

## WEED CONTROL METHODS FOR USE IN AVOCADO CULTURE

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There are no hard and fast rules which can be followed to eliminate weed growth from avocado orchards. Situations and conditions vary from grove to grove, and weed control programs must be tailored to suit individual needs.

There are, however, basic reasons why weed growth should be eliminated if at all practical. The most urgent reason is that weeds compete with the trees for soil moisture and plant nutrients. Increasing water costs have made water use by weeds a factor of considerable economic importance. Other reasons are that weeds harbor insect pests and make rodent control difficult. They also interfere with cultural practices such as irrigation and in the dry season present a serious fire hazard.

Three methods of weed control are available: (1) mowing, (2) cultivation, and (3) herbicides. There are advantages and disadvantages to each method. The grower should acquaint himself with the benefits and limitations of each and choose the system or combination of systems that provide the most efficient solution to his particular weed control problem.

### MOWING

Mowing is used extensively in San Diego County to control weed growth in avocado orchards. Mowing quickly eliminates broadleaved weeds with an upright growth habit. Regular mowing plus adequate irrigation creates an ideal environment for bermuda grass which soon becomes well established and crowds out other low-growing weed species which survive mowing. Mowing offers very few advantages when it is critically considered as a method for weed control. There are some situations where it may be justified; for example, on steep hillsides where some weed cover may be necessary to prevent soil erosion. Other than that, its only advantage is that it is easy to do and that a mowed orchard presents a pleasing appearance. Liabilities resulting from mowing are numerous. Even frequent mowing does not lessen the consumption of water by the grass, and indications are that up to one-half of the water applied to an orchard covered with a solid stand of bermuda is taken up by the grass. Second, bermuda sod (a greedy user of fertilizer) competes heavily with the trees for plant nutrients. Gophers and field mice tend to work more freely in an orchard where there is a cover crop.

## **TILLAGE**

Tillage as a method for weed control is used in some areas of Orange and Los Angeles counties. Cultivation has certain advantages. Again, it is easy to do and a freshly tilled orchard presents a pleasing appearance. However, there are more tangible benefits. Certain perennial weeds are discouraged by frequent tillage. Bermuda grass, morning glory, Johnson and kikuya grass, while remaining present, will not take over an orchard which is frequently tilled. Tillage plus careful use of chemical herbicides for spot treatments will often eradicate these weeds.

Reasons why cultivation is not a good cultural practice are numerous. It destroys the "tilth" of the soil, causes compaction, and results in the formation of a plow sole which retards the penetration of water. Avocado roots which grow in that portion of soil disturbed by cultivation are continually destroyed, and for all practical purposes the cultivated portion of the soil is of no use to the avocado tree. Erosion is frequently a problem in cultivated orchards.

While frequent cultivation controls perennial weeds, it also aids in their distribution since stolens, rhizomes, and other plant parts capable of regrowth are scattered through the orchard on cultivating equipment.

## **USE OF CHEMICAL HERBICIDES**

Control of weeds in avocado orchards by the use of herbicidal chemicals is finding increasing acceptance. While the use of herbicides will eliminate many of the disadvantages arising from mowing or cultivation, their use presents new problems which the grower must understand and take into consideration. Herbicides are, by nature, toxic to plants. Their use in orchards is always accompanied by some degree of hazard to the trees. This limits the kinds and amounts of herbicides that can be used in orchards and requires that precautions be taken to insure that trees are not injured. For example, excessive dosage, careless handling, or use of improper formulations of 2,4-D for broadleaved weed control in avocado orchards can lead to tree damage. Likewise, negligence and sloppy application methods in the use of monuron and weed oil can result in serious loss to the grower.

Advantages derived from the correct use of chemical herbicides are numerous. Getting rid of a continuous cover crop in a mowed orchard eliminates competition for water and soil nutrients. Since bare soil absorbs more heat during the daytime and likewise radiates more heat during the night risk of frost injury is reduced. Conversion of a tilled orchard to nontillage results in an improvement in the physical condition of the soil and improved moisture penetration. There are a few soils, however, which tend to "silt over" under noncultivation practices resulting in reduced moisture penetration where sprinkler irrigation is employed. "Siltting" can be overcome by the use of a surface mulch which, in any event, occurs in time by accumulation of leaves. Also of importance is the fact that the entire soil depth is available for root growth. Harvesting, pest control operations, irrigation, and other orchard practices are more easily accomplished in a weed-free orchard with a firm soil surface.

