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Redvine Control with No-Till Cotton on Clay Soil, 1995-2002

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INTRODUCTION

Redvine [*Brunnichia ovata* (Walt.) Shinners] is a perennial vine that is found in low, wet areas of cotton fields in Mississippi (Elmore, 1984). Redvine is difficult to control. Preplant tillage and cultivation can be used to suppress the growth of redvine plants during the crop year (Hurst, et al., 1979); however, the long-time benefits are negligible. In addition to plant competition with cotton for moisture, nutrients, and light, there is a decrease in efficiency with mechanical harvest where redvine plants are present in large numbers (Elmore, 1984). Redvine plants increase in density when a crop is produced without primary tillage (Hurst, 1995). With less tillage, there is an increased need for effective control with herbicides.

The objective of this study was to investigate several chemical control strategies to maintain low levels of redvine plants or to reduce higher levels of plants over several years duration in no-till cotton production.

MATERIALS AND METHOD

The study was initiated in 1995 on a Sharkey clay soil (Vertic Haplaquepts) with a pH of 6.3 and 1.75% organic matter. Supplemental irrigation was not used. No-till soybean had been grown on the field for the previous 6 years.

Winter and summer annual weeds were controlled with preplant foliar (PPF), preemergence (PRE), postemergence directed (PDS), postemergence over-the-top (POT), and layby (LBY) herbicides, which are listed in Table 1. Predominate winter weeds were henbit (*Lamium amplexicaule* L.), annual bluegrass (*Poa annua* L.), and broadleaf dock (*Rumex obtusifolius* L.). Predominate summer weeds were ivyleaf morningglory [*Ipomoea hederacea* (L.) Jacq.], pitted morningglory (*I. lacunosa* L.), nodding spurge (*Euphorbia nutans* Lag.), and prickly sida (*Sida spinosa* L.). Cotton was planted in April each year. Table 1 lists the planting dates and varieties used. Table 1 also lists the cultivation dates for Treatment 13 and hand weeding dates for Treatment 14 during 1995-1998. PPF (except Roundup), PRE, PDS, and LBY applications were made in 20 gallons total volume per acre. Roundup was applied in 10 gallons per acre. A surfactant (0.5% v/v) or crop oil (1.0% v/v) was used when the label specified. PPF, PRE, and POT applications were made with a four-row, tractor-mounted boom sprayer. PDS applications were made with a four-row cultivator with spray shields and with plows removed for band application plus an additional nozzle between rows for broadcast application in the row middles. The hooded sprayer (HS) applications were made spraying a 34-inch-wide area (85% of the area) between rows. LBY herbicides were applied with a slide unit with one nozzle-spraying

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broadcast between rows. Granular Terrachlor Super X with Di-Syston 14.6 G was used in-furrow at planting at 9 lb/A for disease and insect control and to prevent injury to cotton from Command. Temik 15G was also applied in-furrow at 3.3 lb/A for additional early-season insect control. Fertilization and in-season insect control were accomplished according to the Mississippi State University Extension Service guidelines.

Candidate treatments for redvine control are listed in Table 2. Treatments were arranged in a randomized complete block design with four replications and were applied to the same area each year. Individual plots were four 80-foot cotton rows spaced 40 inches apart. All data were obtained from the two center rows of each plot and were subjected to an analysis of variance by year. Treatment means were separated using a significance level of 0.05 according to Duncan's Multiple Range Test (DMRT).

Redvine control was evaluated by visually estimating the combination of plant injury and the amount of individual plot area occupied with plants using a scale of 0 = no control and 100 = complete control. Control estimates were made in May/June and July/August each year. Redvine plant counts were obtained from a marked area in each plot shortly before or soon after harvest each year. In April/May 1999-2002, redvine "leaf-out" was estimated using a scale of 0 = no leaves present and 100 = leaves at least one-fourth inch in diameter on all stems. The "leaf-out" estimate measured the delay in recovery from the effects of previous treatment.

Cotton stand was determined by counting one or both center rows in each plot. The numbers of plants were converted to plants per acre (Table 7). The two center rows of each plot were harvested one time each year with a spindle picker modified to harvest plots. Plot weights were converted to pounds of seed cotton per acre (Table 8).

Table 1. General information on variety, planting date, and herbicides used for annual weed control with an experiment on redvine control with no-till cotton on clay soil, 1995-2002.

