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Postemergence herbicide treatments for control of johnsongrass in soybeans :with and without preplant soil incorporated and preemergence herbicides

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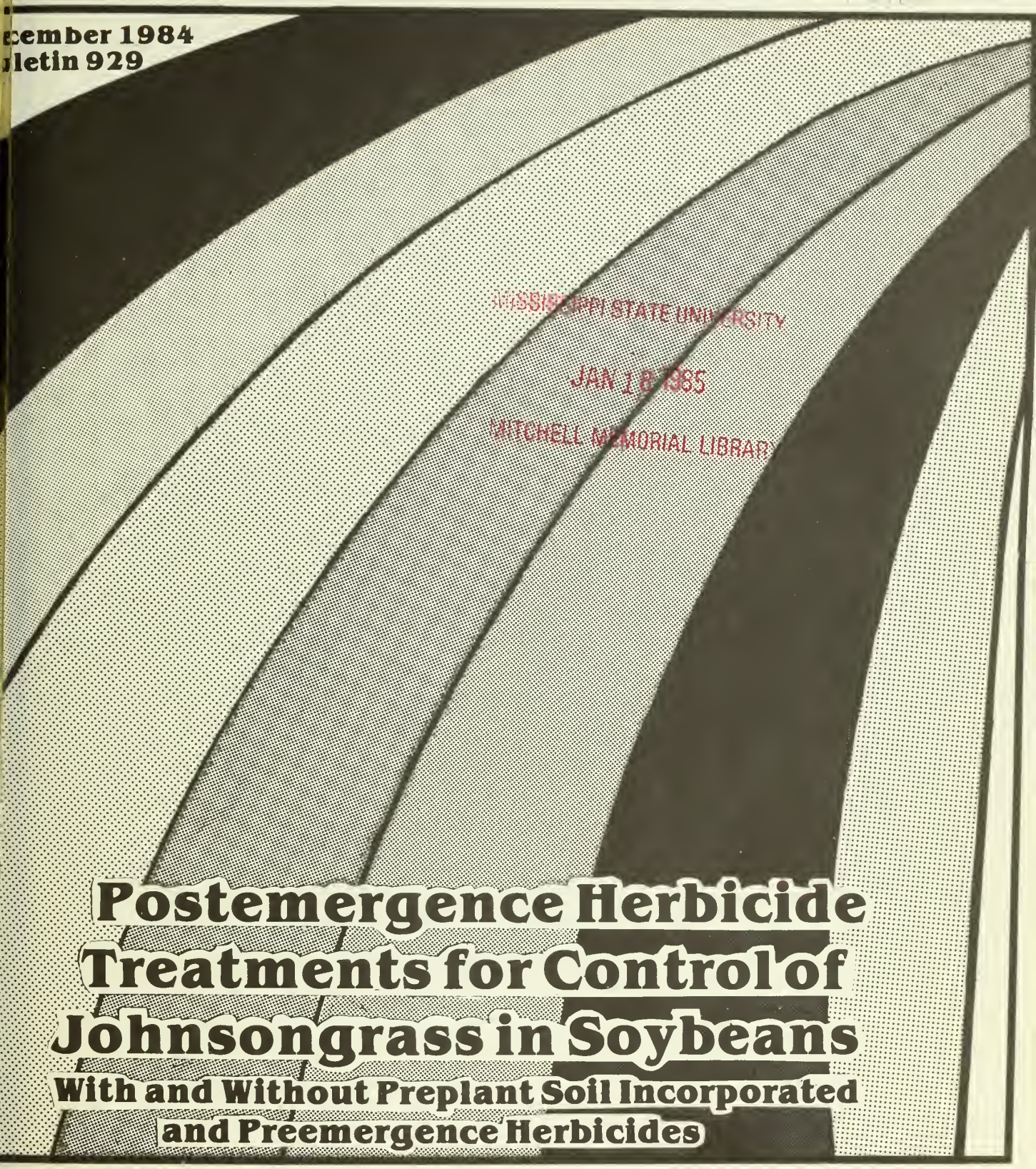

Postemergence Herbicide Treatments for Control of Johnsongrass in Soybeans

With and Without Preplant Soil Incorporated and Preemergence Herbicides

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Johnsongrass [*Sorghum halepense* (L.) Pers.] continues to rank high as a problem weed in Mississippi soybean fields despite improved techniques for control (6). The application of preplant soil-incorporated dinitroaniline herbicides at twice (2X) the normal rate (X), glyphosate applied either with the recirculating sprayer or rope-wick applicator and treatments with newly developed, selective over-the-top herbicides have improved the control of rhizome johnsongrass in soybean fields (1,2,3,4,9,10). However, low-level johnsongrass infestations continue in soybean fields where farmers are using the best weed management programs available. Previous studies have shown the value of applying herbicides as spot sprays for control of johnsongrass (5,7,8,11,12).

