provide good weed control during relatively rainy periods.

Paraquat is a restricted chemical. A license from the Hawaii Department of Agriculture is required for its purchase and use.

Glyphosate
Glyphosate, available as Roundup, is effective on nearly all weed species: annuals, perennials, grasses, sedges, and broadleaves. Certain
species such as guava and honohono (*Commelina diffusa*), however, are difficult to control with glyphosate.

Glyphosate is a systemic herbicide and may not produce symptoms for several days. Annuals are usually killed in a week, whereas perennials may require two to six weeks for control. Glyphosate should not be used when rain is imminent, because rainfall or overhead irrigation within six hours after application may reduce its effectiveness. Glyphosate is generally more effective when applied to vigorously growing weeds.

Glyphosate can severely injure papaya by spray drift or direct contact with foliage, green bark of trunks, fruits, or other parts of trees. Thus, glyphosate can be difficult to use safely in young orchards with green bark. Injury usually appears first as a uniform chlorosis on the youngest leaves. Upon expanding, these will appear deformed, with injury sometimes resembling that caused by broad mite.

Spray drift can be reduced by selecting or adjusting nozzles to produce coarse sprays, spraying during nonwindy periods, and following label directions. Drift control additives can also be used. These increase the spray viscosity and therefore increase spray particle size.

Glyphosate can be applied not only with conventional applicators but also by rope wicks or rollers. With rollers or wicks, the herbicide solution is carried in an absorbent material and wiped on the weed. A 33 percent solution of glyphosate is generally used for rope wicks, whereas rollers require a 5 percent to 10 percent solution. These applicators eliminate spray drift. The label provides precise directions for these application techniques.

**Fluazifop**

Sold as Fusilade 2000, fluazifop will control most grassy weeds; it does not control broad-leaves or sedges. It is a systemic herbicide, and its symptoms may not show for several days. Fluazifop must be applied to actively growing grasses before flowering. It can be used on weeds for site preparation before planting or in non-bearing crops. It cannot be applied within one year before harvesting. As papaya will produce harvestable fruit about one year after sowing or about 10 months after transplanting, the use of fluazifop may require delay of harvesting.

**PREEMERGENCE HERBICIDE**

**Diuron**

Sold as Karmex, diuron controls many emerging annual broadleaves and grasses but gives poor control of many perennial species, such as thunbergia. Susceptible weeds are usually controlled for several months. Unlike post-emergence herbicides, diuron requires moisture to activate it. Rainfall or sprinkler irrigation within two weeks of application provides the best results. Besides its preemergence activity, diuron also controls young weeds as a postemergence application.

Diuron is most effectively used for papaya orchards established for at least one year, at rates of 1.25 lb to 5 lb per acre. It can also be used at a rate of 1 lb per acre as a preplant application, but it cannot be sprayed to the planting holes.

You must obtain a Special Local Need label from the Hawaii Department of Agriculture before using Karmex as a preplant application for papaya.

**WEED CONTROL PRACTICES**

Table 2 lists by trade name the herbicides approved for papaya and gives guidelines for their use. Small-scale trials are recommended before widespread field applications are made.

Certain species of weeds likely will tolerate one or another herbicide treatment or cultural practice. It may be useful to rotate herbicides, use chemical combinations specified on the herbicide label, and vary cultural practices to help reduce population increases of hard-to-control species. Judicious control of small infestations of tolerant species before seeds or other propagules are produced will likely be worth the effort, compared to the consequences of allowing these species to reproduce.

Weed control practices must be planned into the total management of papaya growing. Simply controlling weeds when time is available will often be “too little, too late.”

**SUGGESTIONS ON HERBICIDE USE**

1. **Read the label** on the herbicide container. *Know the precautions* to take when mixing and applying the herbicide. *Know the limitations* of the herbicide.
2. Use all safety equipment required by the herbicide label. Wear protective clothing, such as hat, long-sleeved shirt, trousers, and shoes and socks, as necessary to avoid chemical contact with skin. Wash work clothes separately from other laundry.

