WEED MANAGEMENT SYSTEMS FOR RR/BT COTTON

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ABSTRACT: A study was conducted during the 2004 growing season to evaluate herbicide weed management systems with emphasis on time of herbicide application. The study was conducted on a Catalpa silty clay loam soil where the predominant weed species were sicklepod (*Senna obtusifolia*) and barnyardgrass *(Echinochloa crusgalli)*. Good growing conditions provided maximum herbicide effectiveness in 2004. Except for the untreated check; Sequence (glyphosate + metolachlor) applied preemergence (PRE) followed by (Fb) Touchdown Total [glyphosate (TDT)] at layby; and Sequence applied to 2 leaf cotton Fb Envoke (trifloxysulfuron) at 0.15 oz/ac at 5 to 7 leaf cotton Fb TDT + Suprend (prometryn + trifloxysulfuron) at layby, all weed management systems evaluated provided good weed control and showed no differences in lint yields which ranged from 987 to 1094 lb/ac. The total herbicide cost for the weed management systems ranged from 14 to $45/ac. The results indicated Roundup WeatherMAX [glyphosate (RWM)] or TDT applied postemergence (POT) at 2-leaf cotton and repeated at layby provided good weed control with yields of 987 to 1017 lb/ac with the lowest total herbicide costs of 14 to $15/ac. However, Sequence applied POT at 2 to 3 leaf cotton Fb TDT at layby and RWM applied PRE Fb Sequence applied POT at 2 to 3 leaf cotton Fb RWM at layby produced the highest yield of 1092 and 1094 lb/ac with total herbicide costs of 21 and $27/ac, respectively. Cotoran (fluometuron), Envoke, and Suprend in these systems increased the costs by 7 to $12/ac with no significant improvement in yield or weed control. Envoke at 0.15 oz/ac and Sequence applied POT caused some erratic early season crop injury. However, Sequence applied POT to 2 leaf cotton in combination with Envoke at 0.15 oz/ac applied POT at 5 to 7 leaf cotton Fb TDT + Suprend at layby was the only herbicide weed management system which had early season crop injury and reduced yield.

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MATERIALS AND METHODS: This study was conducted on a Catalpa silty clay loam soil at Verona, Mississippi in 2004, as a randomized complete block with 4 replications. Plot size was 4 rows x 50 ft long. Phosphorous or potassium fertilizer was not necessary based on soil test recommendations. However, zinc sulfate solution (3.5% sulfur and 7.0% zinc) was applied at 1.0 gpa in 10 gpa volume on 10/18/03. The plot area was disked twice on 10/9/03 and bed-rolled on 10/18/03. A burndown application of RWM + Clarity (dicamba) at 1.0 + 0.125 lb ai/ac was made to all treatments 3/25/04. Plots were doalled (row conditioner) prior to planting. DP 444BR cotton cultivar was planted 5/4/04 in 38-inch rows with a seeding rate of 4 seed/ft of row. No cultivation was performed after planting. Urea-ammonium nitrate (32% N) solution at 120 lb

N/ac was applied sidedress with a colter-knife applicator to cotton at the pinhead growth stage on 5/27/04.

Herbicides, rates, times of application, and herbicide weed management system costs are listed in Table 1. Herbicide costs were based on a local retail farm supply price. The herbicide cost per gallon of product for RWM, TDT, Sequence and Cotoran (4L) was $45, $37, $46 and $33, respectively. The cost per ounce of product for Envoke, Staple, and Suprend was $70, $16, and $0.60, respectively. These costs are for the herbicide and did not include application costs. All PRE treatments were applied at planting on 5/4/04 using 8002VS nozzles at 15 gpa spray volume. All POT treatments were made using 8002VS nozzles at either 10 or 15 gpa. All 2 leaf cotton POT treatments were applied on 5/22/04, 18 days after planting (DAP); and all 2 to 3 leaf cotton POT applications were applied 5/25/04, 21 DAP. All 3 to 4 leaf cotton POT treatments were made on 5/28/04, 24 DAP. Post directed layby (PDL) applications in 25 gpa spray volume were made to 11 to 12 leaf cotton on 6/21/04.

