

WEATHERMAX® (MON78270) TANK-MIX PARTNERS IN ROUNDUP READY® COTTON

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Abstract

Weed control with various herbicide chemistries was evaluated at the Cotton Branch Experiment Station, Marianna, AR. There were no significant differences in weed control among treatments that received more than one application of Weathermax, regardless of tank-mix partner, with respect to control of Palmer amaranth, large crabgrass, prickly sida, sicklepod, and velvetleaf. There was no advantage to adding a tank-mix partner to Weathermax, except for control of pitted morningglory. The beneficial tank mixtures for pitted morningglory control were post-directed applications of Weathermax in combination with Aim (carfentrazone) at 0.012, Valor (flumioxazin) at 0.032, or Strongarm (diclosulam) at 0.025 lb ai acre. There could possibly be some antagonism when using low rates of Aim (0.0036 lb ai acre⁻¹) in combination with Weathermax as compared to Weathermax alone. There was no yield advantage from any tank-mix combination when compared to two applications of Weathermax.

Introduction

The advent of herbicide-resistant cotton (*Gossypium hirsutum*) varieties has allowed foliar postemergence control of many problematic weed species in cotton. Roundup Weathermax™ (Weathermax) developed by Monsanto is the potassium salt of glyphosate. Weathermax is formulated as a soluble liquid with 5.5 pounds of the active ingredient glyphosate per gallon or 4.5 pounds glyphosate acid equivalent per gallon. Like early formulations of glyphosate, Weathermax has no appreciable residual activity. Although the level of weed control and or number of glyphosate applications needed for season-long control did not change when using preemergence (PRE) herbicides (Vencill 1996; Goldmon 1996; Culpepper and York 1998; Belcher et al. 1999), there is an innate increase in herbicide cost from the addition of a tank-mix partner. There may be situations in which a POST residual herbicide program may be beneficial in Roundup Ready cotton.

Objectives

The objective of this study was to evaluate weed efficacy of selected tank-mix partners in combination with Weathermax to control annual weeds in Roundup Ready cotton.

Materials and Methods

Studies were conducted at the Cotton Branch Experiment Station, Marianna, AR. The study design was a randomized complete block with four replications. Experimental units were 12.67- by 40-ft plots that were overseeded with seed of Palmer amaranth (*Amaranthus palmeri*), pitted morningglory (*Ipomoea lacunosa*), prickly sida (*Sida spinosa*), velvetleaf (*Abutilon theophrasti*), sicklepod (*Senna obtusifolia*), and large crabgrass (*Digitaria sanguinalis*). Following incorporation of weed seed, cotton cultivar Paymaster 1218BR was planted at a rate of 66,000 seed acre⁻¹ at a depth of 1.5 inches accompanied by an in-furrow application of the insecticide Temik® at 4 lb acre⁻¹.

Herbicide treatments consisted of a broadcast application of Weathermax at 0.75 lb ae acre⁻¹ followed by (fb) post-directed weed control regimes of Weathermax at 0.75 lb ae acre⁻¹ applied once or twice; Weathermax at 0.75 lb ae acre⁻¹ applied alone or in combination with Direx (diuron) at 0.25 lb ai acre⁻¹, Aim at 0.012 or 0.0036 lb ai acre⁻¹, Amplify (cloransulam) at 0.016 lb ai acre⁻¹, Valor at 0.063 or 0.032 lb ai acre⁻¹, Firepower (glyphosate+oxyfluorfen) at 1.06 lb ai acre⁻¹, Strongarm at 0.025 lb ai acre⁻¹, or Envoke (trifloxysulfuron) at 0.0118 or 0.0071 lb ai acre⁻¹ targeting 3- to 5-inch weeds. Treatments were applied using a tractor-mounted sprayer calibrated to deliver 20 GPA.

Data collected consisted of weed control by species and crop injury ratings on a scale of 0 to 100 with 0 being no weed control or crop injury and 100 being complete weed control or total crop destruction. All data except weed control, yield, and crop injury from the untreated control were subjected to analysis of variance. Treatment means were separated using Fisher's Protected Least Significant Difference (LSD) at the 0.05 level of significance.

