

Some Observations of Weed Control Using Above Ground Drip Irrigation

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Summary

If you are considering an investment in a drip irrigation system, along with all of the other considerations, some careful planning should be made for weed control. Where drip systems are designed so that access to farm machinery is prevented, weed control may become the most expensive variable cost.

Where above ground drip is used, mechanical cultivation is less practical, even where access with equipment is possible. Therefore, the grower is dependent upon herbicides for weed control. This may not be a serious problem if only a few annual weeds are present. On the other hand, where heavy weed pressure is expected, the elimination of cultivation will make the weed control program more difficult. It is possible to control most weeds economically and effectively in cotton with herbicides but do not depend on water run herbicides for the total weed control program.

The use of drip irrigation in cotton production has resulted in some new challenges for weed control. This progress report reviews the experience of the authors, beginning in 1982, in problem solving research with drip irrigation in growers fields. It also includes observations made of grower experiences in dealing with weed control problems in drip irrigation.

Below Ground Systems

Those systems using underground installations and that do allow access to conventional farm machinery for mechanical cultivation and application of pre and postemergence herbicides, can utilize available weed control technology. However, the presence of permanent drip lines in the seed bed, prevent deep tillage at any time. This lack of plowing, ripping, etc. can encourage some perennial weed problems. If dense mats of perennial weeds are allowed to form, such as bermudagrass, white horsenettle, or silver leaf nightshade and nutsedge, good seed beds will be difficult to prepare with light tillage. Also the lack of heavy tillage may encourage the early season growth of perennial weeds and make season long control more difficult. Purple and yellow nutsedge thrive under all drip irrigation regime's. If present, these species pose a very serious threat to the success of any drip irrigation system.

Above Ground Systems

The installation and design of above ground systems has varied widely in Arizona. Sometimes, little regard has been given in design, to its effect upon weed control. If access to the field by conventional farm equipment is seriously inhibited, this will impact on the options available for weed control.

With any above ground drip system there will be constraints in the use of mechanical cultivation for weed control. In some instances once the drip lines are in place it will not be practical to either cultivate or apply any herbicides with tractor mounted equipment. Control of weeds would therefore rely upon these options:

1. Herbicides applied preplant or preemergence to the crop.
2. Hand operations such as hoeing, back pack sprayers and hand operated wicks.
3. Applications by aircraft of selective herbicides over the top of the cotton.
4. Herbicides applied through the drip system.

Let us examine each alternative and how they have performed under Arizona conditions.

1. Preplant herbicides:

This practice had been found to be an essential part of any weed control program using either above or below ground drip irrigation. To date, all drip irrigated cotton has been planted in dry soil and irrigated to a stand. Annual weeds, without a preplant treatment, will emerge with the crop. These early season weeds can outgrow the crop and will reduce yields if not removed. Because the weeds are often taller than the crop, the use of directed application of foliar active herbicides is often not successful. Most often, these early season weeds can only be controlled with hand hoeing, a very expensive alternative. A preplant incorporated application of a dinitroaniline herbicide trifluralin (Treflan) or pendimethalin (Prowl) plus prometryn (Caparol, Prometryn) will control a broad spectrum of early season annual weeds and is essential where the crop is watered up. In drip systems, small amounts of water are applied frequently. The area immediately adjacent to each emitter often remains saturated with water. Weeds, ordinarily controlled for 2 or 3 months with preplant herbicides will emerge in these wetted areas in 4 to 6 weeks. Common purslane may emerge shortly after the germination irrigation. These early season weeds will remain stunted for some time due to the residual herbicide and can be easily controlled with foliar active herbicides, if access with equipment is available. In those areas which are further from the emitters, preplant herbicide persistence is similar to that experienced in cotton watered with furrow irrigation. Season long control can be expected. Herbicides may persist in the soil from one crop to the next in the nonirrigated areas.

2. Hand operations:

Hand hoeing near above ground drip systems is not only expensive but will result in mechanical damage to the drip line. The use of back pack sprayers

and hand held wicks has only limited practical use, primarily for control of perennial weeds. It is doubtful if cotton growers want to return to the use of intensive hand labor for cotton production. However, some hand hoeing may be required under any program if 100% weed control is desirable.

3. Aircraft applications:

Very few herbicides are selective enough, for use as over the top applications to cotton. Sethoxydin (Poast) and fluazifop-butyl (Fusilade) selective postemergence grass herbicides, are two notable exceptions. It should be pointed out that because of the relative high cost of these materials, very little of these herbicides are applied by aircraft but are applied as spot application. There are no selective herbicide for broadleaf weed control suitable for application by aircraft in cotton.