Herbicide	Rate (lb ai/A)	Method	Application date							
			DES 119 (Planted 4/10, 4/28)	SG 125 (Planted 4/29)	SG 125 (Planted 4/17)	SG 125 (Planted 4/14)[1]	SG 125 (Planted 4/20)	DP 451B/R (Planted 4/19)	DP 422B/R (Planted 4/6)	DP 458B/R (Planted 4/17)
Preplant										
Goal 1.6E/2XL	0.25	PPF	11/2/94	10/23/95	10/24/96	–	–	–	–	–
Gramoxone Extra	0.75/0.94	PPF	3/30/95, 4/12/95	–	–	3/23/98	4/20/99	–	–	–
Karmex 80DF	1.0	PPF	–	–	–	11/26/97	–	–	–	–
Caparol 4L	2.0	PPF	–	–	–	–	11/6/98	–	–	–
+Goal 2XL	+ 0.25									
Roundup Ultra	1.0	PPF	–	–	–	–	–	4/10/00	–	–
Roundup Ultra Max	1.0	PPF	–	–	–	–	–	–	3/23/01	2/25/02
+ Clarity 4E	+ 0.25									
Preemergence										
Cotoran 4L/Meturon 4L	1.75	PRE	4/12/95	4/30/96	4/17/97	4/14/98	4/20/99	4/20/00	4/6/01	4/17/02
+ Bladex 4L/Cy-Pro 4L[2]	+ 1.2									
+ Zorial 80DF	+ 1.6									
(Trts. 1-3, 6, 8-15)										
or										
+ Command 3ME	+ 1.0									
(Trts. 4, 5, 7)										
Postemergence										
Staple 85SP	0.047	POT-Band	5/16/95	6/6/96	–	–	–	–	–	–
Bladex 4L + Bueno 6	1.0 + 1.5	PDS–middles	6/5/95	–	–	–	–	–	–	–
Cy-Pro 4L	1.0	PDS–middles/broadcast	–	6/6/96	–	–	–	–	–	6/6/02
Bladex 4L	0.8	PDS – row	–	–	6/26/97	–	–	–	–	–
Cotton Pro 4L	1.0	Hood sprayer	–	–	5/21/97	–	–	–	–	–
+Fusilade DX	+ 0.188									
Cotoran 4L + Ansar 6.6E	1.0 + 1.0	PDS–broadcast	–	–	–	5/26/98	–	–	–	–
Bladex 4L	0.8	PDS–broadcast	–	–	–	–	6/9/99	–	–	–
+Herbicide 912 6E	+ 1.5									
Bladex 4L/Cy-Pro 4L	1.0	LBY	7/13/95	7/1/96	7/23/97	7/22/98	–	–	–	–
+Goal 1.6E/2XL	+ 0.25									
Direx 4L	1.0	LBY	–	–	–	–	7/16/99	–	–	7/18/02
Direx 4L + Cobra 2E	1.0 + 0.1	LBY	–	–	–	–	–	7/7/00	–	–
Direx 4L + Goal 2XL	1.0 + 0.2	LBY	–	–	–	–	–	–	6/27/01	–
Cultivation (Trt. 13) (12-inch band on row undisturbed)			5/12/95, 5/30/95, 6/19/95	5/15/96, 6/7/96, 6/18/96	5/12/97, 6/5/97, 7/7/97	5/11/98, 5/26/98, 7/12/98	5/24/99, 6/24/99	–	–	–
Hand weed redvine (Trt. 14)			5/14/95, 6/8/95, 6/30/95, 7/20/95, 9/12/95	6/6/96, 6/28/96, 7/24/96	6/6/97, 7/7/97, 8/1/97	5/19/98, 7/21/98	5/25/99, 6/21/99, 7/12/99	–	–	–

[1]Treatment 10 replanted 5/4.
[2]Substituted Staple 85SP 0.063 lb ai/A for Cy-Pro 4L in 2001, 2002.

Table 2. Treatments for an experiment on redvine control with no-till cotton on clay soil, 1995-2002.

