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# Organic Weed Management

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## Why Organic Weed Management?

Farmers have struggled with the presence of weeds in their fields since the beginning of agriculture. Weeds can be considered a significant problem because they tend to decrease crop yields by increasing competition for water, sunlight, and nutrients while serving as host plants for pests and diseases. Since the invention of herbicides, farmers have used these chemicals to eradicate weeds from their fields. Using herbicides not only increased crop yields but also reduced the labor required to remove weeds. Today, some farmers have a renewed interest in organic methods of managing weeds since the widespread use of agro-chemicals has resulted in purported environmental and health problems. It has also been found that in some cases herbicide use can cause some weed species to dominate fields because the weeds develop resistance to herbicides. In addition, some herbicides are capable of destroying weeds that are harmless to crops, resulting in a potential decrease in biodiversity on farms. It is important to understand that under an organic system of weed control, weeds will never be eliminated but only managed.

Farmers who wish to become organically certified are restricted from using synthetic herbicides for weed control under the U.S. Department of Agriculture's Final Rule. The organic farmer must rely on cultural practices such as crop rotations and mechanical cultivation of the soil for weed control. This has made it difficult for conventional farmers to readily take up organic production since putting an end to herbicide use may cause a potential increase in weed population and negatively affect crop yields and profits. However, proper organic weed management can alleviate these potential problems.

## What Is Organic Weed Management?

Organic weed management is a holistic system involving an entirely different approach to managing a farming system. The organic farmer is not interested in eliminating all weeds but wants to keep the weeds at a threshold that is both economical and manageable. A farmer who manages weeds organically must be intimately familiar with the type of weeds and their growth habits to determine which control methods to employ.

### Organic Methods of Weed Management

#### - Thermal weed control

Thermal weed control involves the use of flaming equipment to create direct contact between the flame and the plant. This technique works by rupturing plant cells when the sap rapidly expands in the cells. Sometimes thermal control involves the outright burning down of the weeds. Flaming can be used either before crop emergence to give the crop a competitive advantage or after the crop has emerged. However, flaming at this point in the crop production cycle may damage the crop. Although the initial equipment cost may be high, flaming for weed control may prove cheaper than hand weeding.

#### - Soil solarization

During summer and fall, organic farmers sometimes sterilize their soil through solarization. During this process, a clear plastic film is placed over an area after it has been tilled. Solarization works when the heat created under the plastic film, which is tightly sealed at the edges, becomes intense enough to kill weed seeds.

## - Mulch

Mulching or covering the soil surface can prevent weed seed germination by blocking light transmission preventing seed germination. Allelopathic chemicals in the mulch also can physically suppressing seedling emergence. There are many forms of mulches available. Listed are three common ones:

### 1. Living mulch

A living mulch is usually a plant species that grows densely and low to the ground, such as clover. Living mulches can be planted before or after a crop is established. It is important to kill, till in, or otherwise manage the living mulch so that it does not compete with the actual crop.

### 2. Organic mulches

Such materials as straw, bark, and composted material can provide effective weed control. Producing the material on the farm is recommended since the cost of purchased mulches can be prohibitive, depending on the amount needed to suppress weed emergence. An effective but labor-intensive system uses newspaper and straw. Two layers of newspaper are placed on the ground, followed by a layer of hay. It is important to make sure the hay does not contain any weed seeds.

### 3. Inorganic mulches

Materials such as black polyethylene have been used for weed control in a range of crops in organic production systems.

## - Mechanical weed management

Managing weeds mechanically is both time-consuming and labor-intensive but it is also one of the most effective methods for managing weeds. The choice of implementation, timing, and frequency will depend on the structure and form of the crop and the type and number of weeds. Cultivation involves killing emerging weeds or burying freshly shed weed seeds below the depth from which they will germinate. It is important to remember that any ecological approach to weed management begins and ends in the soil seedbank. The soil seedbank is the reserve of weed seeds present in the soil. Observing the composition of the seedbank can help a farmer make practical weed management decisions.

## - Stale seedbed

The stale or false seedbed technique of flushing out weed seeds from the soil works by depleting the seedbank. After the soil is cultivated two to three weeks before sowing, emerging weeds are killed by flaming or light cultivation. By helping to reduce the seedbank. This technique reduces subsequent emergences of weeds.

