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Organic weed management in vegetable crops

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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.

Critical period of weed control : This period has been defined as an interval in the life cycle of the crop when a must be kept weed – free to prevent yield loss. If weeds have been controlled throughout the critical period, the weeds that emerge later will not affect yield and can be controlled prior to harvest with a harvest and to burn down the weeds and desiccate the crop.

Crop	Critical weed-free period
Apples, new plantings	During May and June
Apples, bearing	Bud break until 30 days after bloom
Beets	2-4 weeks after emergence
Cabbage, early	3 weeks after planting
Carrots	3-6 weeks after emergence
Cucumbers, pickling	4 weeks after seeding
Lettuce	3 weeks after planting
Onions	The whole season
Potatoes	4 weeks after planting
Squash	Early plantings compete better
Strawberries, new	During May and June
Tomatoes, fresh	36 days after transplanting
Tomatoes, seeded	9 weeks after seeding

Cultural method :

Crop rotation: Crop rotation involves alternating different crops in a systematic sequence on the same land. It is an important strategy for developing a sound long term weed control program. Weeds tend to thrive with crops of similar growth requirements as their own and cultural practices designed to contribute to the crop may also benefit the growth and development of weeds. Monoculture, that is growing the same crop in the same field year after year, results in a build-up of weed species that are adapted to the growing conditions of the crop.

Cover crops: Rapid development and dense ground covering by the crop will suppress weeds. The inclusion of cover crops such as rye, red, clover, buckwheat and oilseed radish or over wintering crops like winter wheat or forages in the cropping system can suppress weed growth. Highly competitive crops may be grown as short duration 'smother' crops within the rotation.

Intercropping : Intercropping involves growing a smother crop between rows of the main crop. Intercrops are able to suppress weeds. However, the use of intercropping as a strategy for seed control should be approached carefully.

Field scouting: It involves the systematic collection of weed and crop data from the field (weed distribution, growth stage, population, crop stage etc.). The information is used, in the short term, to make immediate weed management decisions to reduce or avoid economic crop loss.

Mulching : 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 suppress seedling emergence. There are many forms of mulches available.

Living mulch : 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 ad till in, or manage living mulch so that it does not compete with the actual crop. A living mulch of *Portulaca oleracea* from broadcast before transplanting broccoli suppressed weeds without affecting crop yield.

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.


Growing of Ribbed gourd in black polythene mulch

Planting patterns : Crop population, spatial arrangement, and the choice of cultivar (variety) can affect weed

growth. Fr example, studies have shown that narrow row widths and a higher seeding density will reduce the biomass of later-emerging weeds by reducing the amount of light available for weeds located below the crop canopy.

Variety selection : Careful selection of crop varieties is essential to limit weeds and pathogen problems and to satisfy market needs. Any crop variety that is able to quickly shade the soil between the rows and is able to grow more rapidly than the weeds will have an advantage.

Tillage system : Tillage systems alter the soil seed bank dynamics and depth of burial of weed seeds. Studies have found that almost 75% of the seed bank was concentrated in the upper 5 cm of soil in no-till fields. In the moldboard plough system however, the seed bank is more uniformly distributed over depth.

Sanitation : It is possible to prevent many new weeds from being introduced onto the farm and to prevent existing weeds from producing large quantities of seed. The use of clean seed, mowing weeds around the edges of fields or after harvest to prevent weeds from going to seed, and thoroughly composting manure before application can greatly reduce the introduction of weed seeds and difficult weed species.

Nitrogen fertility : Nitrogen fertilizer can affect the competition between crops and weeds and in the subsequent crops. For example, nitrate is known to promote seed germination and seed production in some weed species. Nitrogen fertilization may result in increased weed growth instead of increased crop yield. Selective placement of nitrogen in a band can favor the crop over the weed. Use of legume residues are opposed to chemical nitrogen fertilizer to supplement nitrogen needs of the crop can enhance weed suppression.

Pre-germination of weeds : In pre-germination irrigation or rainfall germinates weed seeds just before the cash crop is planted. The newly germinated weeds can be killed by light cultivation or flaming. Pre-germination should occur as close as possible to the date of planting to ensure that changes in weather conditions do not have an opportunity to change the spectrum of weeds (cool vs. warm season) in the field.

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 dry period (http://agritech.tnau.ac.in/org_farm/orgfarm_weed mgt.html).

Mechanical weed control: Mechanical weeders include cultivating tools such as hoes, harrows, tines and brush weeders, cutting tools like mowers and stimmers, and dual-purpose implements like thistle-bars. The choice of implement and the timing and frequency of its use depends on the morphology of the crop and the weeds.

Hand hoes, push hoes and hand-weeding are still used when rouging of an individual plant or patch of weed is

Use of biocontrol agents for weed control

Name of the weed	Bioagent
Cyperus rotundus	*Bactra verutana*
Ludwigia parviflora	*Haltica cynea* (Steel blue beetle)
Parthenism hysterophorus	*Zygrogramma bicolarata*
Lantana camara	*Crocidosema lantana, Teleonnemia scrupulosa*
Opuntia dilleni	*Dactylopius tomentosus, D. Indicus* (cochineal scale insect)
Eichhornea crassipes	*Neochetina eichhornea, N. Bruchi* (Hyachinth weevil) *Sameodes alliguttalis* (hyancinth moth)
Salvinia molesta	*Crytobagus singularis* (weevil) *Paulinia acuminate* (grass hopper), *Samea mutiplicalis*
Alternanthera philoxaroides	*Agasides hygrophilla* (flea beetle) *Amynothrips andersoni*
Tribulus terrestris	*Microlarinus lypriformis, M. lareynii*
Solanum elaegnifolium	*Frumenta nephalomicta*

Commercial mycoherbicides

Trade name	Pathogen	Target weed
Devine	*Phyophthora palmivora*	*Morreria odorata* (Strangler vine) in citrus
Collego	*Colletotrichum gleosporoides* f.sp. *aeschynomene*	*Aeschynomene virginica* (northen joint vetch) in rice and soybean
Biopolaris	*Biopolaris sorghicola*	*Sorghum halepense* (Johnson grass)
Biolophos	*Streptomyces hygroscopius*	General vegetation(non-specific)
LUBAO 11	*Colletotrichum gleosporoides* f.sp. *Cuscuttae*	Cuscutta sp. (Dodder)
01	*Alternaria cassiae*	*Cassia abtusifolia*
ABG 5003	*Cercospora rodmanii*	*Eichhornea crassipes* (water hyancinth)

the most effective way of preventing the weed from spreading. Hand-weeding may also be used after mechanical inter-row weeding to deal with weeds left in the crop row.

The hoe-ridger is specifically designed to achieve intra-row control in sugar beet, Thistle-bars are simple blades used to undercut perennial weeds with minimal soil disturbance. The brush weeder, or brush hoe, is used primarily for inter-row weeding of vegetable crop.

Thermal weed control :

Flamers: Flamers are useful for weed control. Thermal weed control involves the use of flaming equipment to crate 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.

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

Infrared weeders : Infrared weeders are a further development of flame weeding in which the burners heat ceramic or metal surfaces to generate the infrared radiation directed at the target weeds. Some weeders use a combination of infrared and direct flaming to kill the weeds.

Freezing : Freezing would be advantageous only where there is an obvious fire risk from flaming. Liquid nitrogen and solid carbondioxide (dry ice) can be used for freezing weeds. Various test systems using electrocution, microwaves and irradiation have also been evaluated for weed control purposes, but high energy inputs, slow work rates and the safety implications for operators have hampered developments.

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