Treatment	Herbicide	Rate (lb ai/A)	Time	Application (month/year)								
				1994	1995	1996	1997	1998	1999	2000	2001	2002
1	Redvine check	–	–	–	–	–	–	–	–	–	–	–
2	Banvel 4S	2.0	After harvest	10/4	9/13	10/4	9/30	9/15	9/13	–	–	–
	Roundup 4E	2.0	After harvest	–	–	–	–	–	–	9/20	–	–
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	10/4	9/13	9/19	9/30	9/15	9/13	9/20	–	–
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks	11/1	9/28	10/4	10/16	9/24	9/27	10/3	–	–
4	Command 3ME	1.0	PRE	–	4/12	4/30	4/17	4/14	4/20	4/20	4/6	4/17
	Roundup (Hood)	1.0	In-Season	–	6/21	6/17	6/25	6/23	6/18	6/21	6/12	6/11
5	Command 3ME	1.0	After harvest	10/4	9/13	10/4	9/30	9/15	–	–	–	–
	Command 3ME	1.0	PRE	–	4/12	4/30	4/17	4/14	4/20	4/20	4/6	4/17
	Roundup 4E	0.5	In-season repeat	–	–	–	–	–	–	–[4]	–[4]	–[4]
6	Roundup	2.0	After harvest	10/4	9/13	10/4	9/30	9/15	9/13	9/20	–	–
	Roundup (Hood)	1.0	In-season	–	6/21	6/17	6/25	6/23	6/18	6/21	6/12	6/11
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	10/4	9/13	10/4	9/30	9/15	9/13	9/20	–	–
	Command 3ME	1.0	PRE	–	4/12	4/30	4/17	4/14	4/20	4/20	4/6	4/17
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	–	7/10	6/17	6/25, 7/7	6/23, 7/9	6/18, 7/8	6/21, 7/7	6/12, 6/25	6/11, 7/9
9	Roundup (Hood)	1.0	In-season	–	6/21	6/17	6/25	6/23	7/8	–	–	–
	Roundup	0.5	In-season repeat	–	–	–	–	–	–	–[4]	–[4]	–[4]
10	Banvel SGF 2E	1.0	Pre-plant	–	3/23	4/18	3/24	4/6	4/7	–	–	–
	Roundup (Hood)[2]	1.0 fb 1.0	In-season	–	7/10	6/17	7/7, 7/22	7/9, 7/21	6/18, 7/8	–	–	–
	Roundup	1.0	In-season repeat	–	–	–	–	–	–	–[4]	–[4]	–[4]
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	10/4	9/13	10/4	9/30	9/15	9/13	9/20	–	–
	Roundup (Hood)	1.0	In-season	–	6/21	6/17	6/25	6/23	6/18	6/21	6/12	6/11
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	10/4	9/13	10/4	9/30	9/15	9/13	9/20	–	–
13	Cultivate only	–	In-season	–	3X[1]	3X	3X	3X	2X	–	–	–
	Roundup 4E	0.75	In-season repeat	–	–	–	–	–	–	–[4]	–[4]	–[4]
14	Hoe check	–	In-season	–	5X[1]	3X	3X	2X	3X	–	–	–
	Roundup 4E	0.375	In-season repeat	–	–	–	–	–	–	–[4]	–[4]	–[4]
15	Redvine check[3]	–	–	–	–	–	–	–	–	–	–	–

[1]See Table 1 for dates.
[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.

[4]Application dates and cotton node (in parentheses)

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

RESULTS AND DISCUSSION

Redvine "Leaf-Out"

In April or May 1999-2002, an estimate of redvine delay from overwinter was determined by estimating the amount of leaf development. The redvine check treatments (5 and 15) ranged from 83% to 100% of the stems with full "leaf-out" (Table 3). Treatments 2 (Banvel or Roundup at 2.0 lb after harvest), 3 (Banvel/Clarity 1.0 lb after harvest followed by [fb] 1.0 lb 2 weeks or more later), 6 (Roundup 2.0 lb after harvest fb 1.0 HS), 7 (Banvel/Clarity 2.0 lb after harvest fb Command 1.0 PRE), 11 (Banvel/Clarity 2.0 after harvest fb Roundup 1.0 HS), and 12 (Banvel/Clarity 2.0 after harvest) ranged from 0% to 21% "leaf-out." All these treatments were treated with Banvel/Clarity or Roundup the previous September in 1998-2000. Without prior fall 2001 treatment, the delay in redvine "leaf-out" was still apparent (0-18%) in mid-April 2002, about 2 weeks after the first appearance of new leaf growth. "Leaf out" values ranged from 1% to 29% for Treatment 10 (Banvel SGF 1.0 PRE fb 1.0 HS fb 1.0 HS in 1999, Roundup 1.0 POT repeat in 2000-2002) in 1999, 2001, and 2002 but were not different from the redvine check treatments in 2000.

Redvine Control

Early redvine control with all herbicide treatments except treatments 8 (Clarity in 1995, 1996, and Roundup 1.0 fb 1.0 lb HS in 1997) in 1995-1997, 9 (Roundup 1.0 lb HS) in 1995-1998, and 10 (Banvel SGF 1.0 PPF) in 1995 (Table 4) was higher than the redvine check. The cultivate-only (Treatment 13) and hand-weed (Treatment 14) treatments were not different from the redvine check treatments except the hand-weed treatment was higher in 1998 and 1999. The highest control ratings over years were obtained with Treatment 2 (Banvel 2.0 1995-1999, Roundup 2.0 2000). Treatments 7 (Banvel/Clarity 2.0 fb Command 1.0 PRE) and 11 (Banvel/Clarity 2.0 fb Roundup 1.0 HS) gave excellent control for 7 of the 8 years of the study, while Treatment 3 (Banvel/Clarity 1.0 fb 1.0) gave excellent early-season control for 6 of 8 years. These treatments had either Banvel® or Clarity applied in the previous fall and all but Treatment 3 began the study with a low redvine plant count (Table 6). Command in Treatments 4 (PRE) and 5 (PRE fb after harvest) greatly discolored redvine plants but only provided poor to good (44% to 85%) control. Banvel or Clarity at 1.0 lb ai/A applied PPF in 1995-1999 (Treatment 10) only provided good control (88% and 93%) 2 of 5 years. This treatment injured cotton (Table 7) especially when rainfall occurred soon after application (replanting was required in 1998). The time interval between the application to redvine foliage and the planting of cotton was short, ranging from 7 to 24 days. Treatment 6

(Roundup after harvest fb Roundup HS) provided 90% or greater control in 7 of 8 years.