Results and Discussion

There were no significant differences in weed control among treatments that received more than one application of glyphosate, regardless of tank-mix partner, with respect to control of Palmer amaranth or prickly sida (Tables 1 and 2). As expected, follow-up treatments plus Weathermax provided better control of weed species evaluated than single applications of

Weathermax. There were no advantages to adding a tank-mix partner to Weathermax, except for the control of pitted morningglory. Weathermax (0.75 lb ae acre⁻¹) + Aim (0.012 lb ai acre⁻¹), Weathermax (0.75 lb ae acre⁻¹) + Valor (0.032 lb ai acre⁻¹), and Weathermax (0.75 lb ae acre⁻¹) + Strongarm (0.025 lb ai acre⁻¹) tended to provide greater control of pitted morningglory than two applications of Weathermax alone. Late-season weed control ratings revealed that Weathermax + Strongarm provided better control of pitted morningglory than two applications of Weathermax; however, there were no differences between this tank mixture and three applications of Weathermax. There may have been a trend for antagonism with Weathermax + Aim (0.0036 lb ai acre⁻¹) as compared to sequential applications of Weathermax alone. This potential antagonism was possibly relieved by increasing the rate of Aim to 0.012 lb ai acre⁻¹. There was no yield advantage to adding a tank-mix partner to post-directed applications of Weathermax.

There appears to be no advantage to adding tank-mix partners to Weathermax for control of Palmer amaranth, large crabgrass, or prickly sida. The addition of Aim, Valor, or Strongarm to the post-directed application of Weathermax tended to provide better control of pitted morningglory than sequential applications of Weathermax alone. There may be some antagonism when Weathermax is tankmixed with lower rates of Aim. There was no yield advantage to adding a tank-mix partner to Weathermax; however, there is an innate increase in herbicide cost from the addition of a tank-mix partner.

References

Belcher, S. B., M. G. Patterson, W. H. Faircloth, and D. O. Stephenson, IV. 1999. Roundup Ready cotton weed control systems in Alabama. Proc. South. Weed Sci. Soc. 52:1.

Culpepper, A. S. and A. C. York. 1998. Weed management in glyphosate-tolerant cotton. J. Cotton Sci. 2:174-185.

Goldmon, D. L., C. Guy, M. McClelland, and A. Kendig. 1996. Weed control systems in Roundup Ready cotton. Proc. Beltwide Cotton Conf. 2:1532.

Vencill, W. K. 1996. Weed management systems utilizing herbicide-resistant cotton. Proc. Beltwide Cotton Conf. 2:1532-1533.

Table 1. Palmer amaranth control after a broadcast application of Weathermax at 3- to 5-inch weeds followed by specific post-directed systems at 3- to 5-inch weed regrowth.

| Herbicide system | % control at weeks after planting | | | |
|--|--|----------|----------|-----------|
| | 6 | 7 | 8 | 12 |
| No follow-up treatment | 86 | 69 | 71 | 39 |
| Weathermax*+Direx (0.25 lb ai acre ⁻¹) | 96 | 98 | 94 | 97 |
| Weathermax+Aim (0.0036 lb ai acre ⁻¹) | 99 | 98 | 93 | 97 |
| Weathermax+Aim (0.012 lb ai acre ⁻¹) | 99 | 99 | 93 | 98 |
| Weathermax+Amplify (0.016 lb ai acre ⁻¹) | 96 | 98 | 95 | 96 |
| Weathermax+Valor (0.032 lb ai acre ⁻¹) | 98 | 99 | 94 | 99 |
| Weathermax+Valor (0.063 lb ai acre ⁻¹) | 99 | 98 | 93 | 99 |
| FirePower (1.06 lb ai acre ⁻¹) | 99 | 99 | 93 | 98 |
| Weathermax+Strongarm (0.025 lb ai acre ⁻¹) | 99 | 99 | 94 | 96 |
| Weathermax | 99 | 100 | 94 | 96 |
| Weathermax fb Weathermax | 99 | 100 | 95 | 100 |
| Weathermax+Envoke (0.0071 lb ai acre ⁻¹) | 99 | 100 | 95 | 99 |
| Weathermax+Envoke (0.0118 lb ai acre ⁻¹) | 99 | 100 | 95 | 99 |
| LSD(0.05) | 5 | 6 | 3 | 12 |