We report the results of studies conducted at the MAFES North Mississippi Branch to evaluate the benefits of applying glyphosate (Roundup®) with the rope-wick applicator and spot spraying selective over-the-top grass herbicides to low-level rhizome johnsongrass infestations. The trial was on plots that previously had been treated with preplant incorporated herbicides at the 2X rate for two consecutive years, followed by one year at the X rate (see footnotes 1 and 2, Table 1).

Methods and Materials

The three-year trial (1980-82) was conducted on a silt loam (16.4% sand, 70.4% silt, 13.2% clay) with 0.8% organic matter and pH of 6.2. The design was a split plot with four replications.

Main plots were 16 rows (30 ft long and 40 inches wide). The main plots (Table 1) were a control (no herbicide), preplant incorporated (PPI) treatment with Basalin® (fluchloralin), Treflan® (trifluralin) and Prowl® (pendimethalin) and preemergence (PRE) treatment with MBR 18337 (benzofluor). Each herbicide was applied broadcast at the X rate each spring. The PPI treatments were mixed 2 inches deep in the soil with a power-driven rotary tiller. Each main plot received the same treatment each year.

Subplots were four adjacent rows in each main plot, with one subplot serving as a control (no herbicide). The subplot treatments were Roundup applied with a tractor-mounted rope wick in 1980 and 1981 and a hand-held rope wick in 1982 and spot-spray applications of RO 13-8895 in 1980 and 1981, Verdict 2E® (haloxyfop) in 1982 and Poast 1.5 E® (sethoxydim) each year (Table 1).

Spot spraying was accomplished by hand treating 15- to 30-inch tall johnsongrass plants from a tractor-mounted seat. Two rows per pass were treated at speed of about 2 miles/hr.

Basagran 4E® at 0.75 lb/acre was applied 6/4/80, 6/21/81 and 6/4/82 to control broadleaf weeds. All row middles were cultivated as needed.

'Forrest' soybeans were planted in May each year. Recommended seedbed preparation, fertilization and other production practices were used. The two center rows of each subplot were combine harvested.

Time required and amounts of spray mixture used were recorded for the hand-applied spot treatments.

Results and Discussion

Johnsongrass infestations on main plots (averages of subplots) treated PPI with Basalin® and PRE with MBR 18337 were smaller ($P < .05$) than the control infestations before superimposed treatment in 1980 but did not differ from the control population after superimposed treatment (Table 3). Reduction in numbers of johnsongrass plants as the precent of numbers in the control was greatest for MBR 18337 before superimposed treatment in 1980 and 1982 and for Basalin before superimposed treatment in 1981 and after superimposed treatment each year.

The three-year average populations of johnsongrass on main plots (averages of subplots) did not differ from those in the control. The per-

centage reduction in numbers of johnsongrass plants was greatest for Basalin before and after superimposed treatment.

Populations of johnsongrass in subplots (averages of main plots) differed ($P < .05$) from those in the control before superimposed treatment in 1980 (Table 4), but differences among herbicide treatments were not significant. The percentage reduction in johnsongrass plants before superimposed treatment was greatest for Roundup in 1980 and Poast® in 1981 and 1982. Percentage reductions in johnsongrass populations after superimposed treatment were greatest for Poast in 1980, RO-8895 in 1981 and Verdict® in 1982.

The three-year average populations of johnsongrass on subplots (averages of main plots) did not differ ($P < .05$) from numbers in the control. The reduction in numbers of johnsongrass plants was greatest for Poast before and after superimposed treatment.

The johnsongrass populations in control plots declined from 223.5/120 row ft in September 1980 to 80.3/120 row ft in September 1981 and was down to 69.8/120 row ft in September 1982 (Table 2). We attribute these declines to cultivation and annual weather patterns.