The late-season redvine ratings for 1998 are based only on foliar plant symptoms while in other years, plots were rated for control using the combination of redvine foliar symptoms and plant density. In 1998, late-season (HS) treatments of Roundup that were applied in late June (Treatments 6, 9, 10) or in late June plus early July (Treatment 8) had foliar symptoms resulting in a higher level of control. In 1995-1997 and 1999, late-season redvine control was variable over years. This inconsistency was affected by the relative time interval between in-season herbicide applications and evaluation dates. In 2000-2002, Treatments 5, 9, 10, 13, and 14 had multiple POT applications of Roundup applied (Table 2). Treatments 5 and 9 had Roundup applied at 0.5 lb ai/A. Treatment 5 (33% to 75%), applied after Command PRE, did not control redvine as well as Treatment 9 (68% to 91%) that was applied after Roundup with a HS in previous years. Of these POT treatments, redvine control was 91% or greater with Roundup at 1.0 lb ai/A (Treatment 10) and 74% to 87% control with 0.75 lb ai/A (Treatment 13). Treatment 14 (Roundup 0.375 lb POT) controlled redvine 65% to 82%. Other treatments in 2000-2002 resulted in variable redvine control in late season except with Treatment 11 (Clarity at 2.0 lb ai/A after harvest followed by Roundup at 1.0 lb ai/A in-season with the HS), which resulted in 94% or greater control. Treatments 2 (Banvel 2.0 lb/A or Roundup 2.0 after harvest), 3 (Banvel/Clarity 1.0 after harvest fb 1.0 + 2 weeks), and 12 (Banvel/Clarity 2.0 lb ai/A after harvest) were applied after harvest in 1994-2000 and no additional herbicide for redvine control was applied to these plots in 2001 and 2002. In July 2001 and August 2002, residual redvine control was 83% and 88% with Treatment 3 and 90% and 84% with Treatment 12, and 100% and 95% control with Treatment 2.

Redvine Plant Counts

In October 1994, Treatments 2, 7, and 11 began with very low redvine plant numbers and continued with very low numbers for all years (Table 6). Treatments 6, 8, 10, and 14 had low numbers of redvine plants initially and maintained or reduced the level through the years. Treatments 3 and 12 had a higher redvine count on October 7, 1994, and reduced the redvine population through time. Treatments 1, 4, 5, 9, and 13 were high in redvine counts initially and remained high. In 2001 and 2002, the POT applications of Roundup resulted in low redvine plant counts for Treatment 13. The redvine check treatments (1, 15) were high in plant numbers in October 1994 and were variable but usually higher than with other treatments each year.

Cotton Stand

The cotton stand in 1997-1999 was low and not usually considered high enough for maximum yield (Table 7), although the 1997 crop outyielded all other years in this study except 2002. The PPF Banvel treatment reduced the cotton stand in 1998 and 1999. Treatments were not different in 1995, 1997, and 2001. Treatment 10 (Banvel PPF) had to be replanted in 1998. The cotton stand was not reduced in 1996, 1998, 1999, 2000, and 2002 by other treatments when compared with the check though there were differences each year.

Table 3. Redvine "leaf-out" with an experiment on redvine control with no-till cotton on clay soil, 1999-2002.[1]

Treatment	Herbicide	Rate (lb a.i./A)	Time	Percent redvine "leaf-out"			
				5/7/99	5/2/00	4/23/01	4/17/02
1	Redvine check	–	–	100 a	100 a	97 ab	83 b
2	Banvel 4S	2.0	After harvest	0 e	0 c	0 f	0 d
	Roundup 4E	2.0	After harvest				
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	0 e	0 c	0 f	8 d
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks				
4	Command 3ME	1.0	PRE	24 de	75 ab	46 de	15 d
	Roundup (Hood)	1.0	In-Season				
5	Command 3ME	1.0	After harvest	61 bc	100 a	96 ab	45 c
	Command 3ME	1.0	PRE				
	Roundup 4E	0.5	In-season repeat[4]				
6	Roundup	2.0	After harvest	0 e	21 c	3 f	3 d
	Roundup (Hood)	1.0	In-season				
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	0 e	0 c	0 f	0 d
	Command 3ME	1.0	PRE				
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	26 d	65 b	78 abc	10 d
9	Roundup (Hood)	1.0	In-season	44 cd	90 ab	77 bc	55 c
	Roundup	0.5	In-season repeat[4]				
10	Banvel SGF 2E	1.0	Pre-plant	1 e	81 ab	29 e	3 d
	Roundup (Hood)[2]	1.0 fb 1.0	In-season				
	Roundup	1.0	In-season repeat[4]				
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	0 e	0 c	0 f	0 d
	Roundup (Hood)	1.0	In-season				
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	1 e	10 c	0 f	18 d
13	Cultivate only	–	In-season	100 a	100 a	68 cd	13 d
	Roundup 4E	0.75	In-season repeat[4]				
14	Hoe check	–	In-season	75 b	100 a	99 a	15 d
	Roundup 4E	0.375	In-season repeat[4]				
15	Redvine check[3]	–	–	100 a	100 a	97 ab	100 a

