

## **Alternative Weed Management Methods in Orchards**

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Organically controlling weeds in orchards requires the use of many techniques and strategies in order to achieve economically acceptable weed control and yields. Weeds can always be pulled or cut out, but the question is simply how much can a grower spend in terms of time and money to reduce weed pressure. The more a grower is able to reduce weed pressure (seed and perennial propagules) the more economical it is to produce crops.

Without some form of weed control, yields and plant vigor will be greatly reduced. In organic farming, weed control is only one goal of weed management. A good organic weed management plan should present a minimum erosion risk, provide a "platform" for the movement of farm equipment, not impact adversely on pest management or soil fertility, while minimizing weed competition for water and nutrients. The following is an overview of some organically acceptable weed control practices for orchards.

### **Mulches**

Weed control in tree crops can be a daunting task whether you are an organic or conventional grower. One encouraging control method is through the use of a mulch. The mulch blocks light, preventing weed germination or growth. Many materials can be used as mulches including plastics or organic materials such as municipal yard waste, wood chips, straw, hay, sawdust, and newspaper. To be effective, a mulch needs to block all light to the weeds; therefore different mulch materials vary in the depth necessary to accomplish this. Wood chip, or other loose material type mulches should be maintained in a layer four or more inches thick. Organic mulches breakdown with time and the original thickness typically reduces by 60 percent after one year.

Cover crops can be grown in the middles and in the spring, "Mow-and-Throw" the mulch in around the base of the trees. Numerous cover crop species can potentially be used in orchards. This works well if the mulch layer is thick. Weeds that emerge through the mulch can be controlled using an organic contact herbicide or hand weeding. Cover crops should not be planted in the tree row, as excess competition may occur, possibly reducing yields.

The additional benefits of mulches are significant. The mulch conserves moisture by reducing evaporation. Soil temperature is better maintained and organic material is added to the soil on breakdown. Weed germination is greatly impeded and growth diminished. Some grasses will survive the mulching but are shallow rooted and can be easily pulled out. Partially rotted straw or hay which is not otherwise of use can be utilized but must come from fields which have not used pesticides or chemical fertilizers. Weed control by mulching is not the only organic option but may be worth considering.

## **Cultivation**

Cultivation is probably the most widely used method of weed control in organic systems. Mechanical cultivation uproots or buries weeds. Weed burial works best on small weeds, while larger weeds are better controlled by destroying the root-shoot connection or by slicing, cutting, or turning the soil to separate the root system from contact with the soil. In systems where permanent sod middles are employed, cultivation may be limited to a row-strip under the drip line in an orchard. The reverse might be true in systems where mulches are employed for weed suppression under the crop and cultivation used to control weeds and incorporate cover crops between the rows. In any case, cultivation must be kept shallow to minimize damage to crop roots and to avoid bringing more weed seeds near the surface to germinate.

Perennial weeds, with established root systems, are difficult to kill with a single tillage operation. In a sense, perennial weeds are like an iceberg – 80 to 90% below water (in the soil) and only 10 to 20% above water (emerged). With tillage, the top is removed and a new top is generated using the underground reserves (the iceberg floats back to the surface). For perennials, tillage at 3 or 4 inches in depth depletes the maximum amount of reserves and forces the weeds to use up more of the reserves.

Even the best cultivators will not eliminate all weeds, thus hand weeding is often needed. Hand cultivation alone may be effective on a small scale. In large orchards -where in-row tillage is desired- "mechanical hoes" such as the Weed Badger, Kimco, or Green Hoe may be useful. These tractor-mounted cultivators extend from the tractor and can till right up to the tree without damaging the plant. Attachment options include powered rotary tillage tools and scraper blades which can move soil either away from or to the base of the plants. Specialty tillage equipment is expensive and due to economies of scale it may not be cost effective for small operations. In orchards less than 3 years old, weed control is still necessary, but grow tube protection is recommended for the young trees.

Night tillage may help to reduce weed germination. Many weeds require a flash micro-seconds in duration, of red light in order to germinate. It is thought that weed seeds get this flash when suspended with soil during tillage. After night tilling, only those seeds left on the soil surface will germinate, which still can be quite a few. Because of seeds left on the soil surface, it may take several tillages to see much affect. Regardless of whether it works or not, at worst you just lose a little sleep. Most summer annual weeds like pigweed, lambsquarters, and barnyardgrass respond favorably to night tillage, as do many winter annual species.

