

## **Integrating Transgenic and Conventional Herbicides in Cotton**

*Steve Wright, Lalo Banuelos, Jamie Changala, Nancy Loza,  
Sara Avila, Katie Wilson, Matt Mills, Tony Garcia  
Univ. of Calif. Coop. Extension, Kings/Tulare Co., Tulare, CA (sdwright@ucdavis.edu)*

Herbicide tolerant cotton acreage has increased dramatically in the United States and amounts to approximately 90 percent in other cotton growing states whereas in California Roundup Ready cotton is grown on 50 percent of the upland and 65 percent of California Pima cotton. The herbicide tolerant acreage of cotton should continue to increase as higher yielding varieties receive these traits. Last season approximately 400,000 acres of cotton was produced and acreage should be over ½ million in 2011 due to extremely high prices.

Integrating herbicide resistant crop technology and conventional herbicides makes sense for many reasons. One of the main concerns is preventing weed resistance. There is a high probability of developing resistant weed species and/or weed shifts when solely relying on one type of herbicide. For example, we have Roundup resistant annual ryegrass and horseweed in California. Cotton growers have also reported poor control of barnyardgrass, pigweed and lambsquarter in some cases.

Roundup Ready technology has provided growers with an excellent tool for managing many annual and perennial grasses, including difficult to control weeds such as nightshades, annual morningglory, and nutsedge. Some of the advantages to this system include the following: Glyphosate can be applied post emergence so growers can wait and see the weeds present. There are no plant back restrictions. This technology has allowed growers to reduce tillage operations and also experiment with ultra narrow row systems. Cost savings range from \$25 to \$120/acre is achieved. Even if growers use an herbicide tolerant system it is still advisable to use one of the following preplant incorporated herbicides in cotton: Prowl, Treflan, Caparol, or Caparol + Treflan/Prowl. The cost is low (\$6-\$8/A) and controls most annual grasses and many broadleaves. Ultimately the decision to use one herbicide tool over and how to integrate different herbicides will depend on costs and effectiveness.

Even with the herbicide tolerant technology weeds like annual morningglory, lambsquarter, and barnyardgrass are increasing especially when growers are only relying on glyphosate. In other cotton growing states where Roundup Ready cotton is grown on greater than 90 percent of the acreage weed shifts have developed after many years of a reduced tillage systems coupled with extensive use of glyphosate. These weeds include palmer amaranth, horseweed, giant ragweed, and tropical spiderwort.

With the adoption of herbicide tolerant systems there are concerns that certain weeds would develop resistance or cause weed shifts due to the repeated use of a single herbicide. Concerns have already surfaced in California regarding reduced control in some cases of barnyardgrass, sprangletop, pigweed, and lambsquarter with continual use of Roundup Ready systems. In

several of the southern states, several weeds have developed resistance to glyphosate where cotton has been grown for a number of years in conservation tillage fields. Amaranth species (pigweed) is becoming more difficult to control. Roundup Ready corn in Roundup Ready cotton is now a problem. Sprangletop, horseweed, and fleabane have now infested most canals, roadsides, and field edges throughout the San Joaquin Valley. In some cases these weeds are just beginning to encroach into the cotton fields.

In many regions, reduced tillage, spot treatments, early postemergence-directed applications, and hand hoeing has decreased because of this technology. Now with more resistant weeds such as palmer amaranth, growers have to bring some of the older technologies back into the system such as the use of some tillage, hand weeding, and the use of residual herbicides. If glyphosate usage continues to increase, the industry incentive to support existing and older active ingredients may decrease. If glyphosate resistant weeds continue to develop and major shifts in weed populations occur, fewer herbicide options may be available due to the number of older herbicides lost to re-registration and the decline in the number of herbicides brought to market.

Dr. Stanley Culpepper reported that a recent survey of weed scientists focused on weed shifts in GR cotton systems. Six scientists in six states (AL, GA, FL, MO, NC, and TX) responded to the survey. All scientists noted weed shifts have occurred, and *Amaranthus* species, annual grasses, dayflower species (*Commelina* sp.), morningglory species (*Ipomoea* sp.), and winter annuals were becoming more problematic in response to currently utilized GR management systems. Four of six states noted these shifts are of economic concern and all specialists are addressing weed shift issues by recommending 1) the use of residual herbicides in current GR programs, 2) the addition of other herbicides in mixture with glyphosate, 3) rotation to other herbicide chemistry, and 4) rotation away from GR crops when feasible.