All RWM applications at 16.4 oz/ac were made PRE or POT at 2 leaf cotton; and POT at 22 oz/ac for the 2 to 3, and 3 to 4 leaf cotton and PDL applications at 11 to 12 leaf cotton. All TDT applications were made at 24 oz/ac. All Sequence applications were made at 40 oz/ac. Envoke rates of 0.10 or 0.15 oz/ac were all applied POT to 5 to 7 leaf cotton. Staple (pyrithiobac) + RWM at 1.5 + 22 oz/ac was applied POT to 3 to 4 leaf cotton. Cotoran + RWM at 38.4 oz/ac + 16.4 oz/ac was only applied PRE. The Suprend PDL applications at 20 oz/ac were made in combination with either RWM or TDT at 22 or 24 oz/ac, respectively, to 11 to 12 leaf cotton. Barnyardgrass and sicklepod control and crop injury were rated on a visual scale of 0 equaled no weed control or crop injury up to 100% which equaled a complete crop kill or complete weed kill.

Pentia (mepiquat pentaborate) + surfactant was applied at 0.077 lb ai/ac + 0.25% v/v in 10 gpa on 7/9/04 and repeated 7/16/04 to control rank cotton growth. CoRoN (10-0-10 + 0.5% Boron) was applied at 1 gpa in 10 gpa volumes on 7/13/04 and repeated on 7/20/04. Bidrin (dicrotophos) was applied 6/15/04 at 0.25 lb ai/ac in 10 gpa volumes for plant bug *(Lygus spp.)* control. Bidrin + Karate Z (lambda-cyhalothrin) were applied at 0.4 + 0.0325 lb ai/ac for plant bug and bollworm *(Heliothis zea)* control on 8/2/04. Cotton was defoliated with Finish (ethephon + cyclanilide) + Dropp (thidiazuron) at 1.0 + 0.04 lb ai/ac in 25 gpa spray volume on 9/9/04.

The center 2 rows of each 4 row plot were harvested 9/20/04 with a spindle picker modified for plot harvest. Seed cotton samples were weighed and grab samples were taken from each plot. The grab samples were ginned with a 10-saw laboratory gin (no dryer or lint cleaner) to determine percent lint turnout. All data was subjected to Analysis of Variance procedure and means were separated using Fisher's Protected LSD calculated at the 5% significance level.

RESULTS AND DISCUSSION: The 2004 growing season had 114 and 153% of normal rainfall for May and June, respectively. However July, August and September were 60, 93, and 96% of normal, respectively. The growing season was excellent (no drought stress) for herbicide activity. Infestations of barnyardgrass and sicklepod were severe with light morningglory infestations.

Crop Injury: Highly erratic crop stunting injury for Envoke at 0.15 oz/ac, and leaf burn and stunting for Sequence were observed 18 days after POT applications 42 DAP (data not shown). The crop injury ranged from 11 to 14%, 42 DAP and 5 to 8%, 64 DAP. Except for Sequence applied POT at 2 leaf Fb Envoke at 0.15 oz/ac Fb TDT + Suprend (SPRN) at PDL, all herbicide weed management systems with Envoke and/or Sequence had no effect on yield. Sequence applied POT to 2 leaf cotton Fb Envoke at 0.15 oz/ac applied POT to 5 to 7 leaf cotton Fb TDT + SPRN applied PDL reduced yield. Since this was the only weed management system with Envoke that showed a yield reduction, the yield loss may have been related to the crop injury from Sequence.

Lint Yield: Yield for the untreated check (no herbicide) was only 116 lb/ac and all herbicide weed management systems produced higher yield than the check with lint yields from 847 to 1094 lb/ac (Table 1). Sequence at 40 oz/ac applied PRE (Fb) TDT applied PDL yield of 847 lb/ac was lower than all other treatments, except the untreated check and Sequnce applied POT to 2 leaf cotton FB Envoke at 0.15 oz/ac applied to 5 to 7 leaf cotton Fb TDT + SUPRN.