Only chemical herbicides which comply with federal and state regulations can be

recommended for use. At the present time, only oil, fortified oils, and oil emulsions, monuron, and the careful use of 2,4-D meet these regulations.

Weed oils, oil-water emulsions, and oils fortified with dinitro and pentachloro-phenol are used as contact sprays. Young annual weeds are killed by single applications of these sprays. Established perennials such as morning glory and bermuda grass can be controlled with oil only if a diligent retreatment program is followed which prevents new top growth and starves out the underground root system. Weed oils kill only the plant tissue with which they come in contact. They are not systemic and do not translocate into underground plant parts.

For the control of most established broadleaved perennials, 2,4-D is the best herbicide at the present time. There are several formulations of 2,4-D on the market — 2,4-D acid, 2,4-D amine, and 2,4-D esters. The ester formulation should not be used in avocado orchards due to the volatility hazard. Even the so-called low-volatile esters are not entirely safe since they will volatilize under our summer temperatures. The emulsifiable acid formulation or amine form of 2,4-D may be used at the rate of 12 ounces per 100 gallons of water. This should be used for careful spot treatment of weed foliage. Care should be taken to prevent excessive soil contamination from foliage run-off and indiscriminate spraying.

Monuron can be used effectively for control of annual weeds in avocado orchards. Applied to bare soil and leached in by rainfall or sprinkler irrigation, it kills weed seedlings as they germinate. Monuron does not kill the dormant seed but is lethal when picked up by the roots of the young seedling. Since only seedling weeds are killed at the 2-pound-per-acre rate safe to use in avocado orchards, larger established annuals and perennials will continue to live. Perennials will thrive in a monuron-treated orchard due to lack of competition from other weeds and combination treatments using other herbicides will be needed where both types of weeds are present.

Outlined are weed control problems as encountered in California avocado orchards and present methods of control. Several of the herbicides listed do not have the approval of Federal and State regulative authorities and are so listed. There is some element of risk to the tree with the use of all weed killers, and careful use is essential. Dangers and precautions are noted.

## **WEED PROBLEM**

I. Perennial grasses (bermuda, Johnson, and kikuyu): Methods of control.

1. Frequent mowing.
2. Frequent cultivation.
3. Weed oil spray when needed. Effective control can be accomplished only if a diligent retreatment program is followed and the grass is "starved out" by the prevention of top growth.
4. Repeat treatment inside the root zone of the tree with weed oil. Treatment outside the root zone with dalapon at the rate of 5 to 10 pounds per acre as needed. Dalapon is not registered for use in avocado orchards. Concentrations above

about 1 ppm (about four pounds per acre-foot of soil) cause injury to avocado trees.

5. Treatment of the grass with amino triazole at rates from 5 to 10 pounds per acre. Amino triazole is not registered for use in avocado orchards. Trees tolerate soil residues of 8 or more pounds per acre dependent upon soil factors.

## II. Perennial broadleaved weeds: Methods of control.

### 1. Morning glory:

- a. Frequent cultivations.
- b. 2,4-D acid or amine at the rate of 12 oz./100 gallons. Avoid spray drift to the trees and soil contamination in excess of 2 pounds per acre. 2,4-D is most effective on morning glory if used when the plant is first starting to bloom. It is also more effective if the spraying is done early in the morning or late in the afternoon avoiding high mid-day temperatures. At warmer temperatures, a rapid burn of the leaves occurs, preventing or at least inhibiting translocation.

### 2. Nightshade:

- a. Repeated oil spraying.
- b. 2,4-D acid or amine, 12 oz./100 gallons.

