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Weed Management for Organic Crop Production

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Introduction

Weed management in organic crop production systems must involve the use of many techniques and strategies, all the goal is achieving economically acceptable weed control and crop yield. Weeds can always be pulled or cut, but the question is simply how much time and money can a grower expend to reduce weed pressure. Ideally growers would like to achieve level of zero weeds on the farm. In practice, this may not be achievable, but any reduction in weeds and in the amount of weed seed or perennial propagules reaching the soil will make subsequent weed control operations less expensive. The cultural practices used in crop production (For instance, using transplants, pre emergent, flaming of weeds, pre-germination of weeds) often provide opportunities for the crop gain. The goal is for the crop to outcompete the weeds, reducing the availability of resources to the weeds. If it can be given the crop a competitive advantage through organically acceptable techniques, subsequent hand weeding operations and costs can be minimized. The following are common techniques available to organic growers to manage weeds in crop production operations.

Cultural Practices

Water management: Effective water management is key to controlling weeds in crop operations. There are a number of ways to careful irrigation management can help to reduce weed pressure on the crop.

Pre-germination of weeds: The newly germinated weeds can be killed by light cultivation of flaming. pre-germination should occur as close as possible date of planting to ensure that change in weather condition do not have an opportunity to change the spectrum of weeds (cool vs. warm season) in the field.

Planting to moisture: Another technique is similar to pre germination i.e. planting to moisture. After weeds are killed by cultivation, the top 2 to 3 inches soil is allowed to dry and form dust mulch. At planting, the dust mulch is pushed away and large seeded crops such as corn and beans can be planted into the zone of soil moisture. These seeds can germinate, grow and provide partial shading of the soil surface without supplemental irrigations that would otherwise provide for an early flush of weeds.

Buried drip irrigation: Drip tape buried below the surface of the planting bed can provide moisture to the crop and minimize the amount of moisture that is available to weeds closer to the surface. If properly managed, this technique can provide significant weed control during periods without rain.

Crop Competition

Crop that grows vigorously can often outcompete weeds. Weeds grow best where competition is sparse, for instance, between rows or gaps in a crop stand. Crops that are well adapted to their planted areas are often better competitor since they will tend to occupy a site rapidly. The increase in the density of the crop by decreasing the in-row spacing or by reducing the space rows it will improve the crop competitiveness. A close planted crop will close the canopy more rapidly, reducing the weeds ability to compete. Some crop (Tomato, bean and sweet corn) compete effectively with weeds if given an early competitive advantage. The use of transplants give the crop an advantage over the weeds because transplants enter the field larger and more developed that the weeds. With help from subsequent cultivation or hand weeding operations, a transplanted crop can develop a full canopy and crowd out weeds.

Reducing the Weed Seed Bank

Practices that reduce the production of weed seed also weed pressure and can help keep weeding costs down over time. In an ideal situation, no weed would be allowed to go to seed. Any that do go to seed can aggravate weed problems for many years to come. As an example, common perslane seed has been sown to remain viable for over 20 year in soil, and black mustard seed survives for over 40 years. The longevity of weed seed, together with the large number of seed produced by individual plants can lead to the long-term build up of enormous seed banks in the soil. Highly competitive cover crops can also significantly reduce the seed bank.

Cultivation

Cultivation is probably the most widely used weed control method in organic crop production. Mechanical cultivation uproots and buried weeds. Burial works best on small weeds, while larger weeds are better controlled by destruction of the root–shoot connection or by slicing, cutting or turning the soil to eliminate the root system's contact with soil. Cultivation is effective almost against all weeds, with the exception of certain parasitic forms such as dodder. Effective cultivation must precisely and accurately target weed-growth areas, and so requires good land preparation and bed shaping. Shallow cultivation is usually best, since it brings fewer weed seeds to the surface. Level beds allow more precise depth of tillage. Cultivation requires relatively dry soil; subsequent irrigations should be delayed long enough to prevent the weeds from re-rooting. In addition, cultivation should be carried out early enough in the growth cycle to kill weeds such as burning nettle and perslane that set seed early in the growth cycle.

Flamers

Flamers are useful for weed control. Propane fuelled models are the most common. Flaming does not burn weeds to ashes; rather the flame rapidly raises the temperature of the weed to more than 130^{o}F. The sudden increase in temperature causes the plant cell shapes to expand, rupturing the cell walls for greatest flaming efficiency, weeds must have fewer than the true leaves. Flaming can be used prior to crop emergence in slow germinating crops. In addition, flaming can be used post emergence on crops.

Sterilization

Soil sterilization in organic agriculture involves the use of heat or naturally generated biocides to kill weeds. Heat is applied as steam or by soil solarisation. In steam soil sterilization, the steam injected into the soil to kill weeds seeds. The large quantities of fuel and water required by this technique make

it an expensive choice, so its use is limited to small acreages of high value crops and landscaping. Ozone is a naturally occurring biocide that is being researched for use as a soil sterilant. The ozone is generated mechanically and then injected into the soil. Ozone injection shows promise as a weed reduction tool, but it is unclear at this time whether this technique will be considered an organically acceptable practice.

Mulches

Mulching is another weed control measure, a mulch block light, preventing weed germination and growth. The materials that can be used as mulches are varied and include plastic and organic materials such as municipal yard waste, wood chips, straw, hay, saw dust and newspaper. To be effective, mulch needs to block all light to the weeds, and some mulch materials require a thicker application layer that others to accomplish this. The most common colour for weed control plastic is black since it completely black light. More recently, a clear infrared transmitting plastic has been introduced. Organic mulches such as municipal yard waste, straw, hay and wood chips must be maintained in a layer 4 or more inches thick in order to block out light. Organic mulches break down over time and the originally thickness typically reduce by 60 percent after one year. Coarse green waste works better as mulch. Organic mulches are used for permanent crops, landscaping and non crop areas, although they are also very effective for transplanted vegetables.

Beneficial Organisms

Weeds are subjected to disease and insect attacks just as crops are. Most biological control of weeds occurs in range or non crop areas. As a result, biological control has little relevance for vegetable growers. Geese have been used for weed control in tree, vines and certain row crops. Most types of geese will graze weeds but Chinese weeder geese are considered the best for row crops. If confined, geese will even dig up and eat johnsongrass and burmudagrass rhizomes.

Chemical Control

Herbicides are chemicals that kill or suppress plants by affecting their physiological processes. Only a limited number of herbicides are organically acceptable, and these include contact materials such as acetic acid, citric acid, and solutions of sodium nitrate as well as preemergent material, corn gluten. Herbicides can be used for selective weed control by manipulating the timing of application or placement of material or by exploiting differences in the chemical tolerances of the crop and the target weed. Weeds that emerge before the crop can be killed with contact herbicides (acetic acid) these herbicides kill plants that have emerged, but have no residual activity on those that emerge later. Corn gluten is a pre-emergence material that is applied to the soil to suppress weeds as they germinate. Currently, the efficacy of these organically acceptable herbicides is marginal at best.