The interactions of main-plot and subplot means are presented in Table 2 (by years) and Table 5 (three-year average). Johnsongrass populations on plots treated PPI with Basalin or PRE with MBR 18337 did not differ ($P < .05$) from those on the control. Plots treated PPI with Treflan had a population decrease of 83% from September 1980 to September 1981, followed by a 55% increase the next year. Johnsongrass populations on plots treated PPI with Prowl declined 65% from September 1980 to September 1981 but remained about the same at the end of the next year.

Spot treatments did not improve johnsongrass control on plots treated PPI with Basalin or PRE with MBR 18337 but gave significantly better johnsongrass control on plots that were treated PPI with Treflan or Prowl or were cultivated only.

The johnsongrass populations in September were much lower following spot treatment with RO 13-8895, Verdict or Poast, irrespective of whether a PPI or PRE herbicide was used. Roundup performed better after application of PPI or PRE herbicides.

Yields in 1981 were lowest ($P < .05$) where no PPI, PRE or superimposed herbicides were applied (Table 6). Yields on main plots (averages of subplots) were higher ($P < .05$) than yields on the main-plot control after PPI treatment with Basalin in 1982, but not higher than yields following PPI treatment with Treflan (Table 7). The three-year average main-plot yields did not differ.

Yields on subplots (averages main plots) were higher ($P < .$ than yields on the subplot cont where Roundup and RO 13-8 were superimposed in 1980 and superimposed treatments w applied in 1982 (Table 8). The thr year average yields following ea superimposed treatment w higher than yields on the subp control.

Slight to moderate (30 to 40 symptoms of injury to soybe plants were observed when MI 18337 was applied in mid-July, 19 The symptoms were shorter plan abnormally dark-green color, rou foliage texture and leaf cupping.

The time required for spot treati ranged from 0.33 hr/acre for R 13-8895 superimposed on ME 18337 in 1980 to 3 hrs/acre f Verdict without PPI or PRE tre ment in 1982 (Table 9). The amou of spray mix needed to spot tre ranged from 3.3 gal/acre for Poa superimposed on Basalin in 1981 51.2 gal/acre for RO 13-8895 supe imposed over the main-plot contr in 1980 (Table 10).

The time required and the amou of spray mix used in spot treatir varied considerably and was n proportional to the level of johnso grass infestation. It was estimat that less than 1 qt of mix (Roundu water; 1:2) was used with each rop wick application to a treated are of 600 row ft.

Summary

Johnsongrass was controlled more effectively by spot treating with Poast, RO 13-8895 or Verdict than by Roundup applied by rope wick, by preplant incorporated Basalin, Treflan or Prowl alone or by preemergence MBR 18337 alone.

Soybean yields were not affected by any herbicide treatment but were lowest when cultivation alone was used to control johnsongrass.

After three years, control of johnsongrass with MBR 18337 was as effective as with Basalin and was more effective than wit Treflan or Prowl. However, plar injury symptoms were apparer after treatment with MBR 18337 i the third year.

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Table 1. Preplant (PPI) and preemergence (PRE) treatments (main plots) and superimposed postemergence treatments (subplots) for herbicide control of rhizome johnsongrass in soybeans in trials at the MAFES North Mississippi Branch, 1980-82.

Main Plot Treatment	Rate	Subplot Treatment		
		Herbicide	Concentration	Dates Applied
	lbs/acre		% V/V	mo/day/year
Basalin 4E (PPI)[1]	0.75	Roundup 4E[3]	33.0	7/7, 9/9/80; 7/14/81; 7/7/82
Treflan 4E (PPI)[1]	0.75	RO 13-8895 3E[4]	1.6;1.0	6/10/80; 7/14/81
		Verdict 2E[4]	0.5	7/6/82
Prowl 4E (PPI)[1]	0.75	Poast 1.5E[5]	0.5	6/10/80; 7/14/81; 7/6/82
MBR 18337 2E (PRE)[2]	0.50	None		-

[1]Applied 5/19/80, 6/11/81 and 5/18/82 and incorporated 2 inches deep with a rotary power incorporator. Each main-plot herbicide treatment followed the same herbicide applied at 1.5 lbs/acre in November 1976 and 1977 and double-disk incorporated and at 0.75 lb/acre in June 1979 incorporated 2 inches deep with a rotary power incorporator.

