

# **AN EVALUATION OF CHEMICAL APPLICATION TECHNIQUES AND TIMING TO TERMINATE COTTON STALKS IN SOUTH TEXAS**

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## **Abstract**

In the past 10 years, cotton stalk destruction deadlines were established within three Texas Boll Weevil Eradication Zones on the Texas Gulf Coast to eliminate hostable cotton plants capable of supporting overwintering boll weevils. In South Texas, only 35% of all harvested cotton acreage was destroyed with chemical treatments in 2003. Chemical usage is increasing because stalk destruction is made easier than mechanical methods, and better results are obtained. In 8 regional stalk destruction tests, rates of 0.5, 1.0 and 1.5 lbs/A of 2,4-D amine were evaluated to terminate standing cotton stalks, flay-shredded and sheared cotton stubble, immediately following wounding. Delays in chemical application after harvest/shredding were evaluated at 1, 2, 7, 14 or 35 days post-harvest. Best results were obtained when flay-shredded stalks were treated with 1.0 or 1.5 lb/A 2,4-D immediately following shredding. Due to limited wound surface area, sheared stalks and standing stalks did not suppress as well as flay-shredded stalks. All three 2,4-D treatment rates and application delays made within one and two days of harvest did not produce new squares in 45+ days. Untreated, shredded plants produced squares in 32 days, while untreated, harvested whole plants produced new squares in as little as 26 days. In a follow-on study, sixty-two commercially available and experimental cotton varieties were evaluated for regrowth at 35 days after shredding. Vast differences in mechanical plant death were observed following flay-shredding, and regrowth vigor is reported on a scale of 1-5. As high as 80 percent plant death was observed with the mechanical shredding of FiberMax 832. Glyphosate, Liberty, Gramoxone, Buctril, Direx, Linex, Goal and Valor were also evaluated to terminate cotton seedlings and to suppress regrowth near urban areas where 2,4-D usage is discouraged. Results from six of 14 locations are reported of those evaluated in 2003.

## **Introduction**

After cotton is harvested, delays in chemical treatment have provided mixed results during the past 3-5 years of 2,4-D usage. Some fields of cotton stalks appear to be completely destroyed with a single 2,4-D application applied immediately after shredding, while others remain green and increase in biomass, requiring a second 2,4-D application for full stalk destruction and killing of new cotton seedlings. Some cotton producers prefer to chemically treat standing stalks instead of shredding, and treat these as soon as possible after harvest to allow skinned bark and other plant wounds to be entry points for the 2,4-D. Others prefer to wait several days following harvest or shredding, until sufficient leaf area is present to absorb the 2,4-D application. In years with weather delays or equipment breakdowns, it has been necessary to defoliate a second time or to flay-shred and treat with 2,4-D. Each of these methods can keep cotton plants from becoming hostable, but the expense and time required for full destruction varies. Weather delays and destruction needs close to urban areas require a full understanding of how to achieve acceptable destruction and what alternative chemical products might be possible to use near more populated areas.

## **Materials and Methods**

Stalk destruction evaluations were made at six South Texas locations: Barlow N, Barlow S, Edroy, Agua Dulce, TAM-CC Meaney, and Port Lavaca. Three rates of 2,4-D (0.5, 1.0 and 1.5 lb/A) were evaluated. Where flay-shredding was required, the same shredder unit was used to cut stalks at a 6-inch height. Normally, this left the cotyledon nodes and the first two true leaf nodes below the shredding line. Sheared stalks were evaluated following harvest with a John Deere 9970 cotton picker fixed with a narrow-row header. This provided alternating rows of standing, harvested stalks and sheared cotton stubble. A Lee Spider Sprayer was used to make all chemical applications, using 8003XR nozzles at 30 psi with 16.6 gal/A air being applied at 4 mph. One pint of COC or 1% NIS was used to provide improved spray coverage. Full regrowth suppression was evaluated. For evaluation purposes, buds could not be broken; but bark could remain green. Untreated checks were evaluated at each location for hostable status and regrowth vigor. FM 832 was common to the Edroy, Agua Dulce and Barlow N locations. Other cotton varieties were compared at the remaining test locations. One hundred plants were evaluated (4 replications) at each test site. Alternative products and tank-mixes were included at Edroy, Agua Dulce and TAM-CC Meaney, to include glyphosate, atrazine, Goal, Valor, Liberty, Buctril, Direx, and Resource. Not all alternative treatments were used at every test location.

#### **Experiments 1-4**

Three rates of 2,4-D amine were applied immediately following shredding or harvest, and at one and two days-of-delay in application. Sites were evaluated at 7, 14, 21, 28 and 35 days after shredding/harvest. FM 989BR and FM 832 were used at Barlow N and Barlow S, respectively. TAM-Meaney used DPL 555BR and ST 4892BR; respectively, for concurrent identical tests. Percent regrowth suppression was evaluated.