4. Water run herbicides:

Herbicides with potential usefulness for water run applications in drip systems, are necessarily limited. Such a herbicide should be sufficiently soluble in water and mobile in the soil so that it will move uniformly from the emitter and encounter the roots of the weeds. This herbicide must be able to control weeds by root uptake. Most importantly, because the roots of the weeds and cotton will be in the same limited area, cotton roots will also have access to this herbicide. Therefore, it is essential that there be sufficient tolerance to the herbicide by cotton so that weeds will be controlled by the herbicide and the cotton remain unaffected.

In conventionally irrigated cotton, the cotton utilizes moisture from five or more feet in the soil horizon. Weeds tend to use moisture from a more shallow depth. This provides some positional selectivity to herbicides because the cotton and weed roots are somewhat separated. The use of drip irrigation, where water is delivered frequently and in relatively small quantities to a limited area, encourages the development of both the crop and weed roots in this limited area.

Previous studies of this subject have been concerned with herbicide applications made directly to the soil, then subjected to movement by rainfall, irrigation and/or mechanical cultivation. A certain portion of the herbicide is "tied up" by the silt, clay and organic matter of the soil. That portion of herbicide remaining in the soil solution or soil water is the portion that is available for weed control or crop injury. Therefore, when herbicides are applied directly through the irrigation water, and are carried in solution directly to the roots of both the crop and weeds, the selectivity of the herbicide maybe modified.

Candidate Herbicides for Drip Irrigation

Experience with some herbicides has indicated that they are neither sufficiently efficacious or mobile for use through drip systems. The dinitroaniline herbicides, Treflan and Prowl are almost insoluble in water and move a very little distance from the emitter. Diuron (Karmex, Direx) has been nonselective through the drip system and injured cotton at rates as low as 0.25 lb/A.

In Arizona prometryn (Caparol, Prometryn) is the only preplant incorporated herbicide registered for use, which is relatively mobile in the soil and will control weeds through root uptake. Seedling and established

cotton have exhibited a tolerance to prometryn. It is an obvious candidate for water run in cotton. Water run applications of prometryn will often result in chlorosis to the cotton but sufficient selectivity can be obtained. There are other possible herbicides, metolachlor (Dual) and cyanazine (Bladex) which have also been tested and may prove to be useful.

The selectivity of prometryn as well as its ability to control weeds, is effected by many variables. Common purslane, Palmers amaranth, groundcherry and many annual grasses seem to be susceptible to water run prometryn. On the other hand tumble pigweed and common sunflower are not controlled. As mentioned earlier soil properties such as sand, silt, and clay content; mineral composition; organic matter; and level of PH and salt content effect the mobility and activity of prometryn. It has also been observed that herbicide distribution can be effected by when during the irrigation run and for how long a period the herbicide is injected. This in turn can effect the control and selectivity of the herbicides. For example, it appears that the best time for application is near the end of the irrigation, when the soil is saturated. We have seen no evidence that injecting herbicides for 4 hours is any better than for 30 minutes but we have not yet been able to adequately test this theory. We have observed that a 30 minutes injecting time is some what better than 3 minutes.

While much research needs to be done, at this date, dependence for weed control upon water run prometryn or any other herbicide in drip irrigation systems is not advisable. Control of weeds has not been consistent and injury to cotton can occur. If no preplant herbicide is used, it will be necessary to apply herbicides in the drip system very soon after cotton emerges. Some growers maybe reluctant to irrigate seedling cotton so early for fear of slowing growth and possible stand loss. If a mistake is made and the herbicide to be injected into the irrigation water, intended for a cotton field is accidentally applied to another crop, serious injury will occur. Further, herbicides are not labeled for use through drip irrigation.

Weed Control Program for Above Ground Drip Systems

Annual weeds can be successfully and economically controlled in above ground drip systems where the following prodecures are available:

1. Use a preplant incorporated herbicide. A combination of a dinitroaniline herbicide plus prometryn is usually best for broad spectrum control.
2. Be prepared to make a directed application of contact herbicides to small weeds shortly after cotton emergence particularly near the drip line.
3. Repeat directed applications of foliar applied herbicide as required. Higher layby rates, as used in furrow irrigated cotton, breakdown rapidly in the wetted area and do not give long term control. High layby rates covering the irrigated as well as the nonirrigated areas may result in cotton injury if rainfall occurs shortly after application. Herbicide carryover would likely occur in the non-irrigated areas.