[2]Applied 5/19/80, 6/11/81 and 5/18/82. Tolban 4E® had been applied at 1.5 lbs/acre in November 1976 and 1977 and double-disked incorporated and at 0.75 lb/acre in June 1979 incorporated 2 inches deep with a rotary power incorporator.

[3]Applied in two directions with a tractor-mounted rope wick in 1980 and 1981 at a hand-held rope wick in 1982.

[4]Applied in water at the concentration indicated, with two rows per pass sprayed by hand from a tractor-mounted seat. Surfactant added to spray mixture at 0.5% v/v. Development of RO 13-8895 discontinued after 1981.

[5]Applied in water at the concentration indicated, with two rows per pass sprayed by hand from a tractor-mounted seat. Petroleum oil (83%)-surfactant (17%) blend added to spray mixture at 0.625% v/v in 1980 and at 1.25% v/v in 1981 and 1982.

Table 2. Numbers of johnsongrass plants per 120 row ft in trials with preplant soil incorporated (PPI) and preemergence (PRE) treatments[1] (main plots) and superimposed treatments[1] (subplots) for herbicide control of rhizome johnsongrass in soybeans, before and after superimposed treatments, MAFES North Mississippi Branch, 1980-82.[2]

Main Plot Treatment	Number of rhizome johonsongrass plants per 120 row ft							
	Before treatment with				After treatment with			
	Roundup 4E	RO 13-8895 3E[3]	Poast 4E	None	Roundup 4E	RO 13-8895 3E	Poast 1.5E	None
	counted 6/4/80[4]				counted 9/16/80[4]			
Basalin 4E (PPI)	3.8	15.8	25.8	42.8	4.0	2.3	1.8	15.3b
Treflan 4E (PPI)	40.3	36.8	29.0	166.0	8.0 B	2.5 B	3.3 B	272.3aA
Prowl 4E (PPI)	11.3	37.3	52.5	93.0	2.8 B	5.0 B	4.8 B	94.8bA
MBR 18337 2S (PRE)	17.8	7.5	33.0	13.8	15.8	21.0	5.8	28.5b
None	79.0	73.3	60.5	179.5	42.0 B	2.3 B	1.0 B	223.5aA
	counted 7/13/8[4]				counted 9/25/81[4]			
Basalin 4E (PPI)	5.3 b	4.8	3.8	18.3c	5.3	1.0	1.0	17.5cd
Treflan 4E (PPI)	14.0abB	14.3 B	8.3 B	51.3bA	9.5 B	1.3 B	2.8 B	46.5bA
Prowl 4E (PPI)	3.8 bB	17.0 B	10.5 B	36.5bcA	5.3 B	1.3 B	1.5 B	33.3bcA
MBR 18337 2S (PRE)	10.3ab	14.0	7.3	19.3c	5.3	1.8	1.0	11.5d
None	26.0aB	22.5 B	20.3 B	81.8aA	17.8 B	2.3 B	1.8 B	80.3aA
	counted 6/30/82[4]				counted 9/7/82[4]			
Basalin 4E (PPI)	8.8 b	5.8 b	6.5	18.5c	4.0	1.3	2.0	16.5b
Treflan 4E (PPI)	17.8 bB	6.0 bB	9.5 B	59.3abA	7.5 B	0.5 B	2.5 B	72.3aA
Prowl 4E (PPI)	10.3 bB	7.0 bB	13.5 B	43.5bA	4.0 B	1.3 B	3.5 B	38.8abA
MBR 18337 2S (PRE)	7.8 b	6.0 b	4.8	2.3c	7.5	2.3	6.8	8.8 b
None	61.5aB	58.0aB	24.5 C	85.8cA	15.5 B	3.0 B	3.5 B	69.8aA

[1]See Table 1 for herbicide rates and application methods.
[2]'Forrest' soybeans planted 5/19/80, 6/11/81, 5/19/82. Basagran 4E at 0.75 lb/acre was applied 6/4/80, 6/21/81 and 6/4/82 to control broadleaf weeds. All row middles were cultivated as needed.
[3]Verdict 2E was substituted when development of RO 13-8895 4E was discontinued after 1981.
[4]Values in columns followed by a different lower case letter or in rows followed a different upper case letter differ (P = .05) according to Duncan's multiple range test.

