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Crop Production Guide Series

How Will Roundup Ready Flex Cotton Change My Weed Management Decisions?

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Roundup Ready Flex cotton will be available in more than 40 commercial varieties in 2006

(different brand names do not necessarily mean that a producer is dealing with different varieties). In 2005, this new technology was tested in over 65 Roundup Ready Flex entries from 10 seed companies. Varieties can contain the Roundup Ready Flex technology alone or in combination with Bollgard II. The “traditional” Roundup Ready cotton varieties will be available for the next several years. These two “glyphosate-tolerant” cotton types may involve different types of weed management strategies.

Regardless of which “glyphosate-tolerant” technology is selected, soil applied residual herbicides are a critical part of the overall weed management system. A dinitroaniline herbicide (Treflan EC, Prowl EC, Prowl H2O, and several generic products) is recommended because these herbicides provide excellent control of annual grasses and small-seeded broadleaf weeds when used at rates appropriate for a given soil type and when appropriate incorporation methods are used. These herbicides are very economical (less than \$10 per acre) and remain the foundation for successful weed control on the High Plains. To control large seeded weeds (i.e. morningglory species), additional herbicides may be needed at planting.

The use of a preemergence (PRE) herbicide at-planting is dictated by the types of weeds present. In Roundup Ready cotton, Caparol, Cotoran, Diuron (Direx), Dual, Prowl H2O, and Staple have been effective, although the general trend of using a PRE herbicide has declined over the past 10 years. Most of these herbicides are also very cost effective (less than \$10 per acre) when applied broadcast, and banded applications will further reduce cost. Staple and Dual Magnum may be applied preemergence or postemergence, alone or in tank mix with Roundup, and will cost between \$10 to \$15 per acre depending on the rate. If Roundup WeatherMax costs approximately \$6 per acre, then most of these herbicides treatments have the potential to cost the same as or considerably less than a glyphosate treatment. A PPI application of trifluralin followed by Direx postemergence-directed or at layby will cost less than \$10 per acre. This system, plus one or two applications of Roundup WeatherMax will cost approximately \$16 to \$22 per acre, and will control a broad-spectrum of weeds. They will also introduce several herbicide modes of action into the system to help prevent the development of resistant weeds.

TRADITIONAL ROUNDUP READY COTTON

In “traditional” Roundup Ready cotton, up to two applications of Roundup may be used from emergence to 4-leaf cotton. The glyphosate rate depends on the herbicide formulation selected. The amount of active ingredient in 22 ounces of the Roundup WeatherMax is equivalent to the active ingredient found in 32 ounces of the four pound per gallon formulations. Unless perennial weeds or difficult-to-control annual broadleaf weeds such as morningglory are present, a postemergence-topical (POST) application at four-leaf cotton is typical. Dual Magnum or Staple may be tank mixed with glyphosate at the POST timing to provide some soil residual activity after application. Sequential applications must be at least 10 days apart and cotton must have at least two nodes of incremental growth between applications. After the POST application(s), an additional two applications may be used postemergence-directed (PDIR). These glyphosate applications may be made alone or in combination with Direx, Caparol, Cotoran, Layby Pro, or Valor for soil activity, or with Aim or ET for additional knockdown.

A salvage treatment may be used after the cotton has reached the four-leaf stage and should be used only where weeds threaten to cause the loss of the crop. Twenty-two fluid ounces per acre may be applied either as an over-the-top application or as a PDIR treatment sprayed higher on the cotton plants and over the weeds. A salvage treatment will result in significant boll loss, delayed maturity and/or yield loss. No more than one salvage treatment should be used per growing season.

The preharvest (20% boll crack to harvest) application rate is dependent upon the herbicide formulation but is typically higher than earlier applications (up to 44 ounces of Roundup WeatherMax). Allow a minimum of seven days between the preharvest application and harvest. A preharvest application is not recommended for cotton grown for seed because a reduction in germination or vigor may occur. Table 1 illustrates important differences between Roundup WeatherMax and other four pound glyphosate products in “traditional” Roundup Ready and Roundup Ready Flex cotton.

Table 1. Cotton technology and herbicide information.