A major concern for an increase in glyphosate resistant weeds is that cotton is often rotated with Roundup Ready corn. There has been considerable interest in reduced tillage corn. A crucial aspect of no-till corn management should revolve around weed control. Keeping noxious weeds and grasses out of dairy silage is essential if the highest quality silage is to be harvested. Corn growers have access to a variety of different herbicide programs, but the Roundup Ready® corn system is the easiest in terms of managing weeds when the tillage is eliminated or used less frequently. By the 2010 season, Roundup Ready Corn comprised 50 percent or more acreage. Most no-till corn growers who use the Roundup Ready system do not use a pre-emergence herbicide, preferring instead to rely on over-the-top applications of Roundup UltraMAX® herbicide, often alone but sometimes in either tank mixes with 2,4-D, dicamba, halosulfuron (Sempra) or in conjunction with separate treatments of these herbicides. Corn growers who use dairy manure as fertilizer need to work extra hard to stay on top of weed control. Some tillage once in awhile, and combined with use of different herbicides, may be necessary where dairy manure is applied to fields.

The results of several cotton studies demonstrate the value of Glytol + Liberty Link Cotton, which will provide an alternative to glyphosate but broadleaves must be small. Research with

“Widestike” Technology gave a 1X safety rate using glufosinate on cotton. Our research demonstrated no advantage to increasing spray pressure or water volume for annual morningglory control when using glyphosate or glufosinate. One study demonstrated a need to use a 4X rate of glyphosate to obtain control of lambsquarter in a field that was in no-till Roundup Ready corn for several years.

### **Summary**

The potential for herbicide resistance should receive serious and thoughtful attention. As weed management systems change with new herbicides and herbicide resistant crops are introduced, resistant management must be an integral part of the production system. If selection pressure is maintained through the continuous use of the same herbicide, herbicide resistance will soon render it ineffective.

Resistance management approach must incorporate crop/herbicide rotation and control of weed escapes by tillage or hand. An integrated weed management system supplements an existing transgenic or conventional weed control program and uses a variety of the available pre-plant, selective over-the-top and layby herbicides along with tillage. Keep in mind many of the weeds were not being easily controlled before herbicide tolerant technology was available. Therefore it will continue to be necessary to use every available tool in the future to economically control weeds in this year’s crop and effectively control weeds from building up in the seed bank for future crops.

### **References:**

- Wright, S. 2010. Integrated Pest Management Guidelines for Cotton. Univ. of California.
- Vargas, R. and S. Wright. 1996. Integrated Pest Management for Cotton in the Western United States. Weed Control in Cotton Chapter Pg. 136-138.
- Wright, S., G. Banuelos. 2006-2010. University of California Cotton Weed Management Research Progress Report.
- Wright, Steve. 2005. Integrating Weed Control in Cotton and Corn. California Weed Science Society Proceedings.
- Dotray, Peter. Impact of Roundup Ready Technology on Cotton Production in the U.S. Beltwide Cotton Research Conference Proceedings. January 2005, New Orleans.
- Vargas, Ron, Steve Wright. A Comparison of Roundup Ready and Roundup Ready Flex Cotton Systems. Beltwide Cotton Research Conference Proceedings. January 2005, New Orleans
- Culpepper A. Stanley. Weed Shifts and Volunteer Crops in Roundup Ready Systems. Beltwide Cotton Research Conference Proceedings. January 2005, New Orleans
- Vargas, Ron, Steve Wright. Principles of Weed Resistance Management. Beltwide Cotton Research Conference Proceedings. January 2005, New Orleans
- Vargas, R., S. Wright, T. Martin-Duvall, G. Banuelos. Ignite and Liberty Link Cotton for the California Production System. Mar. 2005. Western Society of Weed Science proceedings pg. 16. Vol. 58