Treatments 1 through 18 (see Table 1) yields ranged from 987 to 1094 and were not different. Treatments 19 and 20 showed no yield differences. However, treatment 19 yield was equal to treatments 4 through 18 but had lower yield than treatments 1, 2, and 3. The yield of 963 lb/ac for Sequence applied POT to 2 leaf cotton Fb Envoke at 0.15 oz/ac applied POT to 5 to 7 leaf cotton Fb TDT + SPRN applied PDL was lower than Sequence applied POT at 2 to 3 leaf cotton Fb TDT applied PDL; RWM applied PRE Fb Sequence applied POT to 2 to 3 leaf cotton Fb TDT applied PDL; RWM applied PRE Fb RWM applied POT to 2 to 3 leaf cotton Fb RWM + SPRN applied PDL; and RWM PRE Fb RWM + Staple applied POT to 3 to 4 leaf cotton Fb RWM applied PDL which had yields ranging from 1079 to 1094 lb/ac and were not different in yield.

Under good growing conditions in 2004, the addition of Envoke, Sequence, Staple, Cotoran or Suprend in the herbicide weed management systems did not improve yield when compared to no PRE RWM application at planting Fb a 2 leaf POT application of RWM or TDT with a repeat PDL application. The results indicated a PRE application of RWM Fb Sequence POT at 2 leaf cotton Fb TDT applied PDL; and RWM applied PRE Fb Sequence applied POT at 2 to 3 leaf Fb TDT applied PDL produced the highest yield of 1092 and 1094 lb/ac with total herbicide costs of $19 and $25/ac, respectively. Both RWM and TDT applied POT to 2 leaf cotton with a repeat PDL application had the lowest herbicide cost of $14 and $15/ac, and lint yields of 987 and 1017 lb/ac, respectively.

Herbicide Cost: The cost per weed management system ranged from 14 to $45/ac with most systems providing effective weed control and no significant lint yield reductions. The good growing conditions provided maximum herbicide effectiveness for sicklepod and barnyardgrass control. These data indicated growers have a wide array of herbicides to use in several weed management systems and can minimize herbicide costs and maintain effective weed control. The data indicated that a POT herbicide application of either RWM or TDT applied POT to 2 leaf cotton followed by a repeat application at layby, or Sequence applied POT to 2 leaf cotton followed by TDT applied PDL ranged in cost from 14 to $19/ac. The costs for weed

management systems which included Cotoran, Envoke, Staple, and/or Suprend were higher and ranged from 27 to $45/ac, but did not improve yield or weed control.

These results indicated growers have a number of effective weed control products. However, when compared to RWM or TDT applied alone, all other weed management systems have some increased costs associated with them. But they offer flexibility. The PRE residual herbicides, offer weed control insurance, especially when the weather does not allow POT herbicide applications. However, the most important factor in a herbicide weed management system is to identify the weed species that are present and then select the most cost effective flexible herbicide weed management system for the weed spectrum. The appropriate use of a PRE residual herbicide on some of the acreage improves the flexibility to maintain effective weed control when farming extensive acreages and the weather limits POT herbicide applications.

Early Season Weed Control: Barnyardgrass control 25 DAP, 7 and 4 days after the 2 leaf and 2 to 3 leaf cotton POT applications, respectively, ranged from 60 to 91% (Table 1). The PRE residual herbicides (Cotoran and Sequence) and all systems with a 2 leaf cotton POT treatment showed 79 to 91% grass control and the trend was for higher grass control than all other treatments. Four days after the 2 to 3 leaf cotton POT applications grass control ranged from 64 to 80%. This erratic control was probably related to insufficient time after application. The RWM applied PRE with no 2 or 2 to 3 leaf cotton POT application showed the lowest grass control of 60%.

RWM applied PRE Fb RWM applied POT at 2 leaf cotton; RWM or TDT applied POT to 2 leaf cotton; Sequence applied POT at 2 leaf cotton; Sequence PRE Fb TDT applied at 2 to 3 leaf cotton; and Cotoran + RWM applied PRE with no 2 or 2 to 3 leaf RWM applied POT application provided 80 to 92% sicklepod control, 25 DAP. Sequence applied PRE Fb TDT applied at PDL; RWM applied PRE Fb Sequence applied POT 2 to 3 leaf cotton; RWM applied PRE with no RWM applied POT at 2 or 2 to 3 leaf cotton; RWM applied PRE Fb RWM or TDT applied POT to 2 to 3 leaf cotton showed erratic sicklepod control which ranged from 25 to 86%, 25 DAP. The erratic sicklepod control for the POT 2 to 3 leaf cotton applications may have been related to ratings being made too soon (4 days) after herbicide application.