Cotton Technology	Herbicide	Formulation	POST (# applics. and max rate)	PDIR (# applics. and max rate)	Salvage	Preharvest (# applics. and max rate)	Total Seasonal Use (oz/A and qts/A)
“Traditional” Roundup Ready Cotton	Roundup Weather Max	5.5 lb ai/gal (4.5 lb ae/gal)	2 22 oz	2 22 oz	1 22 oz	2 22 oz to 44 oz/A, starting at 20% boll open	172 ounces (5.3 quarts/A)
	Roundup Original	4 lb ai/gal (3 lb ae/gal)	2 32 oz	2 32 oz	1 32 oz	2 32 oz to 64 oz/A, starting at 20% boll open	240 ounces (7.5 quarts/A)
Roundup Ready Flex Cotton	Roundup Weather Max	5.5 lb ai/gal (4.5 lb ae/gal)	Up to 128 oz may be applied from emergence to preharvest using 22 to 32 oz/A per application			22 oz to 44 oz/A, starting at 60% boll open	same as Roundup Ready
	Roundup Original	4 lb ai/gal (3 lb ae/gal)	Up to 176 oz may be applied from emergence to preharvest using 32 to 40 oz/A per application			32 oz to 64 oz/A, starting at 60% boll open	same as Roundup Ready

ROUNDUP READY FLEX COTTON

For the new Roundup Ready Flex cotton, application rates and POST timings are the main differences compared to the “traditional” Roundup Ready cotton varieties (see Table 1). With Roundup Ready Flex cotton, over-the-top applications may be made throughout the growing season at higher rates. There have been reports that various formulations of glyphosate, including the old formulations of

Roundup WeatherMax and Roundup Original/Max have caused significant leaf burn on Roundup Ready Flex cotton. We have not observed this injury in the Texas Southern High Plains. For producers concerned about this potential injury, the glyphosate formulations containing the starburst label should be used. Producers should always be careful with formulations of herbicides that they are not familiar with. Caution should be used with new formulations to insure crop safety before they are widely used. In many cases the carrier solvent and/or adjuvant may cause problems. Figure 1 was created by Monsanto to illustrate the differences between Roundup Ready Flex cotton and the “traditional” Roundup Ready cotton.



A systems approach to weed management in a Roundup Ready Flex cotton field includes both the use of residual herbicides and Roundup WeatherMax, Roundup Original Max, or other approved glyphosate formulation POST.

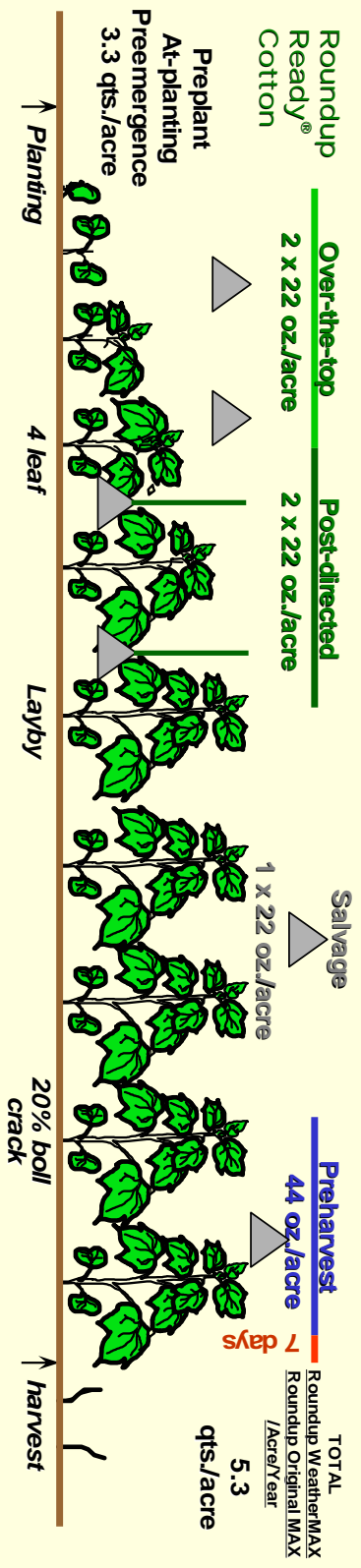
The main benefit of Roundup Ready Flex cotton is the flexibility in timing of POST applications. Initial applications can sometimes be delayed due to windy or wet weather preventing treatment by the fourth leaf stage. Delayed germination due to dry soil conditions may result in a large variability in crop development, thus creating timing issues. Mid- to late-season POST applications may end up being delayed until weeds are too tall to be controlled by PDIR treatments. These problems should all be aided with the Roundup Ready Flex system. In addition, increased glyphosate rates (up to 32 oz/A with Roundup Ready WeatherMax) should improve morningglory and perennial weed control.