[1]Numbers in the same column with the same letter are not different using a significance level of 0.05 according to Duncan's Multiple Range Test (DMRT).
[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.
[4]Application dates and cotton node (in parentheses).

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

Cotton Yield

Seed cotton yield is presented in Table 8. Seed cotton yields were very low with Treatment 10 (Clarity 1.0 lb ai/A applied with HS) in 1995 and 1996 due to cotton injury. PPF Banvel at 1.0 lb ai/A reduced yields in 1998 and 1999 due to stand reduction. Seed cotton yields with Treatment 1 (redvine check treatment with high 1994 count) were low each year. The yields with Treatment 15 (redvine check treatment with lower 1994 count) were higher than Treatment 1 until 1998 when redvine numbers had increased to the level of Treatment 1. Thereafter, yields were also low with this treatment. Generally, seed cotton yields were higher with treatments having lower redvine plant counts. However, the number of redvine plants required for lower seed cotton yield was considerably higher than the most effective treatments in this study. The multiple OT Roundup treatments at 0.75 and 1.0 lb ai/A (10 and 13) resulted in lower yields in 2000-2002.

Early-season redvine control (Table 4) had a positive influence on seed cotton yield. Treatments with high early-season redvine control (Treatments 2, 3, 6, 7, 11, and 12) also had high yields.

CONCLUSIONS

- Redvine was effectively controlled with applications of dicamba (Banvel or Clarity) or glyphosate (Roundup) applied soon after the prior harvest each at 2.0 lb ai/A.
- Cotton was injured when Banvel or Clarity was applied preplant or in-season with the hooded sprayer at 1.0 lb ai/A.
- Over-the-top multiple applications of Roundup at 0.75 or 1.0 lb ai/A to Roundup Ready cotton reduced yield.
- Cotton yield was reduced with average redvine densities of 62 to 316 plants per 267 square feet in the redvine check treatment depending on the year.

Table 4. Early-season redvine control with an experiment on redvine control with no-till cotton on clay soil, 1995-2002.[1]

Treatment	Herbicide	Rate (lb a.i./A)	Time	Percent control by date							
				5/15/95	5/22/96	5/20/97	5/22/98	5/24/99	5/29/00	6/15/01	6/6/02
1	Redvine check	–	–	9 d	28 de	25 de	0 c	0 e	0 f	0 d	0 e
2	Banvel 4S	2.0	After harvest	100 ab	100 a	100 a	100 a	100 a	100 a	99 a	99 a
	Roundup 4E	2.0	After harvest								
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	86 ab	94 ab	75 abc	100 a	96 ab	97 ab	97 ab	90 abc
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks								
4	Command 3ME	1.0	PRE	59 bc	60 bcd	80 abc	58 b	85 bc	58 de	60 c	60 d
	Roundup (Hood)	1.0	In-Season								
5	Command 3ME	1.0	After harvest	65 bc	49 cde	76 abc	44 b	55 d	51 e	90 ab	72 cd
	Command 3ME	1.0	PRE								
	Roundup 4E	0.5	In-season repeat[4]								
6	Roundup	2.0	After harvest	98 a	69 a-d	98 a	93 a	98 ab	98 ab	93 ab	90 abc
	Roundup (Hood)	1.0	In-season								
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	93 a	97 ab	85 ab	99 a	100 a	98 ab	100 a	98 a
	Command 3ME	1.0	PRE								
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	38 cd	13 e	0 e	86 a	86 bc	83 bcd	84 b	81 a-d
9	Roundup (Hood)	1.0	In-season	14 d	14 e	0 e	0 c	74 cd	93 ab	95 ab	86 a-d
	Roundup	0.5	In-season repeat[4]								
10	Banvel SGF 2E	1.0	Pre-plant	20 d	56 bcd	49 bcd	88 a	93 ab	85 abc	99 a	98 a
	Roundup (Hood)[2]	1.0 fb 1.0	In-season								
	Roundup	1.0	In-season repeat[4]								
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	98 a	78 abc	100 a	100 a	98 ab	99 a	100 a	98 a
	Roundup (Hood)	1.0	In-season								
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	94 a	76 abc	38 cde	95 a	94 ab	89 ab	96 ab	81 a-d
13	Cultivate only	–	In-season	23 d	5 e	0 e	0 c	0 e	66 de	95 ab	90 abc
	Roundup 4E	0.75	In-season repeat[4]								
14	Hoe check	–	In-season	13 d	30 de	5 e	96 a	58 d	87 abc	92 ab	88 a-d
	Roundup 4E	0.375	In-season repeat[4]								
15	Redvine check[3]	–	–	29 d	10 e	5 e	0 c	0 e	0 f	0 d	0 e

[1]Numbers in the same column with the same letter are not different using a significance level of 0.05 according to Duncan's Multiple Range Test (DMRT).
[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.