#### **Experiment 5**

FM 832 stubble at the Edroy site was sprayed with 2,4-D amine immediately following shredding at 1.0 and 1.5 lb/A rates and was compared with 44 oz/A of Roundup WeatherMax, and 22 oz/A Roundup WeatherMax as a tankmix. Plant death and hostable surviving plant status was evaluated. Cotton regrowth suppression was evaluated at 7, 14, 21, 28 and 35 days after treatment. Cotton seeding counts were made to determine cotton seeding populations and weed suppression.

#### **Experiment 6**

FM 832 stubble at the Agua Dulce site was treated with 1.0 lb/A 2,4-D immediately following shredding, and was compared with the 1.5 and 1.0 lb/A rates of 2,4-D, 22 oz/A of Roundup Weathermax and 1 lb/A Liberty, with and without a 1.0 lb/A atrazine spike for weed control and enhanced stalk destruction.

#### **Experiment 7**

Sixty-two commercial and experimental cotton varieties were evaluated for regrowth vigor and plant death at 35 days after shredding. Regrowth vigor was reported on a scale of 1-5.

### **Results and Discussion**

#### **Experiment 1-4**

Delaying the application of 2,4-D by 1-2 days to DPL 555BR, resulted in an 11%/day reduction in regrowth suppression in 7 days. Delaying the application of 2,4-D by 1-2 day to ST 4892BR resulted in a 15%/day reduction in suppression in 7 days. These reductions were true for all three rates evaluated and the tests suggest differences in varietal response to 2,4-D applications. The DPL 555BR UTC was observed with 3.5% physical plant death due to shredding while ST 4892BR had 8.0%. Regrowth suppression increased from 75-85% with increase rates of 2,4-D applied immediately following shredding. Suppression was observed to hold well throughout the 28 days following all treatments. At sites 3-4, FM 936 was treated with the same rates of 2,4-D the same day as harvested and one day later. Due to limited wound surface area, regrowth suppression fell from 85 to 48% in 28 days using the 1.5 lb/A 2,4-D rate and the 1.0 lb/A rate fell from 62 to 35% suppression in 28 days. The 0.75 lb/A 2,4-D rate and all treatments made at 1 day-after-shredding provided less than 25% suppression. All rates and days- of-delay prevented hostable plants from occurring within 35 DAT. Reduced 2,4-D rates and delays in chemical application allowed the regrowth of strapped, defective unhostable plants, but suppression was not complete and all plants did not die. For harvested, standing brush that was allowed to produce regrowth for 2 weeks, suppression appeared to have been set-back by two weeks. Plants did not become hostable, but did not die and continued to retain damaged regrowth in the lower half of the cotton plants. FM 969 was even more difficult to terminate at 2 weeks of delay in chemical application to standing brush.

#### **Experiment 5**

At the Edroy site, both treatments containing 2,4-D (1.5 lb/A 2,4-D FB 1.5 lb/A 2,4-D in 2 weeks, and 1.5 lb/A 2,4-D + 22 oz/A WM TM) resulted in 98% suppression and plant death. Those treatments containing only glyphosate became hostable in 32 days at both the 22 oz and 44 oz/A rates of Roundup WeatherMax. The UTC was nearly equal to the 22 oz/A glyphosate treatment, indicating that nearly as much FM 832 was destroyed by shredding (28%) as could be attributed to the glyphosate application (25%).

#### **Experiment 6**

At the Agua Dulce site four treatments contained 1.0 or 1.5 lb/A 2,4-D and were not significantly different at the 5% confidence level. These provided 85-100% full suppression, with the three 1.5 lb/A rates performing slightly better than the 1.0 rate. No additional suppression was observed with a 1.0 lb/A atrazine spike either when combined with 2,4-D or with glyphosate. The 22 and 44 oz/A rates of Roundup Weathermax performed only slightly better than the UTC. Liberty at the 1 lb/A rate performed equal to the glyphosate and is not effective as a stand-alone product. Plants from Liberty and Glyphosate plots became hostable within 36 days following treatment.