## - Crop rotation

Crop rotation has been at the heart of the organic weed management system since medieval times and has persisted well into the 20<sup>th</sup> century due to its proven effects on weed populations. The goal of a crop rotation is to create an unstable environment that discourages weeds from becoming established in the field. Deciding on the sequence of crops, a farmer must take into account the type of soil he or she is working with, the climate, and the crop.

## Crop establishment and competition

Make sure crops emerge first to give them a head start in their competition with weeds. Transplanting helps increase a crop's competitive ability since the plants are larger and easier to establish. Sow crops close together by reducing the row spacing. Since the crop will take up more space, it shades the weeds, reducing the weeds' ability to compete. Another technique involves increasing the seeding rate of a crop. This increases the competitive ability of the crop by increasing the odds that the crop will survive in greater numbers than the weeds.

Limiting the spread and introduction of weeds  
It is important to maintain proper sanitation on the farm to reduce the introduction and spread of weed seeds. There are several ways to keep weeds and weed seeds from entering the farm. First, any animal manure that will be used on the farm should be composted because weed seeds can pass through an animal's digestive system unharmed, it is important to compost the manure. Composting results in temperatures that become high enough to kill many weed seeds. Second, purchase certified seed that is guaranteed to be free of weed seeds. If you are a farmer interested in saving your own seed, be

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diligent about collecting clean seed so you do not contaminate your collections. Also make sure to remove weeds before they set seed. Once a weed is allowed to set seed, the number of weed seeds in the seedbank is increased. Last, keep tillage and other equipment clean when moving between fields to reduce the spread of weed seeds.

- Allelopathy

Allelopathy is an alternative and organic approach to weed control that uses chemicals that are excreted from a plant to cause either direct or indirect harm to weeds by negatively affecting their germination, growth, or development. Nearby weeds can be affected by allelopathic chemicals entering the rhizosphere from the roots or the aerial parts of the crop plant. Crop residues from cover crops, such as fall rye, or other organic mulches can also be used to suppress weeds through such allelopathic interactions.

### **Biological Weed Management**

Little research has been conducted on using predatory or parasitic microorganisms or insects to manage weed populations. However, this may prove to be a useful management tool in the future.

- Chemical control

A few herbicides are approved for organic production under the Final Rule. Some materials that are approved, such as corn gluten and acetic acid, tend to have low efficacy. It is recommended that farmers try the techniques listed above and use organic herbicides as a last resort.

### **Future Directions**

More research is needed to predict when a farmer should take action to control weeds to achieve optimum benefits. Having a thorough understanding of the biology of weeds and the interaction between weeds and crops will further help farmers make weed management decisions. Unfortunately, the vast number of weed and crop combinations makes knowing the optimum time and techniques to control weeds seem impossible. Instead, it has been recom-

mended to use models that take into account the environment, the weed species, and the crops grown to predict optimum weeding times. However, much additional research is needed to develop such comprehensive models.

In the past, breeding plants for weed suppression has not been popular because herbicides took care of the job. Today, however, with the increase in organic farming and the decrease in the use of herbicides, breeding for weed suppression has become a higher priority.

### **A New Outlook**

As part of the organic movement, the attitudes of farmers toward weeds have shifted. Instead of eradicating weeds, farmers especially organic farmers-- are learning to manage weeds. Farmers who manage weeds are trying to learn more about which weeds are present and the best management practices to keep the weeds below preset economic thresholds.

In addition, although it is assumed that weeds are negative to a crop's growth and yield and must be eradicated, not all weeds should be considered detrimental. In fact, some weeds can be seen as useful. Although weeds can serve as host plants for pests, they can also serve as hosts to beneficial organisms. Some weeds can be used for food (purslane) or medicine or as an aid to soil fertility. An organic farmer will benefit from knowing which weeds are in their fields, the biology of the plants, and whether they should be considered detrimental to crop growth.

### **Resources:**

Bowman, G. 1997. Steel in the fields: A farmer's guide to weed management tools. Beltsville, MD: Sustainable Agriculture Network.

[www.wvu.edu/~agexten/ipm/weeds/index.htm](http://www.wvu.edu/~agexten/ipm/weeds/index.htm)

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