[4]Application dates and cotton node (in parentheses)

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

Table 5. Late-season redvine control with an experiment on redvine control with no-till cotton on clay soil, 1995-2002.[1]

Treatment	Herbicide	Rate (lb a.i./A)	Time	Percent control by date							
				7/12/95	7/22/96	7/15/97	7/20/98	7/16/99	7/6/00	7/17/01	8/2/02
1	Redvine check	–	–	1 e	49 bcd	0 c	0 e	19 e	0 e	0 f	18 c
2	Banvel 4S	2.0	After harvest	50 bcd	99 a	75 a	0 e	100 a	83 ab	100 a	95 a
	Roundup 4E	2.0	After harvest								
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	63 abc	84 ab	69 ab	27 d	84 abc	25 de	83 a-d	88 ab
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks								
4	Command 3ME	1.0	PRE	78 abc	70 abc	56 ab	28 d	88 ab	63 a-d	64 de	65 b
	Roundup (Hood)	1.0	In-Season								
5	Command 3ME	1.0	After harvest	5 e	54 bcd	15 bc	4 e	59 cd	33 cde	54 e	75 ab
	Command 3ME	1.0	PRE								
	Roundup 4E	0.5	In-season repeat[4]								
6	Roundup	2.0	After harvest	86 abc	80 abc	78 a	84 ab	95 ab	91 ab	99 ab	90 ab
	Roundup (Hood)	1.0	In-season								
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	63 abc	95 a	25 bc	0 e	96 ab	50 bcd	96 ab	96 a
	Command 3ME	1.0	PRE								
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	45 cd	97 a	79 a	95 a	86 abc	56 a-d	80 cde	90 ab
9	Roundup (Hood)	1.0	In-season	74 abc	43 cde	63 ab	66 c	82 bc	91 ab	68 de	83 ab
	Roundup	0.5	In-season repeat[4]								
10	Banvel SGF 2E	1.0	Pre-plant	58 de	98 a	69 ab	78 bc	82 bc	91 ab	96 ab	97 a
	Roundup (Hood)[2]	1.0 fb 1.0	In-season								
	Roundup	1.0	In-season repeat[4]								
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	90 ab	100 a	75 a	0 e	96 ab	95 a	100 a	94 a
	Roundup (Hood)	1.0	In-season								
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	19 de	58 bcd	73 a	0 e	88 ab	40 cd	90 abc	84 ab
13	Cultivate only	–	In-season	4 e	18 e	3 c	0 e	55 d	74 abc	86 abc	87 ab
	Roundup 4E	0.75	In-season repeat[4]								
14	Hoe check	–	In-season	100 a	58 bcd	0 c	0 e	99 ab	66 a-d	65 de	82 ab
	Roundup 4E	0.375	In-season repeat[4]								
15	Redvine check[3]	–	–	3 e	32 de	0 c	0 e	13 e	0 e	0 f	13 c

[1]Numbers in the same column with the same letter are not different using a significance level of 0.05 according to Duncan's Multiple Range Test (DMRT).
[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.

[4]Application dates and cotton node (in parentheses)

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

Table 6. Late-season redvine plant numbers with an experiment on redvine control with no-till cotton on clay soil, 1995-2002.[1]