#### **Experiment 7**

Following 35 days post shredding, these 62 replicated cotton varieties were evaluated for regrowth and plant death on a scale of 1-5. The easiest cotton varieties to kill with flay-shredding included FM 832 and 832B, FM 958 and FM 819RR. Plants with

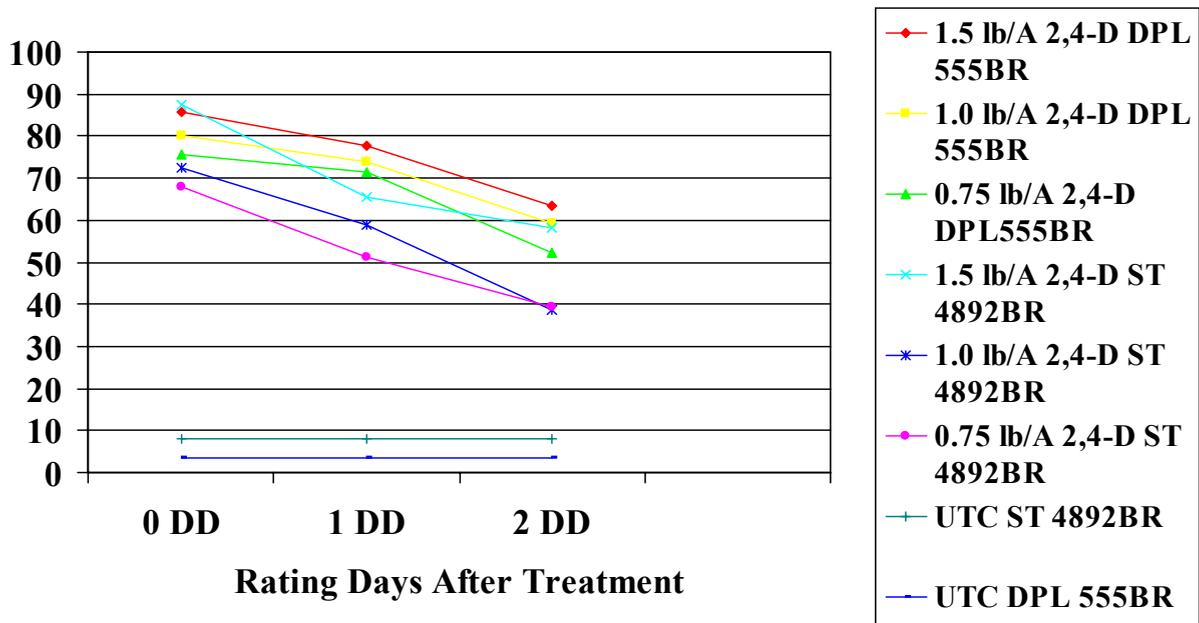
increasing vigor and more robust regrowth are shown in Table 1. Cotton varieties which require more mepiquat to manage also appear to survive mechanical shredding better than low management cottons. DPL 555BR was ranked as a 4 in regrowth vigor. Of the commercially available cottons evaluated, the highest vigor ratings were observed with DPL 491.

### Conclusions

1. Full regrowth suppression declined 11-15%/day for the cotton varieties evaluated, for each day-of-delay in treatment with 2,4-D amine. For shredded stalks treated with the 1.0 or 1.5 lb/A rate of 2,4-D, suppression held over a 28-35 day period and cotton plants did not become hostable.
2. There are varietal differences in plant death due to flay-shredding, and among the 62 varieties observed, these could be grouped into 5 vigor rating categories. The bark of some cotton varieties were observed to fully separate from the wood, leaving no intact buds to generate regrowth.
3. Roundup WeatherMax and Liberty did not provide adequate regrowth suppression at the 22 or 44 oz/A rates (glyphosate), or the 1 lb/A rate of Liberty. No products evaluated were as effective as 1.0 or 1.5 lb/A of 2,4-D amine applied immediately behind the shredder.
4. The addition of 1 lb/A atrazine did not improve regrowth suppression, but provided some preemergence weed control.
5. Flay shredded stalk destruction is more effective than treating shears plants, immediate 2,4-D application to harvested cotton stalks, or to stubble or standing stalks that have been allowed to produce enough leaves to absorb a subsequent 2,4-D application in one or two weeks.
6. None of the products tested were effective substitutes of stalk suppression and destruction near urban areas. All alternative products provided 30-50% of the suppression resulting from 1.0 to 1.5 lb/A 2,4-D applied immediately following shredding.