### 3. Tuberous oxalis:

- a. Repeated oil spraying.
- b. Amino triazole, 5 lbs./acre. (Not yet registered.)
- c. 2,4,5-TP (silvex) 16 oz./acre for use outside the avocado orchard. Use particular caution to avoid spray drift to trees and contamination of orchard soil. Silvex is probably more toxic to avocados than 2,4-D.

### 4. Poison oak:

- a. Repeated 2,4-D treatments, 12 oz./100 gallons.
- b. Amino triazole, 4 lbs./100 gallons. Spray when leaves are fully expanded but have not yet turned red. (Does not have registration for use in orchards.)

### 5. Nutgrass:

- a. Repeated oil sprayings.
- b. Repeated sprayings with emulsifiable acid of 2,4-D, 12 oz./100 gallons.

## III. Annual Weeds: Methods of Control.

1. Cultivation.
2. Weed oil spray as needed.
3. Amino triazole at 2 pounds of commercial formulation per acre when weeds are ½" to 2" tall. Larger weeds will require increased concentrations of amino triazole. (Not registered.)

4. Monuron at 2 pounds of commercial formulation per acre. Apply to bare soil before sprinkler irrigation or rainfall.

Weed control in newly planted avocado orchards or around individual replants can be greatly facilitated by the use of a ground cover such as black plastic tarp or with 2,4-D and dalapon, respectively. There are some drawbacks to the use of a ground cover material which will exclude light over the root zone of the tree. The surrounding area outside of the root zone of the tree can be kept free of annual weed growth by the use of monuron, and perennial broadleaved weeds and grasses can be treated cover of this type, however. Irrigation will necessitate furrows which allow the water to run under the tarp, or soaker hoses may be used. Sprinkler irrigation will not suffice. Also, gophers are hard to detect under these covers.



Figure 1. Bermuda grass has invaded area around the young tree. Chemical treatment in such close proximity is hazardous and impractical. Weeds farther from the tree have been sprayed with oil.

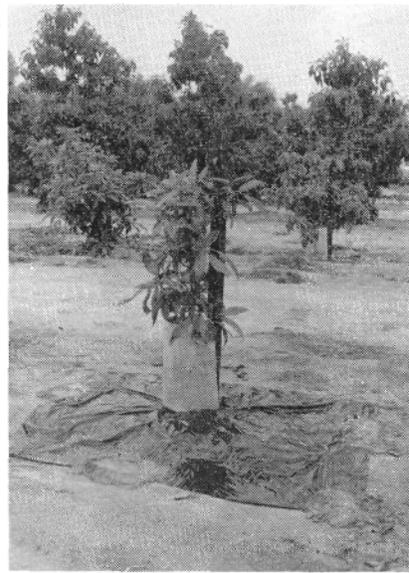


Figure 2. Ground cover prevents weed growth in root zone of tree. Treatment of area outside the root zone can be made with chemical herbicides with little or no hazard to the tree.

Quite a number of new herbicides have become available recently. We are now in the process of testing these on citrus, avocados and other orchard crops. A particularly promising group of these new chemicals is the triazines of which simazine, atrazine, and others are members. These compounds are exceptionally powerful soil sterilants with herbicidal properties similar in many respects to the urea herbicides of which monuron is a typical example. Avocados are sufficiently resistant to simazine to permit its selective use for control of seedling annual weeds much in the way the monuron is used. Unfortunately a suitable analysis for the residues of the triazine herbicides has not been developed and regulatory approval for their use in orchards is delayed.

EPTC is showing considerable promise for control of nutgrass in row crops where it can be thoroughly incorporated into the soil prior to planting the crop. Orchard trees are not

injured by the rates of EPTC normally required to give season-long control of nutgrass. It has not been determined how many treatments are necessary to provide eradication of nutgrass nor have practical methods for application in non-cultivated orchards been adequately tested.

Weed control outside the orchard cannot be overemphasized. Weeds along ditches, fence rows, roadways, and other non-farmed areas serve as a continual source of seed supply for infestation. These areas may be kept weed-free with the use of soil-sterilant types of herbicides which are not safe for orchard use. Control of these seed sources is of immense value to the grower.