

Roundup Ready Flex Cotton System

Robert Lemon, Ph.D., Professor and Extension Agronomist - Cotton
Randy Boman, Ph.D., Associate Professor and Extension Agronomist - Cotton
Todd Baughman, Ph.D., Associate Professor and Extension Agronomist
Paul Baumann, Ph.D., Professor and Extension Weed Specialist
Peter Dotray, Ph.D., Professor and Extension Weed Specialist

Roundup Ready Flex cotton provides a new transgenic, postemergence herbicide management system for cotton developed by Monsanto. Roundup Ready Flex cotton varieties will be marketed by numerous seed companies and these varieties will have a genetically based tolerance to Roundup (glyphosate) herbicide. Commercial varieties will be marketed in the 2006 season and will be available as Roundup Ready Flex alone and in combination with the Bollgard II trait.

Roundup Ready Flex will be significantly different from the Roundup Ready system that has been available for several years. Roundup Ready cultivars currently marketed have a vegetative tolerance to Roundup and other labeled glyphosate products, but are susceptible to injury during the reproductive stage. Unfortunately, the effects of glyphosate injury cannot be seen on the vegetative portions of the plant; it is evident only by the absence of bolls. Beyond the four leaf stage, over-the-top applications of glyphosate may induce the plant to shed small bolls because the flower produces less viable pollen, resulting in poor seed fertilization. Consequently, glyphosate contact with plant tissue must be minimized through the use of directed sprayers beyond this growth stage.

Roundup Ready Flex varieties, however, possess both vegetative and reproductive tolerance to glyphosate herbicide. Thus, over-the-top applications can be made somewhat later in the growing season, potentially through the early bloom period (the product label is still in review). Roundup Ready Flex cotton will utilize the same metabolic tolerance expressed in current Roundup Ready cotton, soybeans and corn. The difference between Roundup Ready and Roundup Ready Flex is that the Flex cultivars possess an improved promoter sequence that provides the plant with both vegetative and reproductive tolerance

to the herbicide. Unlike Roundup Ready varieties, over-the-top applications after the four true-leaf stage should not affect reproductive development in Roundup Ready Flex cultivars. Results from several years of research conducted across the Cotton Belt indicate that Roundup Ready Flex cultivars are highly tolerant to broadcast applications of glyphosate well into the bloom period. Studies have evaluated different rates and timings of glyphosate applications, assessing subsequent plant growth and development, yield and fiber quality. Results from this research indicate that none of these traits were affected.

It is important to recognize that crop loss or yield reductions can occur where a grower inadvertently treats Roundup Ready, Roundup Ready Flex or Liberty Link cotton with the wrong herbicide. These systems are not interchangeable. The need for good record keeping on variety/technology field location(s) is imperative to avoiding potential problems such as these.

Early in the season cotton grows slowly and is not a strong competitor with weeds. Consequently, cotton fields must be fairly weed-free for an extended period – up to 10 weeks. Although it may not be visually apparent, early season competition from weeds can drastically reduce final yield. Some insurance against this early season competition could be provided by preplant incorporated or preemergence herbicides applied broadcast or in a band over the row area. Research indicates that weed management in Roundup Ready and Roundup Ready Flex cotton is best when glyphosate is used in a program that utilizes residual herbicides. Many growers are still using a dinitroaniline herbicide preplant incorporated to control annual grasses and small-seeded broadleaf weeds such as Palmer amaranth (also known as pigweed and carelessnessweed). This will still be a very

sound practice even with the new Roundup Ready Flex technology. Additional residual herbicides applied at planting, followed with glyphosate applied postemergence up to the four true leaf stage, and/or postemergence-directed or layby applications with or without glyphosate will likely aid in season-long weed management. These residual herbicides help to manage pigweed escapes and larger seeded broadleaf weeds and perennials not controlled by the dinitroaniline herbicides. The use of residual herbicides may delay or eliminate the need for a postemergence or postemergence-directed glyphosate application. For optimum weed control, glyphosate applications should be properly timed (based on weed species) and weeds should be in good growing condition. It is also important to use the appropriate labeled rate of glyphosate. Reducing the rate can lead to poor weed control and is not a sound weed resistance management technique. In addition to the use of residual herbicides, the first application of glyphosate should still be made in a timely manner with the Roundup Ready Flex system. Even with the wider over-the-top application window, delaying the first application could lead to reduced weed control (larger weeds growing under stress will be more difficult to control) and lower yields (due to early season weed competition).

Since 1977 there have been several reported cases of weed resistance to herbicides. Worldwide, there are 178 weed species (296 biotypes) that have been reported to have some sort of herbicide resistance.

Of these species, 107 are broadleaf weeds and 71 are grasses (see <http://www.weedscience.com> for more details). In Texas, herbicide resistance has been reported in Italian ryegrass and johnsongrass to ALS inhibiting herbicides (Oust, Pursuit, Accent), barnyardgrass to amide herbicides (Stam), and in Palmer amaranth and kochia to photosystem II inhibiting herbicides (atrazine). Recently, there is concern that horseweed or marestalk found in Tennessee and giant ragweed found in Arkansas have developed resistance to glyphosate. General strategies to delay or prevent the development of weed resistance include: 1) use cultivation as part of the overall weed management plan, 2) rotate herbicide modes of action in conjunction with crop rotation, 3) rotate herbicide modes of action in a continuous cropping system, 4) use tank mixes or sequential herbicide applications with different modes of action, and 5) use short residual herbicides to avoid high selection pressure on weeds. Weed resistance to herbicides does not develop quickly, nor will it occur on a variety of different weed species at once. Be on the lookout for weeds that are no longer controlled by herbicides that at one time controlled them. Small areas of herbicide resistant weeds are easier to control than large areas. Using preplant incorporated and residual herbicides as previously outlined is an important component of resistance management. This concept of resistant weed development and prevention practices is more fully explained in the publication "Weed Resistance to Herbicides" (SCS-1999-02).

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