Mid Season Weed Control: Sicklepod control for all treatments 42 DAP ranged from 0 to 91% (Table 2). Except for RWM applied PRE Fb RWM + Staple POT at 3 to 4 leaf cotton Fb RWM applied PDL, the untreated check and Sequence applied PRE with no 2 to 3 leaf or POT 4 leaf herbicide applications, all treatments provided 78 to 89% sicklepod control and were not different. RWM applied PRE at planting Fb RWM + Staple applied POT at 3 to 4 leaf cotton Fb RWM applied PDL had the highest sicklepod control of 91%. Sicklepod control with Sequence applied PRE Fb TDT applied PDL and the untreated check ranged from 0 to 13% and was lower than all other treatments.

All herbicide weed management systems provided 70 to 91% barnyardgrass control 18 days after 4 leaf cotton POT applications (42 DAP) were made. Except for the untreated check; Sequence applied PRE Fb TDT applied PDL; and RWM applied PRE Fb RWM applied POT at 2 leaf cotton Fb RWM applied PDL, all weed management systems controlled barnyardgrass 83 to 94% with no differences. Sequence applied PRE Fb TDT applied PDL and RWM applied PRE

Fb RWM applied POT at 2 leaf cotton Fb RWM applied PDL controlled barnyardgrass 70 and 79%, respectively.

Late Season Weed Control: Barnyardgrass control 64 DAP (16 days after PDL applications) was excellent and ranged from 87 to 99% for all herbicide weed management systems, except the check (Table 2). Barnyardgrass control was 0 and 81% for the untreated check and Sequence PRE followed by TDT applied PDL, respectively. This was lower than the 91 to 99% barnyardgrass control for all other weed management systems. Except for the Sequence PRE Fb TDT applied PDL and the untreated check, sicklepod control for all treatments ranged from 91 to 98%.

COOPERATORS: None

PUBLICATIONS: None

Table 1. Lint yield, herbicide costs, sicklepod and barnyardgrass control as influenced by herbicide and time of application in 2004, Verona, MS.

	Herbicide/rate oz/ac[1]						% Control	
	PRE	(18 DAP) POT (2 LF Cot)	(21 DAP) POT (2/3 LF cot)	(24 DAP) POT (Cot 3/4 LF)	(48 DAP) PDL (11/12 LF cot)	Lint lb/ac	Herb $/ac	B-Grass 25 DAP	Sickle 25 DAP
1	RWM/16.4	----------	SQ/40	----------	TDT/24	1094	27	74	66
2	----------	SQ/40	----------	----------	TDT/24	1092	21	88	83
3	RWM/16.4	----------	----------	RWM/22 + STP/1.5	RWM/22	1082	45	60	48
4	RWM/16.4	----------	RWM/22	----------	RWM/22 + SPRN/20	1079	32	64	65
5	SQ/40	----------	----------	TDT/24	TDT/24 + SPRN/20	1072	40	79	74
6	RWM/16.4	----------	RWM/22	----------	RWM/22	1065	21	87	86
7	RWM/16.4	----------	SQ/40	ENV/0.10 [2]	TDT/24 + SPRN/20	1061	45	69	66
8	RWM/16.4	----------	SQ/40	ENV/0.10 [2]	TDT/24	1051	34	80	71
9	RWM/16.4	RWM/16.4	----------	----------	RWM/22	1044	19	96	92
10	RWM/16.4	----------	RWM/22	ENV/0.10 [2]	RWM/22	1035	28	79	74
11	----------	RWM/22	----------	ENV/0.15 [2]	RWM/22 + SPRN/20	1035	37	88	84
12	----------	RWM/22	----------	----------	RWM/22 + SPRN/20	1032	27	91	84
13	COT/38.4+ RWM/16.4	----------	----------	RWM/22	RWM/22	1030	31	89	88
14	----------	RWM/22	----------	ENV/0.15[2]	RWM/22	1029	26	91	86
15	RWM/16.4	----------	RWM/22	ENV/0.10 [2]	RWM/22 + SPRN/20	1028	39	84	75
16	----------	TDT/24	----------	----------	TDT/24	1017	14	89	83
17	SQ/40	----------	TDT/24	----------	TDT/24	1015	28	92	85
18	----------	RWM/22	----------	----------	RWM/22	987	15	91	85
19	----------	SQ/40	----------	ENV/0.15 [2]	TDT/24 + SPRN/20	963	43	85	80
20	SQ/40	----------	----------	----------	TDT/24	847	21	88	25
21	UT-CK	----------	----------	----------	----------	116	0	0	0
					LSD (0.05)	110	-----	14	19
					% CV	9	-----	12	19