Treatment	Herbicide	Rate (lb a.i./A)	Time	Number of plants per 267 square feet at nine dates								
				10/7/94	9/1/95	10/2/96	9/16/97	9/10/98	8/17/99	8/21/00	8/2/01	8/8/02
1	Redvine check	–	–	228	231 ab	146 a	257 a	213 a	62 a	111 a	132 b	341 a
2	Banvel 4S	2.0	After harvest	8	12 b	3 b	2 c	3 b	0 d	2 d	0 c	10 b
	Roundup 4E	2.0	After harvest									
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	299	56 ab	52 ab	61 bc	19 b	16 bcd	6 d	3 c	9 b
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks									
4	Command 3ME	1.0	PRE	207	258 a	120 ab	138 abc	87 ab	37 abc	36 cd	42 c	78 b
	Roundup (Hood)	1.0	In-Season									
5	Command 3ME	1.0	After harvest	242	149 ab	96 ab	115 bc	117 ab	56 a	88 ab	48 c	65 b
	Command 3ME	1.0	PRE									
	Roundup 4E	0.5	In-season repeat[4]									
6	Roundup	2.0	After harvest	22	17 b	28 ab	32 c	20 b	5 cd	3 d	0 c	17 b
	Roundup (Hood)	1.0	In-season									
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	5	10 b	4 b	10 c	5 b	2 d	0 d	1 c	2 b
	Command 3ME	1.0	PRE									
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	28	7 b	8 b	20 c	11 b	8 bcd	16 cd	2 c	7 b
9	Roundup (Hood)	1.0	In-season	234	136 ab	126 ab	149 abc	119 ab	40 ab	61 bc	31 c	48 b
	Roundup	0.5	In-season repeat[4]									
10	Banvel SGF 2E	1.0	Pre-plant	20	7 b	12 ab	20 c	20 b	16 bcd	16 cd	4 c	6 b
	Roundup (Hood)[2]	1.0 fb 1.0	In-season									
	Roundup	1.0	In-season repeat[4]									
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	6	3 b	1 b	2 c	1 b	2 d	0 d	1 c	1 b
	Roundup (Hood)	1.0	In-season									
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	109	94 ab	64 ab	36 c	28 b	16 bcd	18 cd	19 c	20 b
13	Cultivate only	–	In-season	149	111 ab	80 ab	114 bc	82 ab	49 a	55 bc	3 c	22 b
	Roundup 4E	0.75	In-season repeat[4]									
14	Hoe check	–	In-season	21	14 b	15 ab	14 c	19 b	14 bcd	20 cd	15 c	15 b
	Roundup 4E	0.375	In-season repeat[4]									
15	Redvine check[3]	–	–	108	111 ab	103 ab	189 ab	226 a	70 a	89 ab	215 a	316 a

[1]Numbers in the same column with the same letter are not different using a significance level of 0.05 according to Duncan's Multiple Range Test (DMRT).
[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.

[4]Application dates and cotton node (in parentheses)

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

Table 7. Cotton stand with an experiment on redvine control with no-till cotton on clay soil, 1995-2002.[1]

Treatment	Herbicide	Rate (lb a.i./A)	Time	Plants per acre (thousands)							
				1995	1996	1997	1998	1999	2000	2001	2002
1	Redvine check	–	–	35.9 a	37.6 b	23.8 a	18.9 d	17.2 d	31.2 ab	43.4 a	41.5 ab
2	Banvel 4S	2.0	After harvest	42.6 a	47.5 ab	26.3 a	25.3 ab	27.3 ab	33.7 ab	44.4 a	41.7 ab
	Roundup 4E	2.0	After harvest								
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	42.1 a	51.2 a	23.9 a	26.5 a	25.9 ab	35.4 ab	45.8 a	35.1 b
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks								
4	Command 3ME	1.0	PRE	43.8 a	41.7 ab	25.6 a	21.0 bcd	27.0 ab	32.9 ab	41.2 a	40.3 ab
	Roundup (Hood)	1.0	In-Season								
5	Command 3ME	1.0	After harvest	36.4 a	45.7 ab	24.1 a	21.2 bcd	23.0 bc	36.8 ab	45.0 a	42.5 ab
	Command 3ME	1.0	PRE								
	Roundup 4E	0.5	In-season repeat[4]								
6	Roundup	2.0	After harvest	39.2 a	39.5 ab	23.6 a	23.8 a-d	30.6 a	34.8 ab	44.0 a	39.4 ab
	Roundup (Hood)	1.0	In-season								
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	41.5 a	43.0 ab	23.2 a	24.3 abc	28.2 ab	37.5 a	44.2 a	40.3 ab
	Command 3ME	1.0	PRE								
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	43.0 a	43.5 ab	23.9 a	25.1 ab	26.0 ab	34.5 ab	46.4 a	40.3 ab
9	Roundup (Hood)	1.0	In-season	36.9 a	40.1 ab	24.0 a	19.0 d	26.5 ab	33.6 ab	45.4 a	40.2 ab
	Roundup	0.5	In-season repeat[4]								
10	Banvel SGF 2E	1.0	Pre-plant	36.4 a	44.2 ab	20.0 a	19.4 cd	17.7 d	32.7 ab	44.4 a	38.6 ab
	Roundup (Hood)[2]	1.0 fb 1.0	In-season								
	Roundup	1.0	In-season repeat[4]								
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	39.4 a	46.8 ab	21.7 a	24.9 ab	27.1 ab	37.0 ab	45.4 a	43.5 a
	Roundup (Hood)	1.0	In-season								
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	37.4 a	46.1 ab	25.0 a	24.9 ab	25.7 ab	38.9 a	45.8 a	46.1 a
13	Cultivate only	–	In-season	36.1 a	41.5 ab	25.4 a	21.4 a-d	23.3 bc	34.2 ab	44.0 a	40.8 ab
	Roundup 4E	0.75	In-season repeat[4]								
14	Hoe check	–	In-season	37.1 a	46.4 ab	26.6 a	21.5 a-d	25.1 bc	34.4 ab	44.6 a	39.2 ab
	Roundup 4E	0.375	In-season repeat[4]								
15	Redvine check[3]	–	–	43.3 a	43.9 ab	25.3 a	18.7 d	20.7 cd	29.0 b	29.4 b	40.2 ab

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[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.

