Weed Management in Vegetables

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Weeds compete with crops to reduce yields and affect crop quality. In vegetables, weeds can cause severe yield reductions and can delay or interfere with harvesting of vegetables if left uncontrolled. Common methods to control weeds in vegetables include mechanical, cultural, and use of herbicides (chemical). Use of mechanical or physical and cultural methods is applicable in organically produced vegetables and is also effective in small farms and home gardens. Herbicides are effective tools to manage weeds in commercial vegetable production using IPM tactics.

Mechanical or physical weed control involves hand weeding, use of mulches, or simple machinery like hoes, cultivators, mowers, flamers, etc. Hand weeding is expensive but can be very effective in early-season weed control. Mulches used to control weeds include straw, newspaper, plastic, and grass clippings. When mulching with organic materials, it is important to mulch deep enough to conserve soil moisture as well as block weed emergence. Most organic mulches keep the soil cool, and thus will not result in early harvest of most vegetables.

Plastic mulches are becoming popular for vegetable weed control in both home gardens and commercial fields. Mulches block light so weeds do not germinate. In addition, the plastic keeps the soil warmer (black mulch) or cooler (white mulch) and reduces evaporative loss of water. Natural products such as vinegar, clove oil, corn gluten, etc. are also becoming available for weed control in organically grown vegetables.

Cultural methods are also practiced in some situations which involve use of competitive and smother crops, use of allelopathic cover crops, and crop rotation. A popular cultural method for controlling weeds in vegetables is the stale seedbed technique. With the stale seedbed method, the soil is tilled approximately two weeks before the expected seeding date, and weeds are allowed to germinate and emerge under optimal soil moisture and temperature. The emerged weeds are then tilled into the soil or burned down with a non selective herbicide such as glyphosate prior to planting the crop.

Biological weed control involves the use of natural enemies to reduce the weed populations which might include parasites, predators or pathogens specific to certain weeds. However, current economics and short shelf life of the biological agents make biological control a relatively less popular method.

Weed Control in Organically Grown Vegetables – Research at West Virginia University

Research was conducted at WVU to evaluate different non-chemical options to manage weeds in vegetables. Under irrigated conditions, hand-cultivated plots and plastic mulch plots resulted in similar levels of pepper yields (Table 1). However, plastic mulch increased pepper

yields by an average of 100%, compared to plots that received hand-cultivation, or 8" straw mulch, respectively in non-irrigated pepper (Table 2). In this study, twenty-fold pepper yield increases were noted in plastic mulch plots compared to untreated plots (weedy check). Hand-cultivated plots and plastic mulch plots resulted in similar root dry weight of pepper, but ten-fold increases of root dry weight were noted compared to untreated plots, however, roots were 35% longer in pepper grown on plastic mulch plots compared to hand-cultivated pepper. Corn gluten applied at 80 lbs/1000 sq. ft. reduced weed counts by 78% at 3 weeks after treatment, however, the weeds that germinated outgrew the crops to cause severe yield reductions (data not shown). Directed application of vinegar to actively growing weeds provided >90% control of young actively growing broadleaf weeds but did not translate to yield benefits in peppers due to crop injury, grass competition, and germination of broadleaf weeds after vinegar application.

Directed application of vinegar (12.5% acetic acid) was also evaluated for weed control in potatoes. Broadleaf weeds were lower in vinegar-treated plots compared to untreated plots. Grasses and sedges were suppressed for two to three weeks following vinegar application but exhibited re-growth later. Hand cultivation resulted in 63% higher yields compared to untreated plots, whereas, a directed spray of vinegar, or at the low application rate during early and late growth stage resulted in 36% higher tuber yield compared to untreated plots (data not shown).

Table 1. Effect of physical weed control methods in irrigated pepper.

Treatment	Pepper yield -- lb/plot --	Pepper number (per plot)	Shoot dry wt (lb/plot)
Hand Cultivation	36.7	175	1.5
Plastic Mulch	38.7	199	2.0
Straw Mulch (2 in)	3.7	31	0.3
Straw Mulch (4 in)	13.9	78	0.5
Straw Mulch (8 in)	6.0	38	0.6
Control	0.1	10	0.0
Hand Cultivation	22.8	101	1.4
Plastic Mulch	28.7	146	2.1
Straw Mulch (2 in)	2.4	25	0.3
Straw Mulch (4 in)	9.3	66	0.5
Straw Mulch (8 in)	6.3	43	0.5
Control	6.8	48	0.1
L.S.D (P=0.05)	11.8	49	0.1

Table 2. Effect of weed control methods in non-irrigated pepper.

Treatment	Pepper yield (lb/plot)	Pepper number (per plot)	Shoot dry wt. (lb/plot)	Root length (in)	Root dry wt. lb/plant
Hand Cultivation	32.3	321	1.6	4.4	0.007
Plastic Mulch	51.7	655	2.6	6.9	0.007
Straw Mulch (2 in)	11.1	173	0.7	4.5	0.004
Straw Mulch (4 in)	7.6	152	0.5	3.7	0.003
Straw Mulch (8 in)	20.7	285	1.2	5.1	0.006
Control	2.7	21	0.1	2.8	0.004
L.S.D (P=0.05)	8.4	104	0.3	0.6	0.003

Chemical Weed Control in Vegetables

Herbicides are often used for weed control in commercial vegetable production. They are marked by savings in farm labor, effective weed control, and reduction in production costs. Herbicides registered in vegetables are tested for crop tolerance and residues by the IR-4, a governmental agency that assists the EPA to register herbicides in specialty crops. If herbicides are used according to the label guidelines and are included in an integrated approach (IPM) to control weeds they enhance the production capability of a grower. Growers should be careful to read the label thoroughly before using herbicides in vegetables because of potential crop injury. Misapplication (broadcast vs. row middle), application at the wrong timing (before crop emergence vs. after crop emergence), crop stage (seedbed vs. transplants) etc., can affect crop safety significantly. Use of non-selective herbicides such as glyphosate may be carried out very carefully using a hand held wick-applicator if necessary to minimize injury from spray drift. Prior to herbicide application, spray equipment used to apply herbicides in vegetables should be washed thoroughly using a detergent solution to rinse off residues from previous pesticide applications. Herbicides registered for common vegetables in West Virginia along with some general guidelines for their use are listed in *Tables 3-5*.