3. Use a low-pressure sprayer (25 lb/sq in) with a flat fan nozzle.

4. Clean application equipment thoroughly after each use. Do not use herbicide spray equipment for insecticide or fungicide.

5. Do not spray in windy weather.

6. A herbicide usually does not control all weeds, and it may be necessary to mix two chemicals in combinations specified on the herbicide label, to alternate the chemicals used, or to use other control methods, such as mechanical cultivation or mulching.

7. Consult your county extension agent or the Hawaii Department of Agriculture if you need advice and to make certain that no new regulations have been issued on the particular herbicide that is to be used.

8. Always use herbicides with caution. Store them in their original, labeled containers in locked cabinets or sheds, away from food or feeds. Triple-rinse metal, plastic, and glass containers before disposal. Puncture metal or plastic containers; do not reuse them. Wrap glass containers in newspapers and plastic bags if they are to be deposited in municipal waste collection sites.

9. Weeds are usually easiest to kill when they are small.

**SPRAYER CALIBRATION**

It is important to know how much herbicide you are applying, because each one is designed to be effective at a certain concentration and because laws and regulations limit the amounts of herbicides that may be applied to a given area during a given time. Read the label. Know the total area to which the herbicide will be applied. Calibrate your equipment.

Here is a simple way to calibrate your sprayer.

1. Fill sprayer with water only.

2. Spray a measured area at a comfortable speed at a fixed pressure.

3. Find the amount of water used by measuring the amount used to refill the tank.

4. To calculate the amount of water to apply to one acre, divide the area of an acre (43,560 sq ft) by the measured area, then multiply this by the amount of water used.

   \[
   \text{Measured area} = \text{length (feet)} \times \text{width (feet)} = \text{area (square feet)}
   \]

   \[
   \frac{43,560}{\text{measured area}} \times \text{amount of water used} = \text{water needed per acre}
   \]

5. You now know the rate of sprayer output when operated at the speed and pressure you used in your calibration test. To obtain the desired output rate as recommended on the label of the product you intend to apply, you may need to increase or decrease your sprayer output. This can be done by changing spray nozzle types, speed of travel, or tank pressure. Recalibrate until the desired output is achieved.

Example:

A sprayer applies 3 qt (0.75 gal) of water to an area 8 ft by 50 ft.

\[
\text{Measured area} = 8 \text{ ft} \times 50 \text{ ft} = 400 \text{ sq ft}
\]

\[
\frac{43,560 \text{ sq ft}}{400 \text{ sq ft}} \times 0.75 \text{ gal} = 81.7 \text{ gal/acre}
\]

So, at the rate of speed and tank pressure used during the calibration test, about 82 gal is applied to one acre.
Table 1. Herbicides for weed control in papaya.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Trade Name(s)</th>
<th>Weeds Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>POSTEMERGENCE HERBICIDES</strong></td>
</tr>
<tr>
<td>Dalapon</td>
<td>Dowpon M</td>
<td>Most annual and some perennial grasses</td>
</tr>
<tr>
<td>Paraquat</td>
<td>Paraquat+Plus</td>
<td>Annual broadleaf and grassy weeds</td>
</tr>
<tr>
<td></td>
<td>Gramoxone</td>
<td></td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Roundup</td>
<td>Nearly all weeds: annuals, perennials, grasses, sedges, and broadleaves</td>
</tr>
<tr>
<td>Fluazifop</td>
<td>Fusilade 2000</td>
<td>Most annual and perennial grasses</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PREEMERGENCE HERBICIDE</strong></td>
</tr>
<tr>
<td>Diuron</td>
<td>Karmex</td>
<td>Annual broadleaf and grassy weeds</td>
</tr>
</tbody>
</table>