[4]Application dates and cotton node (in parentheses)

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

Table 8. Seed cotton yield with an experiment on redvine control with no-till cotton on clay soil, 1995-2002.[1]

Treatment	Herbicide	Rate (lb a.i./A)	Time	Seed cotton yield (lb/A)							
				1995	1996	1997	1998	1999	2000	2001	2002
1	Redvine check	–	–	1488 bc	1131 c	1863 d	830 e	1386 b	1053 e	621 f	1072 e
2	Banvel 4S	2.0	After harvest	1812 a	1916 a	2300 abc	1570 a	1690 a	1799 a	1651 cde	2989 abc
	Roundup 4E	2.0	After harvest								
3	Banvel, SGF 2E/Clarity 4E	1.0	After harvest	1682 ab	1845 ab	1989 bcd	1504 ab	1716 a	1662 ab	1799 a-d	2816 a-d
	Banvel SGF 2E/Clarity 4E	1.0	Harvest + 2+ weeks								
4	Command 3ME	1.0	PRE	1381 cd	1487 b	2299 abc	1111 cde	1780 a	1833 a	1574 cde	2628 bcd
	Roundup (Hood)	1.0	In-Season								
5	Command 3ME	1.0	After harvest	1590 abc	1720 ab	2137 a-d	1079 de	1629 a	1497 abc	1834 a-d	2788 a-d
	Command 3ME	1.0	PRE								
	Roundup 4E	0.5	In-season repeat[4]								
6	Roundup	2.0	After harvest	1841 a	1829 ab	2388 ab	1484 abc	1668 a	1651 ab	1904 abc	3255 a
	Roundup (Hood)	1.0	In-season								
7	Banvel SGF 2E/Clarity 4E	2.0	After harvest	1739 ab	1912 a	2264 a-d	1516 ab	1699 a	1729 ab	1936 abc	2668 bcd
	Command 3ME	1.0	PRE								
8	Roundup (Hood)[2]	1.0 fb 1.0	In-season	1176 de	302 d	2142 a-d	1280 a-d	1571 ab	1772 ab	1815 a-d	2565 cd
9	Roundup (Hood)	1.0	In-season	1636 abc	1696 ab	2092 a-d	1122 cde	1733 a	1556 abc	1944 abc	2809 a-d
	Roundup	0.5	In-season repeat[4]								
10	Banvel SGF 2E	1.0	Pre-plant	989 e	588 d	2339 ab	1251 a-d	1139 c	1244 cde	1373 e	2645 bcd
	Roundup (Hood)[2]	1.0 fb 1.0	In-season								
	Roundup	1.0	In-season repeat[4]								
11	Banvel SGF 2E/Clarity 4E	2.0	After harvest	1742 ab	1867 b	2442 a	1614 a	1647 a	1620 ab	2112 a	3175 ab
	Roundup (Hood)	1.0	In-season								
12	Banvel SGF 2E/Clarity 4E	2.0	After harvest	1727 ab	1821 ab	2157 a-d	1577 a	1638 a	1753 ab	2053 ab	2326 d
13	Cultivate only	–	In-season	1713 ab	1689 ab	2143 a-d	1173 b-e	1560 ab	1419 bcd	1523 de	2598 cd
	Roundup 4E	0.75	In-season repeat[4]								
14	Hoe check	–	In-season	1744 ab	1850 ab	2412 a	1481 abc	1683 a	1623 ab	1682 b-e	2893 abc
	Roundup 4E	0.375	In-season repeat[4]								
15	Redvine check[3]	–	–	1746 ab	1701 ab	1914 cd	1069 de	1418 b	1161 de	594 f	1039 e

[1]Numbers in the same column with the same letter are not different using a significance level of 0.05 according to Duncan's Multiple Range Test (DMRT).
[2]Clarity 4E 1.0 in 1995, 1996.
[3]Banvel 4S 2.0 in fall before 1994.

[4]Application dates and cotton node (in parentheses)

2000	2001	2002
5/17 (2, 3)	5/10 (2, 3)	5/8 (3)
5/26 (4, 5)	5/21 (5, 6)	5/15 (4, 5)
6/2 (7)	5/29 (6-8)	5/24 (6-8)
6/9 (9, 10)	6/5 (9, 10)	6/3 (9, 10)
	6/20 (12-14)	6/11 (11-14)

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