

Weed Control in Vegetable Seed Crops

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Vegetable seed production is a major industry in the Lower Sacramento Valley. The major crops grown are cucurbits (cucumbers, squash, watermelon, cantaloupes/mixed melons and pumpkins). Minor seed crops include onions, carrots and brassicas. Cucurbit and onion seed crops will be discussed here.

Cucurbit seed production & weed management

In 1998, there were an estimated 22,000-25,000 acres of cucurbit seed, with an on-farm value of over \$40 million, produced in a five-county Lower Sacramento Valley area. The acreage was approximately 45 % cucumbers, 25 % watermelon, 20 % squash and the remainder mixed melons and pumpkins. Most of the production of cucumbers and squash is hybrids, while the mixed melons and watermelon are open pollinated. Grower returns are higher for hybrids than for open pollinated types. Cucurbits are relatively low-value crops, compared to other options, but the income is predictable and consistent. There is a tendency to under-utilize chemical inputs (including herbicides).

Some of the major issues facing the California vegetable seed industry include: cheap labor in emerging or third world countries. This is especially important for hybrid production of watermelon and mixed melons which, owing to their reproductive morphology, require large inputs of hand labor. The result has been the movement of hybrid watermelon and mixed melon seed production off-shore; a high dependence on exports. In some cases, world politics enter into the equation. Many of the mid-east countries (Iran, Iraq, etc.) were formerly important cucurbit seed customers, but US policies have negatively impacted these relationships; inadequate land availability to allow additional industry expansion in the Lower Sacramento Valley. Cucurbit seed fields require ½ mile + isolations from other varieties within the same genus, and that is becoming difficult to attain.

Important weed considerations in local cucurbit seed fields include: velvetleaf (*Abutilon theophrasti*), Wright groundcherry (*Physalis acutifolia*), black nightshade (*Solanum nigrum*), pigweeds (*Amaranthus sp*), barnyardgrass (*Echinochloa crusgalli*) and field bindweed (*Convolvulus arvensis*).

There are limited cucurbit broadleaf herbicide options. Prefar® (Gowen) is the only preplant material currently registered. It may be applied either preplant incorporated or post-plant surface applied, followed by an irrigation within 36 hours. There are plant-back restrictions for many rotational crops that may impact the decision to use this material. Relevant weeds that are controlled include barnyardgrass, lambsquarters, purslane and pigweed. Curbit® (UAP) is registered for post-plant, pre-emergence applications. It must receive at least

one-half inch of irrigation within two days following application to move it into the soil profile and activate the material. It also has a plant-back restriction for sugar beets that should be considered if this crop is in the rotational program. Curbit[®] controls johnsongrass (from seed), lambsquarters, pigweeds and purslane. The third broadleaf option is trifluralin. This product is applied as a directed spray, between plant rows, when the plants have at least 3-4 true-leaves. It is incorporated and treated soil is thrown around the base of plants. There is also a sugar beet plant-back restriction for trifluralin which needs to be considered. Additional plant-back restrictions for corn, sorghum or crops not listed on the label apply. Trifluralin controls annual bluegrass, barnyardgrass, johnsongrass (from seed), chickweed, lambsquarters, pigweed, purslane and Russian thistle.

Conversely, there are good herbicide options for grass control in cucurbits. Prefar[®] and Curbit[®] have already been discussed. Poast[®] is a third option, and is commonly used. However Poast[®] does not control annual bluegrass, so trifluralin may be required if this is a problem.

The picture for herbicidal broadleaf control in cucurbit crops is not good, and there are many important species that are not currently controlled. As noted in the above discussion, there is relief for pigweed. That leaves velvetleaf, groundcherry, nightshade and field bindweed as potential problems that will have to be controlled by non-herbicidal means. Some of these techniques include: pre-irrigations followed by cultivations to sprout and destroy weed seeds; rotating with other crops that receive greater herbicidal inputs and have low weed populations; post-emergence cultivations; hand hoeing, when the crop is normally thinned. Cucurbit seed crops are planted densely and almost always require a thinning crew to go through anyway; and, the use of a butane-powered flamer when the crop is mature and the foliage has died back. Because the crop is being grown for seed, and external cosmetics are unimportant, this technique is possible *after the fruit is mature*. It is unclear, however, how effective this is in killing the maturing weed seed.

Onion seed production and weed management

Onion seed production is a minor, but an important crop locally. It was grown on 1500-2000 acres in 1998, and had an estimated farm-gate value of \$8 million. About 40 % short-day types, 40 % long-day types and 20 % intermediate-day types are produced in the area. This is a crop that costs a lot to produce, but has the potential for equally high returns. Consequently, growers will do whatever is necessary to maintain or enhance plant growth and seed yields, so chemical inputs are an accepted part of the program.