*Weathermax applied at 0.75 lb acid equivalent (ae) acre⁻¹

Active component in tank-mix partners Trade name (common name): Direx (diuron), Aim (carfentrazone), Amplify (cloransulam), Valor (flumioxazin), FirePower (glyphosate+oxyfluorfen), Strongarm (diclosulam), Envoke (trifloxysulfuron)

Table 2. Pitted morninglory control after a broadcast application of Weathermax at 3- to 5-inch weeds followed by specific post-directed systems at 3- to 5-inch weed regrowth.

| Herbicide system | % control at weeks after planting | | | |
|--|-----------------------------------|----|----|----|
| | 6 | 7 | 8 | 12 |
| No follow-up treatment | 60 | 50 | 55 | 18 |
| Weathermax*+Direx (0.25 lb acre ⁻¹) | 89 | 91 | 93 | 83 |
| Weathermax+Aim (0.0036 lb acre ⁻¹) | 86 | 83 | 79 | 60 |
| Weathermax+Aim (0.012 lb acre ⁻¹) | 96 | 96 | 95 | 86 |
| Weathermax+Amplify (0.016 lb acre ⁻¹) | 78 | 83 | 83 | 80 |
| Weathermax+Valor (0.032 lb acre ⁻¹) | 94 | 98 | 95 | 81 |
| Weathermax+Valor (0.063 lb acre ⁻¹) | 90 | 89 | 88 | 81 |
| FirePower (1.06 lb acre ⁻¹) | 91 | 93 | 90 | 88 |
| Weathermax+Strongarm (0.025 lb acre ⁻¹) | 85 | 93 | 94 | 92 |
| Weathermax | 80 | 83 | 85 | 73 |
| Weathermax fb Weathermax | 74 | 78 | 81 | 89 |
| Weathermax+Envoke (0.0071 lb ai acre ⁻¹) | 83 | 83 | 90 | 89 |
| Weathermax+Envoke (0.0118 lb ai acre ⁻¹) | 81 | 89 | 90 | 89 |
| LSD(0.05) | 9 | 7 | 8 | 16 |

*Weathermax applied at 0.75 lb acid equivalent (ae) acre⁻¹

Active component in tank-mix partners Trade name (common name): Direx (diuron), Aim (carfentrazone), Amplify (chloransulam), Valor (flumioxazin), FirePower (glyphosate+oxyflorfen), Strongarm (diclosulam), Envoke (trifloxysulfuron)

Table 3. Large crabgrass control after a broadcast application of Weathermax at 3- to 5-inch weeds followed by specific post-directed systems at 3- to 5-inch regrowth.

| Herbicide system | % control at weeks after planting | | | |
|--|-----------------------------------|----|----|----|
| | 6 | 7 | 8 | 12 |
| No follow-up treatment | 58 | 48 | 39 | 23 |
| Weathermax*+Direx (0.25 lb acre ⁻¹) | 91 | 94 | 90 | 81 |
| Weathermax+Aim (0.0036 lb acre ⁻¹) | 95 | 94 | 91 | 76 |
| Weathermax+Aim (0.012 lb acre ⁻¹) | 98 | 98 | 91 | 83 |
| Weathermax+Amplify (0.016 lb acre ⁻¹) | 94 | 96 | 94 | 89 |
| Weathermax+Valor (0.032 lb acre ⁻¹) | 96 | 97 | 95 | 90 |
| Weathermax+Valor (0.063 lb acre ⁻¹) | 98 | 96 | 94 | 92 |
| FirePower (1.06 lb acre ⁻¹) | 86 | 98 | 89 | 83 |
| Weathermax+Strongarm (0.025 lb acre ⁻¹) | 97 | 98 | 91 | 83 |
| Weathermax | 98 | 80 | 91 | 81 |
| Weathermax fb Weathermax | 92 | 92 | 93 | 93 |
| Weathermax+Envoke (0.0071 lb ai acre ⁻¹) | 97 | 95 | 93 | 79 |
| Weathermax+Envoke (0.0118 lb ai acre ⁻¹) | 95 | 97 | 94 | 86 |
| LSD(0.05) | 12 | 13 | 8 | 13 |