Table 3. Chemical weed control recommendations for Pepper.

Herbicide (Trade Name)	Rate of Application (Product/A)	Application Timing	Weeds Controlled	Comments
Napropamide (Devrinol 2EC)	*2 -4 qt*	Pre-emergence (Pre-plant incorporated)	Annual grasses and broadleaves.	Shallow incorporation is required. Follow label for rotational restrictions.
Clomazone (Command)	*0.67 to 2.67 pt*	Pre-emergence to transplants	Annual grasses and few broadleaves.	Not to be used in banana peppers. Weak on pigweed. Apply prior to transplanting. Place roots of transplants below chemical barrier. Avoid drift.
Halosulfuron (Sandea)	*0.5 to 1 oz*	Pre-or Post-emergence to weeds.	Pre: Annual broadleaves Post: Yellow nutsedge and most annual broadleaves.	Apply to row-middles when applied Post-emergence to crop.
Sethoxydim (Poast 1.5L)	*1.0 to 1.5 pt*	Post-emergence	Annual grasses.	Apply to actively growing grasses.
Carfentrazone (Aim 1.9 EW)	*0.5 to 2.0 oz*	Post-emergence	Young, actively growing broadleaves. Does not control grasses.	Apply to row middles using a shielded sprayer (no crop contact). Apply prior to transplanting.

Table 4. Chemical Weed Control Recommendations for Tomato.

Herbicide (Trade Name)	Rate of Application (Product/A)	Application Timing	Weeds Controlled	Comments
Metribuzin (Sencor DF)	*0.33 – 0.67 lb*	Pre-emergence (Pre-plant incorporated) Or Post-emergence	Annual broadleaves and few grasses.	For use in transplants only. Limit to 1.3 lb/A per season.
Napropamide (Devrinol 2EC)	*2 -4 qt*	Pre-emergence (Pre-plant incorporated)	Annual grasses and broadleaves.	Shallow incorporation is required. Follow label for rotational restrictions.
Metolachlor (Dual Magnum)	*0.67 to 2.67 pt*	Pre-transplant or Post-transplant within 2-3 days	Annual grasses, yellow nutsedge, galinsoga, few other small seeded broadleaves.	No incorporation necessary.
Rimsulfuron (Matrix 25 WP)	*2.0 oz*	Pre-emergence or Post-emergence	Annual grasses and few broadleaves.	Post-emergence application requires an adjuvant (crop oil or NIS).
Halosulfuron (Sandea)	*0.5 to 1 oz*	Pre-or Post-emergence to weeds.	Pre: Annual broadleaves Post: Yellow nutsedge and most annual broadleaves.	Post-emergence applications require at least 2 weeks after transplanting. Max. of 2 applications/season.
Sethoxydim (Poast 1.5L)	*1.0 to 1.5 pt*	Post-emergence	Annual grasses.	Apply to actively growing grasses.
Carfentrazone (Aim 1.9 EW)	*0.5 to 2.0 oz*	Post-emergence	Young, actively growing broadleaves, does not control grasses.	Apply prior to transplanting. Apply to row middles using a shielded sprayer (no crop contact).

Table 5. Chemical Weed Control Recommendations for Potato.

Herbicide (Trade Name)	Rate of Application (Product/A)	Application Timing	Weeds Controlled	Comments
Metribuzin (Lexone or Sencor DF)	*0.33 – 1.33 lb*	Pre-emergence	Annual broadleaves and few grasses.	Limit to 1.33 lb/A per season.
Pendimethalin (Prowl 3.3 EC)	*1.2 – 3.6 pt*	Pre-emergence	Annual grasses and few small seeded broadleaves.	Prowl H2O, new formulation has no stain. Check label for rates.
Dimethanamid (Outlook 6 EC)	*12 – 21 oz*	Pre-emergence after planting	Annual broadleaves and few grasses.	Shallow incorporation is required. Follow label for rotational restrictions.
Metolachlor (Dual II Magnum)	*1.0 to 2.0 pt*	Pre-transplant or Post-transplant after hilling	Annual grasses, yellow nutsedge, galinsoga, few other small seeded broadleaves (will not control germinated weeds).	Total must not exceed 3.6 qt/season.
Rimsulfuron (Matrix 25 WP)	*2.0 oz*	Pre-emergence or Post-emergence	Annual grasses and few broadleaves.	Post-emergence application requires an adjuvant (crop oil or NIS).
Sethoxydim (Poast 1.5L)	*1.0 to 1.5 pt*	Post-emergence	Annual grasses.	Apply to actively growing grasses.
Carfentrazone (Aim 1.9 EW)	*0.5 to 2.0 oz*	Post-emergence	Young, actively growing broadleaves and a few grasses.	Apply to row middles using a shielded sprayer (no crop contact).

For further information concerning vegetable herbicides, consult the *Commercial Vegetable Production Guide for West Virginia*.