Table 3. Numbers per 120 row ft and reduction in numbers of rhizome johnsongrasss plants in main plots (averages of superimposed treatments) after preplant (PPI) and preemergence (PRE) treatments (main plots) and superimposed treatments (subplots), before and after superimposed treatment, MAFES North Mississippi Branch, 1980-82.[1]

Main Plot Treatment	No. and reduction in No. of rhizome johnsongrass plants							
	Before superimposed treatment							
	7/13/80		6/4/81		6/30/82		Average	
	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]
Basalin 4E (PPI)	22.0 b	78	8.0	79	9.9	83	13.3	79
Treflan 4E (PPI)	68.0ab	31	21.9	42	23.2	69	37.7	42
Prowl 4E (PPI)	48.5ab	51	16.9	55	18.6	68	28.0	57
MBR 18337 2S (PRE)	18.0b	82	13.0	65	5.2	91	12.1	81
None (control)	98.1a	--	37.6	--	57.4	--	64.4	--
	After superimposed treatment							
	9/16/80		9/23/81		9/7/82		Average	
	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]
Basalin 43 (PPI)	5.8	91	6.2	76	6.0	74	6.0	84
Treflan 4E (PPI)	71.5	(14)[4]	15.0	42	20.7	10	35.7	3
Prowl 4E (PPI)	26.8	57	10.4	59	11.9	48	16.4	56
MBR 18337 2S (PRE)	17.8	71	4.9	81	6.3	73	9.7	74
None (control)	67.2	--	25.6	--	23.0	--	36.9	--

[1]Derived from Table 2.
[2]Number of rhizome johnsongrass plants per 120 row ft.
[3]Reduction in numbers as percent of numbers in control.
[4]Increase over control.

Table 4. Numbers per 120 row ft 12and reduction in numbers of rhizome johnsongrasss plants in subplots (averages of PPI and PRE treatments) after preplant (PPI) and preemergence (PRE) and superimposed treatments (subplots), before and after superimposed treatments, MAFES North Mississippi Branch , 1980-82.[1]

Subplot Treatment	No. and reduction in No. of rhizome johnsongrass plants							
	Before superimposed treatment							
	6/4/80		7/13/81		6/30/82		Average	
	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]
Roundup 4E	30.4 b	69	11.9	71	21.2	49	21.2	65
RO 13-8895 3E	34.1 b	65	14.5	65				
Verdict 2E[4]					16.6	60	21.7	64
Poast 1.5E	40.2 b	59	10.0	76	11.8	72	20.6	66
None (control)	97.2 a	--	41.4	--	41.9	--	59.8	--
	After superimposed treatment							
	9/16/80		9/23/81		9/7/82		Average	
	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]	No.[2]	%[3]
Roundup 4E	14.5	89	8.6	77	7.7	81	10.3	85
RO 13-8895 3E	6.6	95	1.3	97				
Verdict 2E					1.7	96	3.3	95
Poast 1.5 E	3.3	97	2.1	94	3.7	91	2.8	96
None (control)	126.9	--	37.8	--	41.2	--	68.7	--

[1]Derived from Table 2.
[2]Number of rhizome johnsongrass plants per 120 row ft.
[3]Reduction in numbers as percent of numbers in control.
[4]Verdict 4E was substituted when development of RO 13-8895 4E was discontinued after 1981.

Table 5. Three-year average numbers per 120 row ft and reduction in numbers of johnsongrass plants in trials with preplant soil incorporated (PPI) and pre-emergence (PRE) treatments (main plots) and superimposed treatments (subplots) for herbicide control of rhizome johnsongrass in soybeans, before and after superimposed treatments, MAFES North Mississippi Branch, 1980-82.[1]