Cotton is extremely sensitive to early season weed competition and early season weed control is essential to maximize both lint yield and quality to potential. Therefore growers need to continue with excellent weed management practices and avoid waiting too long in making the first POST application.

ROUNDUP READY® FLEX COTTON

Application Rates & Timing for Roundup® Brand Agricultural Herbicides 2006 Crop Year

Growers choosing Roundup WeatherMAX® or Roundup Original MAX™ herbicide for new labeled uses over the top of Roundup Ready Flex cotton should use only product with a starburst on the label stating "Herbicide for use with Roundup Ready crops and now specially formulated for expanded Roundup Ready Flex cotton uses."



Roundup Ready® Flex cotton has full regulatory clearance in the United States, but as of September 2005 does not have full import approval in all export markets. Processed fractions from Roundup Ready Flex cotton, including linters, oil meal, cottonseed and gin trash must be used and consumed domestically, and must not be exported without all necessary approvals in the importing country. Roundup® brand agricultural herbicides are available to growers for the expanded applications tolerated by Roundup Ready Flex cotton for its impending commercial launch. Always read and follow pesticide label directions. Please refer to label for more specific recommendations. Roundup Ready® crops contain genes which confer tolerance to glyphosate, the active ingredient in Roundup® brand agricultural herbicides. Roundup brand agricultural herbicides will kill plants that do not contain a Roundup Ready gene. Roundup Ready®, Roundup WeatherMAX® and Roundup Original MAX™ are trademarks of Monsanto Technology LLC. © 2005 Monsanto Company.

Figure 1. Application rates and timing in "traditional" Roundup Ready and Roundup Ready Flex cotton. Approved for use by Monsanto Corporation, St. Louis, MO.

Concerns regarding the inappropriate use of Roundup Ready Flex cotton include:

- 1) Delaying the first POST over-the-top application, especially under severe weed pressure or if difficult-to-control weeds such as morningglory are present. These weeds require early and sometimes repeated applications. In the case with severe weed pressure, effective weed control may be achieved, but early-season weed competition, which is often not visibly apparent, may reduce yield.
- 2) Less tillage, fewer herbicide “modes of action” (see publication entitled [“Herbicides: How They Work and the Symptoms They Cause”](#)), and an increased reliance on a glyphosate-intensive weed management systems will increase the selection pressure toward the development of glyphosate-resistant weeds. Glyphosate resistant horseweed and Palmer amaranth (pigweed/carelessweed) have already been discovered in the U.S. Cotton Belt.
- 3) Increased glyphosate rates and POST applications made later in the growing season may increase the potential for drift on non-Roundup Ready Flex cotton, which includes conventional (non-transgenic), LibertyLink, and “traditional” Roundup Ready cotton varieties.
- 4) Producers should keep flawless records concerning the location of various herbicide-tolerant cotton varieties and make sure that the appropriate over-the-top herbicide is applied.

For questions pertaining to the new Roundup Ready Flex cotton, consult your local Texas A&M University Research and Extension Center, Monsanto Corporation, or your local County Agent. Additional information may be obtained in a publication entitled [“Roundup Ready Flex Cotton System”](#) (SCS-2005-18-6-05).



The foreground plot is "traditional" Roundup Ready cotton while the background is the new Roundup Ready Flex cotton. Both glyphosate tolerant cotton types received a mid-season over-the-top glyphosate application. The “traditional” Roundup Ready cotton has little fruit while the Roundup Ready Flex cotton has a full boll load.



The foreground plot shows effective ivyleaf morningglory control in Roundup Ready Flex cotton using repeated over-the-top applications at the higher rates (32 ounces of Roundup WeatherMax).

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