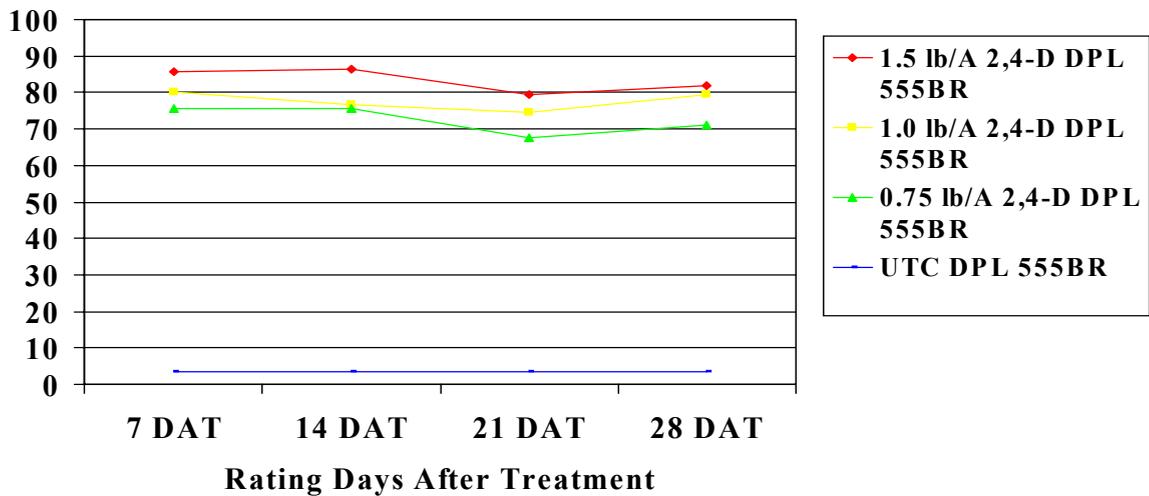
Table 1. Percent control of cotton seedlings, cotton regrowth, pigweed and Texas panicum from 9 herbicide treatments made at 35 days after shredding, Texas Cooperative Extension, Texas A&M Meaney Farm Annex, Nueces County, TX, 2003.

Treatment	Percent Control @ 7 DAT			
	Seedling	Stubble regrowth	Pigweed	Panicum
1. 2 oz/A Valor + 1.0 lb/A 2,4-D + NIS	99.5	85.0	100.0	65.0
2. 1.0 lb/A 2,4-D + NIS	86.5	65.0	70.0	7.5
3. 2 oz/A Valor + 1 pt/A COC	96.5	80.0	95.0	58.8
4. 2 oz/A Resource + 1 pt/A COC	81.8	76.3	10.0	7.5
5. 1 lb/A Direx + NIS	55.0	61.3	97.5	10.0
6. 1 lb/A Liberty + NIS	98.3	88.8	100.0	97.5
7. 1 pt/A Gramoxone + NIS	95.0	81.3	85.0	45.0
8. 1 pt/A Goal + NIS	88.8	80.0	50.0	8.3
9. 1 pt/A Buctril + NIS	99.3	76.3	50.0	8.8



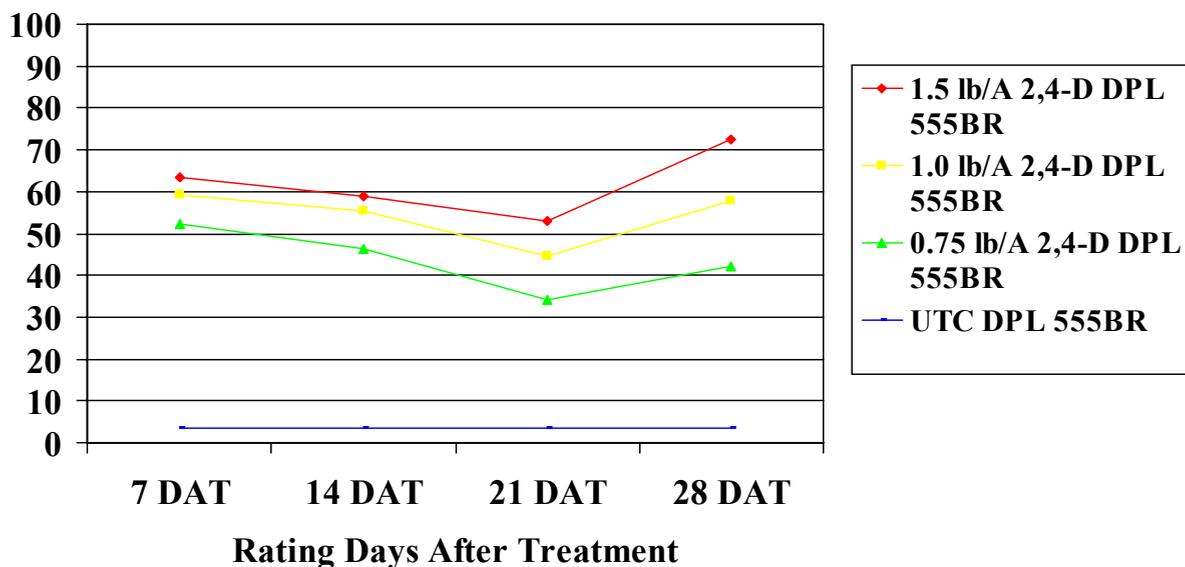
**Rated 9/6-8/03 @ 7 DAT = 15%/ DD, ∴ Varietal Differences**

Figure 1. Cotton regrowth suppression with three rates of 2,4-D applied to stubble of DPL555BR and ST4892BR on same day and two consecutive days following shredding, Texas Cooperative Extension, Texas A&M Meaney Farm Annex, Nueces County, TX, 2003.