Main Plot Treatment	No. and reduction in No. of rhizome johnsongrass plants Before sumperimposed treatment with: Roundup 4E		RO 13-8895 3E[2]		Poast 1.5E		None (Control)	
	Before superimposed treatment[3]							
	No.[4]	%[5]	No.[4]	%[5]	No.[4]	%[5]	No.[4]	%[5]
Basalin 4E (PPI)	6.0 b	89	8.7 b	83	12.0a	66	26.5cd	76
Treflan 4E (PPI)	24.0 bB	57	19.0abB	63	15.6aB	56	92.2abA	17
Prowl 4E (PPI)	8.4 bB	85	20.4abAB	60	25.5aAB	27	57.7bcA	49
MBR 18337 2S (PRE)	11.9 b	79	9.2 b	82	15.0a	57	10.1d	10
None (control)	55.5 aB	--	51.3aB	--	35.1aB	--	10.1dA	--
	After superimposed treatment[3]							
Basalin 43 (PPI)	4.4	82	1.5	40	1.6	34	16.4 c	93
Treflan 4E (PPI)	8.4 B	66	1.5 B	40	2.8 B	(33)[4]	130.3aA	(5)[6]
Prowl 4E (PPI)	4.0 B	84	2.5 B	0	3.3 B	(57)[4]	56.0 bA	53
MBR 18337 2S (PRE)	9.5	62	8.8	(35)[6]	4.5	(114)[4]	163. c	87
None (control)	25.1 B	--	2.5 B	--	2.1 B	--	124.5aA	--

[1]Derived from Table 2.
[2]Verdict 4E was substituted when development of RO 13-8895 4E was discontinued after 1981.
[3]Values in columns followed by a different lower case letter or in rows followed by a different upper case letter differ (P = .05) according to Duncan's multiple range test.
[4]Number of rhizome johnsongrass plants per 120 row ft.
[5]Reduction in numbers as percent of numbers in control.
[6]Increase over control.

Table 6. Combine yields of soybeans in trials with preplant (PPI) and pre-emergence (PRE) treatments[1] (main plots) and superimposed treatments (sub-plots) for herbicide control of rhizome johnsongrass in soybeans, MAFES North Mississippi Branch, 1980-82.[2]

Main Plot Treatment	Combine yield[2]			
	Roundup 4E	RO 13-8895 3E[3]	Poast 1.5E	None
	bu/acre			
		1980		
Basalin 4E (PPI)	22.5	23.3	22.7	22.8
Treflan 4E (PPI)	26.9	26.6	23.6	22.0
Prowl 4E (PPI)	23.3	23.7	22.7	21.7
MBR 18337 2S (PRE)	20.3	19.7	19.6	20.3
None (control)	22.6	23.5	23.4	16.0
		1981		
Basalin 43 (PPI)	43.9	44.2	44.1	41.4
Treflan 4E (PPI)	48.7	45.7	49.5	44.0
Prowl 4E (PPI)	44.0	49.2	48.2	43.8
MBR 18337 2S (PRE)	45.6	41.5	42.3	42.7
None (control)	44.8A	48.2A	45.8A	35.6B
		1982		
Basalin 4E (PPI)	29.9	30.5	28.2	25.9
Treflan 4E (PPI)	25.7	30.4	28.0	21.9
Prowl 4E (PPI)	24.2	25.9	25.6	20.4
MBR 18337 2S (PRE)	24.9	25.1	22.6	20.7
None (control)	24.7	23.3	25.2	21.4
		Three-year average		
Basalin 43 (PPI)	31.4	31.9	31.0	29.3
Treflan 4E (PPI)	32.9	33.4	33.0	28.6
Prowl 4E (PPI)	29.8	32.2	31.5	28.0
MBR 18337 2S (PRE)	29.6	28.1	27.6	27.3
None (control)	30.0	30.9	30.8	23.7

[1]See footnote 1, Table 2.
[2]Values in a row followed by a different letter differ (P = .05) according to Duncan's mulitple range test.

Table 7. Combine yield of main plots (averages of superimposed treatments) in trials with preplant (PPI) and preemergence (PRE) treatments (main plots) and superimposed treatments (subplots), MAFES North Mississippi Branch, 1980-82.[1]

Main Plot Treatment	Combine yield[2]			
	1980	1981	1982	Average
	bu/acre			
Basalin 4E (PPI)	22.8	43.4	28.6a	31.6
Treflan 4E (PPI)	24.8	47.0	26.5ab	32.8
Prowl 4E (PPI)	22.8	46.3	24.0 b	31.0
MBR 18337 2S (PRE)	20.0	43.0	23.3 b	28.8
None (control)	21.4	43.6	23.6 b	29.5

[1]Derived from Table 6.
[2]Values in the same column followed by a different letter differ (P = .05) according to Duncan's multiple range test.