Table 2. Guide to use of herbicides for papaya.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate of Commercial Formulation/Acre</th>
<th>Method and Time of Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dowpon M</td>
<td>5-10 lb</td>
<td>Apply before grass-heading stage in 100 gal of spray mix per acre. Add a surfactant at no more than 8 oz per 100 gal of spray mix. As a spot treatment in orchard areas, mix 0.06 oz to 0.12 oz per gallon of water. Add a surfactant. Do not apply more than 30 lb of Dowpon per acre per year. Use spray solution within 24 hours after mixing for maximum effect. Do not contaminate fruit, foliage, or young plants.</td>
</tr>
<tr>
<td>Paraquat+Plus</td>
<td>1-2 qt</td>
<td>Apply as directed spray to emerged weeds in 100 gal of spray mix per acre. Add a nonionic surfactant at 8 oz to 16 oz per 100 gal of spray mix. Do not allow spray to contact foliage, fruit, or stems. Do not allow animals to graze on treated areas.</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>Maximum 2 qt</td>
<td>For hand-held, high-volume equipment, mix 0.3 oz to 0.6 oz Paraquat+Plus or Gramoxone and 0.08 oz to 0.16 oz nonionic surfactant per gallon of water. Apply spray to foliage without runoff.</td>
</tr>
<tr>
<td>Roundup</td>
<td>1-5 qt</td>
<td>Apply as directed spray to emerged weeds in 10 gal to 40 gal of spray mix per acre when using conventional boom equipment. Repeat treatments may be necessary, but no more than 10.6 qt per acre per year can be used. Do not allow spray to contact foliage, fruit, or stems. Drift control additives may be used; if used, observe precautionary statements on the additive label. Do not allow animals to graze on treated areas for eight weeks after application.</td>
</tr>
<tr>
<td></td>
<td>Maximum 5 qt</td>
<td>For hand-held, high-volume equipment, mix 0.6 oz to 1.3 oz Roundup per gallon of water and apply to foliage without runoff. For harder-to-control weeds, use 2.6 oz Roundup per gallon of water. Adding a surfactant to the spray solution may enhance weed control.</td>
</tr>
</tbody>
</table>

CAUTION: Test any herbicide on a small area before using it in a widespread application.
Table 2. Guide to use of herbicide for papaya (Cont.).

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate of Commercial Formulation/Acre</th>
<th>Method and Time of Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusilade 2000</td>
<td>1-1.5 qt</td>
<td>Apply as a directed spray to weeds, with enough spray volume and pressure to ensure complete coverage. Avoid contact with crop foliage. Add a nonionic surfactant at 1 qt per 100 gal of spray mix or a nonphytotoxic crop oil concentrate as specified on the Fusilade 2000 label. Apply only to weeds in nonbearing plantings. Do not apply within one year of harvest.</td>
</tr>
<tr>
<td>Maximum</td>
<td>1.5 qt</td>
<td>For hand-held, high-volume equipment, mix 1.5 oz Fusilade 2000 and 0.5 oz nonionic surfactant or 1.5 oz crop oil concentrate per gal of water and apply to weeds without runoff.</td>
</tr>
</tbody>
</table>

**PREEMERGENCE HERBICIDE**

| Karmex | 1.25-5 lb | Use under established trees, preferably as a preemergence treatment (no surfactant). If weeds have emerged, add surfactant to the spray mix. Do not contact fruit or foliage with spray or drift. Do not use on home plantings. Do not replant treated area to any crop within two years after last application. Do not apply more than 12 lb of Karmex 80W per acre per year. |
| 1.0 lb | Apply as a preplant treatment. Do not spray to designated planting holes. |

The authors wish to thank Dale O. Evans for his assistance in preparing this publication.

**DISCLAIMER**

CAUTION: Laws and regulations concerning the use of pesticides, including herbicides, are continually changing. The user is responsible to make sure that label directions are strictly followed. The information in this guide is based on regulations in effect when it was prepared and is not to be considered a substitute for or an alternative to directions, limitations, and precautions specified on the pesticide label or on Special Local Need labels.

Mention of a trade name does not constitute an endorsement of the product by the authors or by the College of Tropical Agriculture and Human Resources.