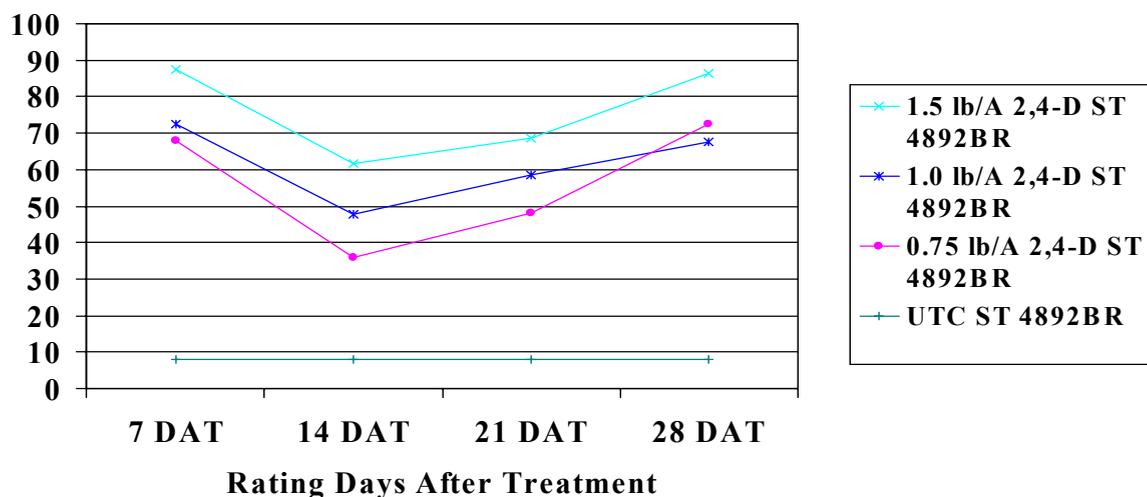
**TAMU Rated: 9/6, 9/12, 9/19, 9/25 = Suppression holding over time**

Figure 2. Cotton regrowth suppression with three rates of 2,4-D applied to stubble of DPL555BR immediately following shredding, Texas Cooperative Extension, Texas A&M Meaney Farm Annex, Nueces County, TX, 2003.



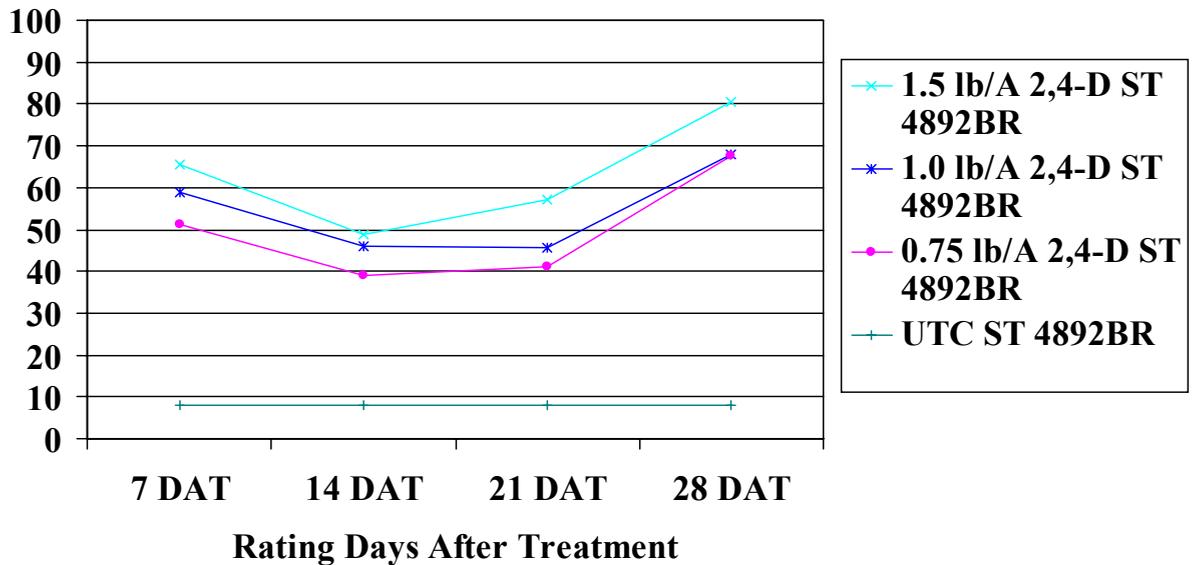
**TAMU Rated: 9/6, 9/12, 9/19, 9/25 = Low rate; less suppression**

Figure 3. Cotton regrowth suppression with three rates of 2,4-D applied to stubble of DPL555BR 2DD following shredding, Texas Cooperative Extension, Texas A&M Meaney Farm Annex, Nueces County, TX, 2003.