Table 8. Combine yield of subplots (averages of main plot treatments) in trials with preplant (PPI) and preemergence (PRE) treatments (main plots) and superimposed treatments (subplots), MAFES North Mississippi Branch, 1980-81.[1]

Subplot Treatment	Combine yield[2]			
	1980	1981	1982	Average
	bu/acre			
Roundup 4E	23.1a	45.4	25.9a	31.5a
RO 13-8895 3E[3]	23.4a	45.8	27.0a	32.1a
Poast 1.5 E	22.4ab	46.0	25.9a	31.4a
None (control)	20.6 b	41.5	22.1 b	28.1 b

[1]Derived from Table 6.
[2]Values in the same column followed by a different letter differ (P = .05) according to Duncan's multiple range test.
[3]Verdict 4E was used in 1982.

Table 9. Time required to spot treat light johnsongrass infestations in trials with preplant soil-incorporated (PPI) and preemergence (PRE) treatments (main plots) and superimposed treatments (subplots) for herbicide control of rhizome johnsongrass in soybeans, MAFES North Mississippi Branch, 1980-82.

	Time required for spot treating with					
	Poast 1.5 E			RO 13-8895		Verdict 2E
	1980	1981	1982	1980	1981	1982
	hrs/A[1]					
Basalin 4E (PPI)	0.60 (.36 - .88)	0.49 (.30 - .61)	1.45 (1.24 - 1.69)	0.39 (.30 - .48)	0.43 (.15 - .97)	1.44 (1.27 - 1.75)
Treflan 4E (PPI)	0.86 (.36 - 1.63)	0.65 (.55 - .70)	1.55 (1.27 - 1.85)	0.61 (.24 - 1.03)	0.70 (.55 - .85)	1.48 (.97 0 1.97)
Prowl 4E (PPI)	1.06 (.58 - 1.79)	0.64 (.45 - .85)	1.62 (1.24 - 2.33)	0.64 (.27 - 1.03)	0.79 (.58 - 1.00)	1.59 (1.27 - 1.94)
MBR 18337 2S (PRE)	0.42 (1.8 - 1.15)	0.51 (.30 - .70)	1.41 (1.18 - 1.60)	0.33 (.21 - .58)	0.59 (.21 - .97)	1.41 (1.15 - 1.57)
None	1.14 (1.12 - 1.27)	0.74 (.61 - .88)	1.94 (1.48 - 2.36)	1.28 (1.03 - 1.69)	0.92 (.70 - 1.06)	3.00 (2.21 - 3.93)

[1]Calculated from values recorded for each plot; average of 4 replications with (parentheses) indicating range.
[2]Applied preemergence.

Table 10. Amounts of spray solutions used in postemergence spot treatments of light johnsongrass infestations in soybeans in trials at the MAFES North Mississippi Branch, 1980-82.

	Amount of spray used with					
	Poast 1.5 E			RO 13-8895		Verdict 2E
	1980	1981	1982	1980	1981	1982
	gal/A[1]					
Basalin 4E (PPI)	7.5 (3.9 - 10.4)	3.3 (0 - 6.5)	4.9 (1.3 - 10.4)	14.0 (6.5 - 23.5)	3.9 (1.3 - 10.4)	6.8 (2.6 - 17.0)
Treflan 4E (PPI)	8.5 (3.9 - 17.0)	4.2 (1.3 - 7.8)	6.2 (1.3 - 9.1)	17.6 (1.3 - 61.3)	6.5 (1.3 - 15.7)	6.8 (2.6 - 11.7)
Prowl 4E (PPI)	13.7 (2.6 -23.5)	6.2 (3.9 - 9.1)	9.8 (2.6 - 18.3)	15.0 (7.8 - 27.4)	7.8 (1.3 - 14.4)	8.5 (1.3 - 15.7)
MBR 18337 2S (PRE)	11.1 (3.9 - 19.6)	6.5 (2.6 - 10.4)	11.4 (2.6 - 24.8)	20.2 (14.4 - 23.5)	10.4 (5.2 - 17.0)	8.8 (1.3 - 15.7)
None	36.8 (26.1 - 43.0)	9.5 (7.8 - 11.7)	16.0 (7.8 - 26.1)	51.2 (30.0 - 69.1)	11.7 (6.5 - 17.0)	33.9 (19.6 - 52.2)

[1]Calculated from weights before and after each plot assuming 1 gallon weight 8.35 pounds. Values are an average of 4 replications with parentheses indicating range.
[2]Applied preemergence.