[1] Abbreviation codes: PRE = Premergence application at planting; POT = Postemergence over top application; PDL = Post directed layby application; DAP = days after planting; B-grass = barnyardgrass; Sckle = sicklepod; RWM = Roundup WeatherMAX; TDT = Touchdown Total; SQ = Sequence; ENV = Envoke; SPRN = Suprend; and STP = Staple.

[2] Envoke was applied POT 36/DAP to cotton in 5 to 7 leaf stage.

Table 2. Sicklepod and barnyardgrass control as influenced by herbicide and time of application, 42 and 64 days after planting in 2004, Verona, MS.

	Herbicide/rate oz/ac[1]					% Control			
	PRE	(18 DAP) POT (2 LF Cot)	(21 DAP) POT (2/3 LF cot)	(24 DAP) POT (Cot 3/4 LF)	(48 DAP) PDL (11/12 LF cot)	B-grass 42 DAP	Sicklepod 42 DAP	B-grass 64 DAP	Sicklepod 64 DAP
1	RWM/16.4	----------	SQ/40	----------	TDT/24	93	80	97	97
2	----------	SQ/40	----------	----------	TDT/24	86	79	96	96
3	RWM/16.4	----------	----------	RWM/22 + STP/1.5	RWM/22	85	91	93	97
4	RWM/16.4	----------	RWM/22	----------	RWM/22 + SPRN/20	83	80	95	97
5	SQ/40	----------	----------	TDT/24	TDT/24 + SPRN/20	83	81	95	96
6	RWM/16.4	----------	RWM/22	----------	RWM/22	88	85	96	94
7	RWM/16.4	----------	SQ/40	ENV/0.10 [2]	TDT/24 + SPRN/20	89	88	98	96
8	RWM/16.4	----------	SQ/40	ENV/0.10 [2]	TDT/24	94	88	99	98
9	RWM/16.4	RWM/16.4	----------	----------	RWM/22	79	78	96	98
10	RWM/16.4	----------	RWM/22	ENV/0.10 [2]	RWM/22	91	89	97	97
11	----------	RWM/22	----------	ENV/0.15 [2]	RWM/22 + SPRN/20	90	85	99	98
12	----------	RWM/22	----------	----------	RWM/22 + SPRN/20	83	80	91	91
13	COT/38.4 + RWM/16.4	----------	----------	RWM/22	RWM/22	91	88	97	97
14	----------	RWM/22	----------	ENV/0.15[2]	RWM/22	89	88	97	96
15	RWM/16.4	----------	RWM/22	ENV/0.10 [2]	RWM/22 + SPRN/20	91	89	98	97
16	----------	TDT/24	----------	----------	TDT/24	87	83	97	93
17	SQ/40	----------	TDT/24	----------	TDT/24	91	85	98	97
18	----------	RWM/22	----------	----------	RWM/22	89	78	96	96
19	----------	SQ/40	----------	ENV/0.15 [2]	TDT/24 + SPRN/20	93	84	98	94
20	SQ/40	----------	----------	----------	TDT/24	70	13	87	81
21	UT-CK	----------	----------	----------	----------	0	0	0	0
					LSD (ODS)	11	11	5	4
					% CV	9	10	4	3

[1] Abbreviation codes: PRE = Premergence application at planting; POT = Postemergence over top application; PDL = Post directed layby application; DAP = days after planting; B-grass = barnyard grass; RWM = Roundup WeatherMAX; TDT = Touchdown Total; SQ = Sequence; ENV = Envoke; SPRN = Suprend; and STP = Staple.

[2] Envoke was applied POT 36/DAP to cotton in 5 to 7 leaf stage.