The major issues facing the Lower Sacramento Valley onion seed industry are: high germination requirements for seed delivered to contractors, and difficulty always attaining it. Minimum germination requirements are 85 %, or more, and if the delivered seed does not meet this criteria it is heavily re-cleaned until it does; high production costs and high risk. By the time the seed is delivered to the contractor, the grower may have in-excess of \$3000 per acre invested. There are many disease or environmental factors that can injure or destroy onion seed crops and the risk is very high; a very labor-intensive crop that has needs for large numbers of laborers for intermittent periods. The Lower Sacramento Valley area does not have a large labor pool; disease management. There are two potentially-serious foliar diseases experienced locally.

They are Botrytus blast (*Botrytus squamosa*) and downy mildew (*Perinospora destructor*). Downy mildew is the worst of the two, and under conditions favorable for the disease, can cause severe damage and seed yield reductions; and, weed management. Onions are planted in August-October and harvested in July. Therefore, they experience summer and winter annual, biennial and perennial weeds. Add to that the recognized limitations onions have competing with most weeds, and you have the formula for disaster. Many fields have been “walked-away” from for out-of-control weeds.

Important weeds in local onion seed fields include: field bindweed, burclover (*Medicago polymorpha*), yellow starthistle (*Centaurea solstitialis*), purslane (*Portulaca oleracea*), black nightshade, barnyardgrass, shephardspurse (*Capsella bursa-pastoris*) and annual bluegrass (*Poa annua*).

Although Dacthal[®] is still available, if you inventoried it or are fortunate enough to find some on the market, eventually stocks will be depleted unless someone starts manufacturing it again. In the absence of this important tool, the only current preplant material available is Prefar[®]. While there are clearly situations where the use of this material should be considered, it will not control many of the important weeds. There is some preplant use of metham sodium for early-season weed control.

While, on the surface, there appear to be a number of post-emergence broadleaf materials available, they have some serious usage restrictions that leave a 6-8 week vulnerable period from seeding to at least the 2nd true-leaf stage. Goal[®] (Rohm & Haas) is an effective contact material that *usually* only mildly damages the onions, but it can not be used until the 2nd true-leaf stage. Under common cool, wet weather conditions, crop injury may be severe and applications should be delayed until the plants are larger. Goal[®] controls black nightshade, pigweed, purslane and shephardspurse. Bucril[®] (Rhone-Poulenc) is another contact option, but also can not be used until the 2nd-5th true-leaf stage. Additionally, it must be applied in 50 or more gallons of water per acre or injury may result. It also is impacted by weather conditions, and prolonged fog causes serious onion injury. Bucril[®] controls black nightshade, lambsquarters and shephardspurse, and suppresses pigweed, velvetleaf and yellow starthistle. Prowl[®] (American Cyanamide) is a third selective post-emergence option, but can not be applied until the 2nd-6th true-leaf. Irrigation or rainfall within a week is needed to incorporate/activate the material. The same cautions about use under cool, wet weather apply to Prowl[®]. Prowl[®] can control barnyardgrass, lambsquarters, pigweed, purslane and velvetleaf. The grass spectrum is well-covered by Poast[®], Fusilade[®] (Zeneca) and Prism (Valent). Poast[®] is most commonly used, but does not control the annual bluegrass that Prism[®] picks-up.

So the herbicidal control picture is a mixed-bag: There are post-emergence materials that will control most of the serious weeds, but there is a 6-8 week gap in control and post-emergence applications may be negatively impacted by weather conditions common in the area during the desired spraying time. Both of these factors create the need for additional, non-herbicide control measures. These include: pre-irrigations and cultivations. It is common to pre-irrigate and cultivate up to three times before planting, to germinate and destroy weed seeds; hand-hoeings. One of these may be coupled with the thinning operation, but the other two are solely for that purpose; soil solarization. The use of soil solarization has been demonstrated to be a viable weed control options for onion seed production. The ground is fallow during the prime time of year

for obtaining optimum results from solarization. High costs have been the primary factor holding this technology back. There is also the need to have effective post-emergence weed control with solarization; the use of foliar ammonium fertilizers. Concentrated ammonium fertilizers, such as ammonium sulfate, effectively control many common weeds in emerging and seedling onions. The onions waxy cuticle imparts selectivity. However, *ammonium fertilizers are not registered for use as pesticides in California*. If they are being used as foliar fertilizers, a side-benefit is enhanced weed control. Some of the more succulent weed species, such as purslane, are not effectively controlled with foliar fertilizers. There is also the need for a later-season control program, as foliar fertilizers may injure more mature onions.

References

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