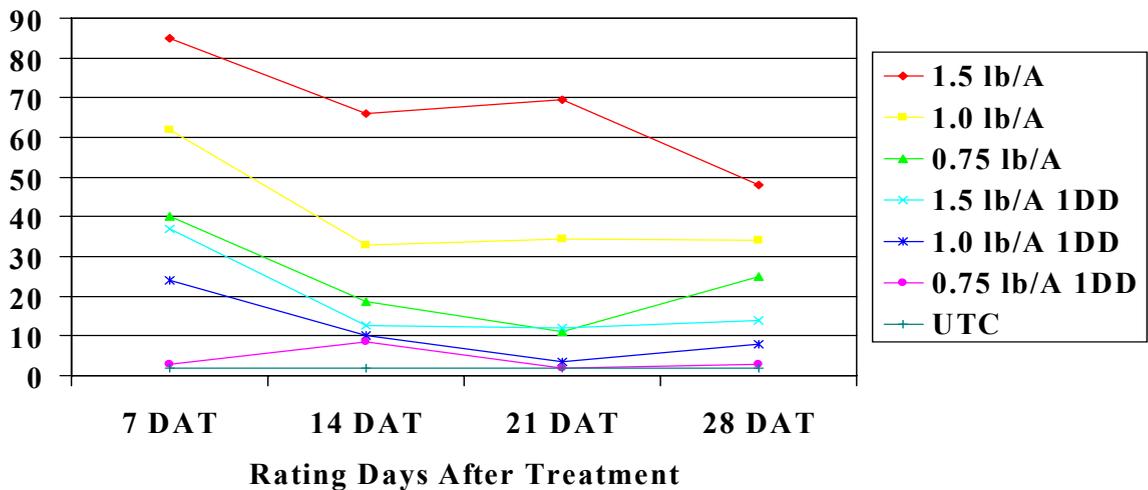
**TAMU Rated: 9/6, 9/12, 9/19, 9/25 = Suppression recovery**

Figure 4. Cotton regrowth suppression with three rates of 2,4-D applied to stubble of ST4892BR immediately following shredding, Texas Cooperative Extension, Texas A&M Meaney Farm Annex, Nueces County, TX, 2003.



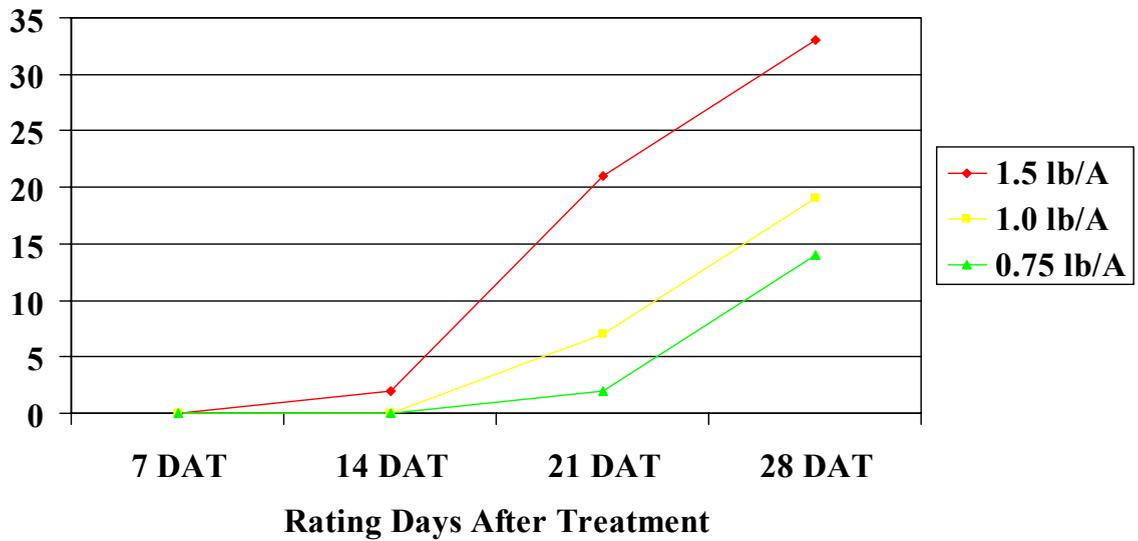
**TAMU Rated: 9/6, 9/11, 9/19, 9/25**

Figure 5. Cotton regrowth suppression with three rates of 2,4-D applied to stubble of ST4892BR 2DD following shredding, Texas Cooperative Extension, Texas A&M Meaney Farm Annex, Nueces County, TX, 2003.