*Weathermax applied at 0.75 lb acid equivalent (ae) acre⁻¹

Active component in tank-mix partners Trade name (common name): Direx (diuron), Aim (carfentrazone), Amplify (cloransulam), Valor (flumioxazin), FirePower (glyphosate+oxyflorfen), Strongarm (diclosulam), Envoke (trifloxysulfuron)

Table 4. Prickly sida control after a broadcast application of Weathermax at 3- to 5-inch weeds followed by specific post-directed systems at 3- to 5-inch weed regrowth.

| Herbicide system | % control at weeks after planting | | | |
|--|-----------------------------------|-----|----|----|
| | 6 | 7 | 8 | 12 |
| No follow-up treatment | 20 | 43 | 61 | 73 |
| Weathermax*+Direx (0.25 lb acre ⁻¹) | 94 | 100 | 95 | 95 |
| Weathermax+Aim (0.0036 lb acre ⁻¹) | 98 | 96 | 95 | 95 |
| Weathermax+Aim (0.012 lb acre ⁻¹) | 100 | 100 | 95 | 95 |
| Weathermax+Amplify (0.016 lb acre ⁻¹) | 88 | 100 | 95 | 95 |
| Weathermax+Valor (0.032 lb acre ⁻¹) | 100 | 100 | 95 | 95 |
| Weathermax+Valor (0.063 lb acre ⁻¹) | 99 | 100 | 95 | 95 |
| FirePower (1.06 lb acre ⁻¹) | 98 | 100 | 95 | 95 |
| Weathermax+Strongarm (0.025 lb acre ⁻¹) | 100 | 100 | 95 | 95 |
| Weathermax | 100 | 100 | 95 | 95 |
| Weathermax fb Weathermax | 99 | 100 | 95 | 95 |
| Weathermax+Envoke (0.0071 lb ai acre ⁻¹) | 99 | 100 | 95 | 95 |
| Weathermax+Envoke (0.0118 lb ai acre ⁻¹) | 99 | 100 | 95 | 95 |
| LSD(0.05) | 17 | 14 | 2 | 6 |

*Weathermax applied at 0.75 lb acid equivalent (ae) acre⁻¹

Active component in tank-mix partners Trade name (common name): Direx (diuron), Aim (carfentrazone), Amplify (cloransulam), Valor (flumioxazin), FirePower (glyphosate+oxyfluorfen), Strongarm (diclosulam), Envoke (trifloxysulfuron)

Table 5. Dryland seed-cotton yield after a broadcast application of Weathermax at 3- to 5-inch weeds followed by specific post-directed systems at 3- to 5-inch regrowth.

| Herbicide system | Seed cotton yield (lb per acre) |
|--|---------------------------------|
| No follow-up treatment | 1050 |
| Weathermax*+Direx (0.25 lb acre ⁻¹) | 3061 |
| Weathermax+Aim (0.0036 lb acre ⁻¹) | 2784 |
| Weathermax+Aim (0.012 lb acre ⁻¹) | 3106 |
| Weathermax+Amplify (0.016 lb acre ⁻¹) | 2829 |
| Weathermax+Valor (0.032 lb acre ⁻¹) | 2593 |
| Weathermax+Valor (0.063 lb acre ⁻¹) | 2735 |
| FirePower (1.06 lb acre ⁻¹) | 2158 |
| Weathermax+Strongarm (0.025 lb acre ⁻¹) | 2338 |
| Weathermax | 2867 |
| Weathermax fb Weathermax | 3017 |
| Weathermax+Envoke (0.0071 lb ai acre ⁻¹) | 2717 |
| Weathermax+Envoke (0.0118 lb ai acre ⁻¹) | 2700 |
| LSD(0.05) | 769 |

*Weathermax applied at 0.75 lb acid equivalent (ae) acre⁻¹

Active component in tank-mix partners Trade name (common name): Direx (diuron), Aim (carfentrazone), Amplify (cloransulam), Valor (flumioxazin), FirePower (glyphosate+oxyfluorfen), Strongarm (diclosulam), Envoke (trifloxysulfuron)