## **Organically Acceptable Herbicides**

In recent years, several organic, contact-type herbicide products have appeared on the market. These include Weed Pharm (acetic acid), C-Cide (citric acid), GreenMatch (d-limonene), Matratec (clove oil), WeedZap (clove + cinnamon oil), and GreenMatch EX (lemongrass oil), among others. All these products will damage any green vegetation they contact, though they are safe as directed sprays against woody stems and trunks. These herbicides kill weeds that have emerged, but have no residual activity on those emerging subsequently.

All of these products will work well when the weeds are small and the environmental conditions are optimum. In studies conducted this past year, we found that weeds in the

cotyledon or first true leaf stage were much easier to control than weeds in the four to six true leaf stages. Broadleaf weeds were also found to be easier to control than grasses, possibly due to the location of the growing point (at or below the soil surface for grasses), or the orientation of the leaves (horizontal for most broadleaf weeds).

These herbicides only kill contacted tissue; thus, good coverage is essential. In test comparing various spray volumes and product concentrations, we found that high concentrations at low spray volumes (35 gallons per acre) were less effective than lower concentrations (1/2 of the high concentration) at high spray volumes (70 gallons per acre). Applying these materials through a green sprayer (only living plants are treated), can reduce the amount of material and the overall cost. Additionally, adding an organically acceptable surfactant has resulted in improved control. Because these materials lack residual activity, repeat applications will be needed to control new flushes of weeds.

Another organic herbicide that has appeared on the market in the last few years is corn gluten meal, which is sold under many trade names. It is expensive and has failed to provide even minimal weed control in the vast majority of California trials. Organic herbicides are expensive at this time and may not be affordable for commercial orchard production. Finally, approval by one's organic certifier should also be checked in advance as use of such alternative herbicides is not cleared by all agencies. The efficacy of all these materials is much less than synthetic herbicides.

### **Weeder Geese**

Geese have been used for weed management in a large number of crops for many years. All types of geese will graze weeds. Investigators studied the impacts of populations of domestic geese and chickens in a non-chemical orchard system. Geese were observed to feed heavily on weeds—especially grasses. Geese prefer grass species and will eat other weeds and crops only after the grasses are gone and they become hungry. If confined, they will even dig up and eat johnsongrass and bermudagrass rhizomes. They appear to have a particular preference for bermudagrass and johnsongrass—weeds that can be especially troublesome in perennial crops.

Care must be exercised when using geese to avoid placing them near any grass crops, i.e. corn, sorghum, small grains, etc. as this is their preferred food. Geese also require water (drinking not swimming), shade during hot weather and protection from dogs. Portable fencing helps to keep them in the area you want them work and also keeps dogs and other predators out. Young geese work best, as their major interests are eating and sleeping – older geese prefer to fight and make more geese.

Although geese are mentioned in this report, other animals such as sheep or goats can also be used. Sheep will effectively remove all weeds down to ground level. Goats are browsers, and must be carefully managed to avoid damage to trees.

### **Flame Weeding**

Flamers can be used for weed control with propane-fueled models being most common. Fire causes the cell sap of plants to expand, rupturing the cell walls; this process occurs in most plant tissues at about 130° F. Weeds must have less than two true leaves for greatest efficiency

of the burner. Grasses are harder to kill by flaming because the growing point is below the ground. After flaming, weeds that have been killed change from a glossy to a matte finish. This occurs very rapidly in most cases. Foliage that retains a thumb print when pressure is applied between your thumb and index finger has been adequately flamed. Typically, flaming can be done at three to five mph through fields, although this depends on the heat output of the unit being used. Repeated flaming can likewise be used to suppress perennial weeds such as field bindweed. Care must be taken to avoid igniting dry vegetation, which could injure the crop, or start a wildfire.

The specific flaming angle, flaming pattern, and flame length vary with the manufacturer's recommendations, but range from 30° to 40°, at 8 to 12 inches above the base of the plants, with flame lengths of approximately 12 to 15 inches. Best results are obtained under windless conditions, as winds can prevent the heat from reaching the target. Early morning or evening is the best time to observe the flame for adjustment. Flame Engineering, Inc. and Thermal Weed Control Systems, Inc. manufacture both hand and tractor mounted flame weeding equipment.

In a study comparing control of weeds by flaming, species and growth stage were the most important variables. One weed which was resistant to flaming was *Malva neglecta*, (cheeseweed), with little or no control. To control annual weeds at later developmental stages (> 6 true leaves), a single pass flame treatment was not sufficient. For lambsquarters, three subsequent treatments were necessary for 95 % control. For the flame control of dandelion, the developmental stage is also crucial. Small plants were killed by one flaming, while bigger plants, often survived four flamings.

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