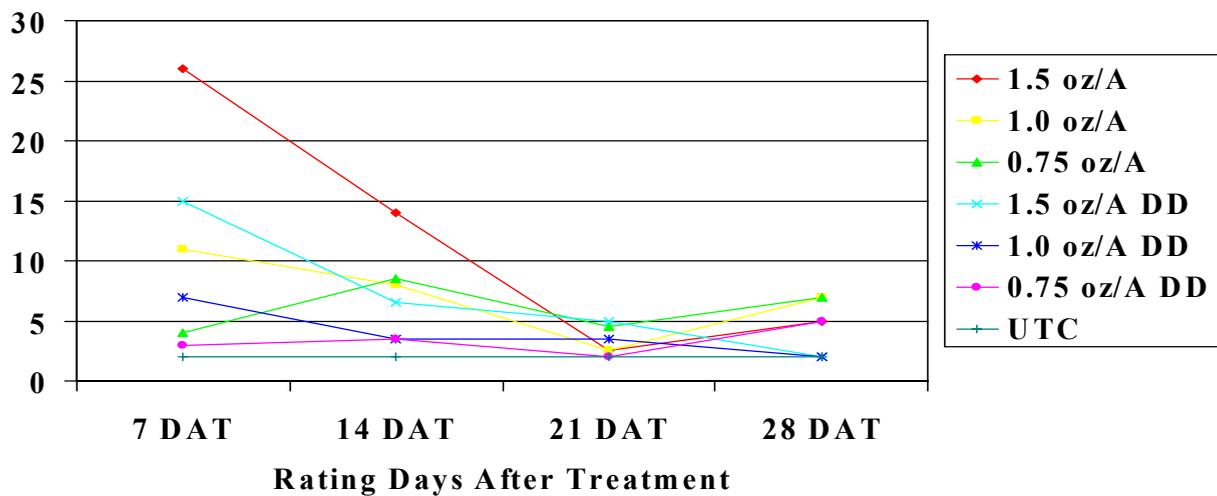
**Barlow IA rated: 8/20, 8/28, 9/3, and 9/11/03 Sheared surface area ↓**

Figure 6. Cotton regrowth suppression with three rates of 2,4-D applied the same day as sheared and one day of delay (DD), Barlow IA, Texas Cooperative Extension, San Patricio County, TX, 2003.



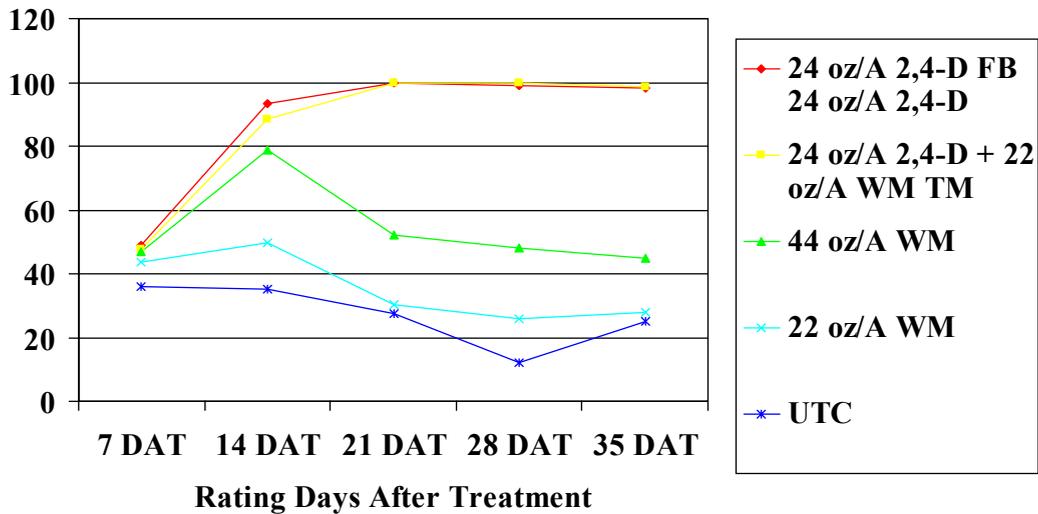
### Barlow I-B rated: 8/29, 9/5, 9/13/03 **Suppression set-back 14 days**

Figure 7. Cotton regrowth suppression with three rates of 2,4-D applied to standing brush, Barlow 1B, FM 969, Texas Cooperative Extension, San patricio County, TX, 2003.



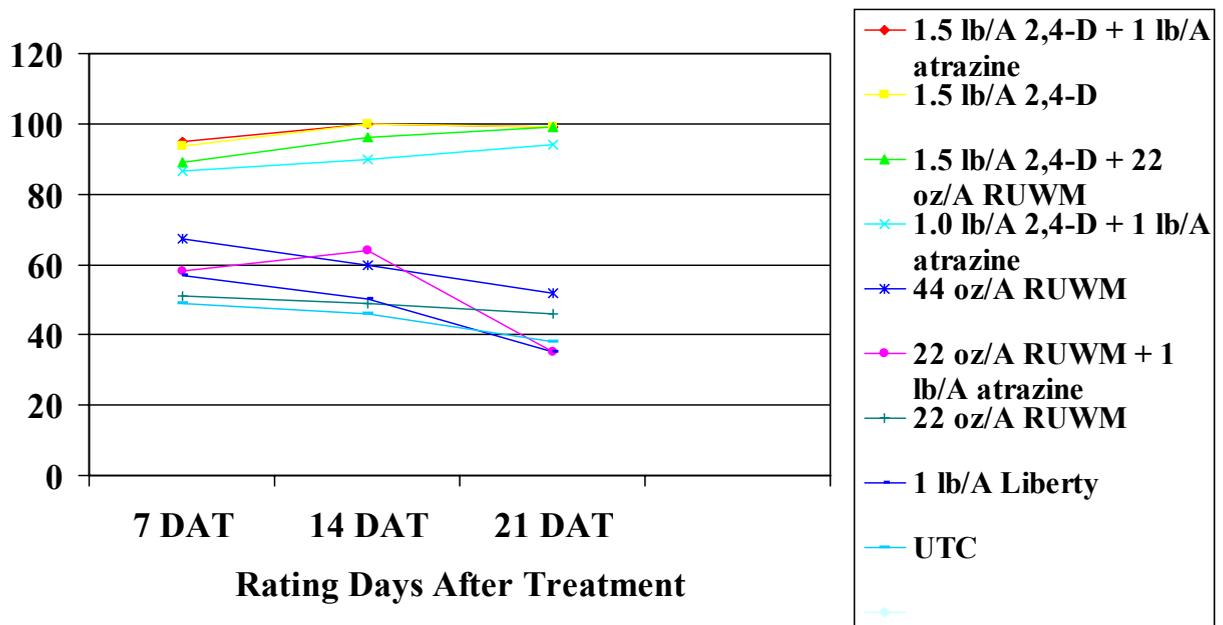
### **Standing brush more difficult to terminate**

Figure 8. Cotton regrowth suppression with three rates of 2,4-D applied to standing brush, Barlow 1B, FM 969, Texas Cooperative Extension, San Patricio County, TX, 2003.



**Barlow II rated: 8/26, 9/2, 9/9, 9/15, 9/28, 9/30/03**

Figure 9. Cotton regrowth suppression with five rates of 2,4-D and/or WeatherMax (glyphosate) applied the same day as shredding, Edroy site, Texas Cooperative Extension, TX, 2003.



**Hoelscher rated: 9/10, 9/17, 9/24**

Figure 10. Cotton regrowth suppression with nine treatments applied to stubble of FM 832 following shredding, Agua Dulce site, Texas Cooperative Extension, Jim Wells County, 2003.

## Regrowth Rating System @ 35 Days



1. Greater than 5 inches of regrowth above shredding line.



2. 2-5 inches of regrowth above shredding line



3. Stronger regrowth, but not above shred line



4. Less than 50% dead plants  
More leaves below shredding line



5. More than 50% dead plants  
Weak regrowth below shredding line

Figure 11.

<b>1. Easy to kill</b>	<b>FM 958, FM 819RR, FM 832B</b>
<b>2. Weak Regrowth</b>	<b>BCG 245, FM 832, ATLAS, FM 989BR, DPL 444BR</b>
<b>3. Even w/Shred Line</b>	<b>DPL 493, FM 800BR, DPL 449BR, DPL Pearl, ST5303R, FM 991BR, BCG 295, BCG 30R, ST 4892BR, FM960BR, ST 5599BR</b>
<b>4. Robust Regrowth ( &lt; 6 inches)</b>	<b>DPL 555BR, DPL 458BR, DPL 33B, BCG 950R, DPL 436RR, DPL 451BR, FM 966, BCG 24R, BCG 28R</b>
<b>5. Very Robust Regrowth (&gt;6 inches)</b>	<b>DPL 491</b>

Figure 12. Selected cotton varieties rated for regrowth at 35 days after shredding, Texas Cooperative Extension, Texas A&M Research and Extension Station, Corpus Christi, TX, 2003.