NON-SELECTIVE AND RESIDUAL HERBICIDE TANKMIXES IN NO-TILL RICE

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ABSTRACT

No-till rice production is becoming increasingly popular in Louisiana. A current limitation is the lack of registered herbicides for use in no-till rice. Two studies were conducted in southwestern Louisiana to evaluate a number of burndown herbicides when used alone and in'combination with residual herbicides in tank-mix applications. In 1991, paraquat and glyphosate were applied singly and in combination with either oxyfluorfen or quinclorac 6- and 3-weeks preplant. Weed control was greater and grain yields were significantly higher with both 3-week preplant applications and the residual tankmixes. In 1992, diquat, glyphosate, and glufosinate were applied either singly or in Combination with either quinclorac or thiobencarb 3- and 1-week preplant. Weed control and grain yields were higher with a 1-week preplant application and with the residual tankmixes. These studies indicate the importance of both timing of burndown applications and the use of residual herbicides in combination with burndown herbicides for effective weed control.

Nomenclature: rice, Oryza sativa; paraquat, 1,1'-dimethyl-4,4'-bipyridinium ion; glyphosate, N-(pbosphonomethy1)glycine; oxfluorfen, 2-chloro-l-(3-ethoxy-4-nitrophenoxy)-4-(trifluromethyl) benzene; quinclorac, 3,7-dichloro-8-quinoline-carboxylic acid; diquat, 6,7-dihydrodipyrido[1,2-a:2',1'-c]pyrazinediium ion; glufosinate, 2-amino-4-(hydroxymethylphosphinyl)-butanoic acid; thiobencarb, S-[(4-chlorophenyl)methyl]-diethylcarbamothioate

INTRODUCTION

Conservation tillage practices are slowly being adapted by rice producers in the south. Increased awareness of the importance of soil and water conservation, reducing sediment loss during field drainage, the judicious use of pesticides and other agronomic inputs, and the need to reduce production costs have led to greater interest in no-till or stale seedbed rice production. Since 1987, studies have been conducted in Louisiana to evaluate conservation tillage practices in water- and drill-seeded rice (Bollich, 1991, 1992; Feagley et al., 1992). There is considerable potential for the use of conservation tillage practices in commercial rice production.

Control of existing vegetation prior to no-till rice establishment is critical to successful stand establishment and resulting weed control after seeding. Glyphosate was the only herbicide registered for burndown in rice through 1992. While it does possess broad-spectrum activity, it is ineffective on some semiaquatic broadleaf weed species such as smartweed *(Polygonum pensylvanicum* L.), knotweed *(Polygonum aviculare* L.), and cutleaf evening primrose *(Oenolhera laciniata* Hill). Paraquat and glufosinate are non-selective contact herbicides that give more rapid burndown of preplant vegetation but are not registered for use in rice. Paraquat is registered for use as a burndown in corn, cotton, and soybeans. Glufosinate is not registered for use in any crop at the present time, but is widely used for this purpose outside the U.S. The residual herbicides quinclorac and tbiobencarb are registered for use in rice, but only thiobencarb can be applied in combination with glyphosate as a preplant burndown. Oxyfluorfen is registered for use in fallow bed cotton.

The objective of these two studies was to compare burndown herbicides when used alone and in combination with residual herbicides in no-till rice.

MATERIALS AND METHODS

The experiments were conducted at the Rice Research Station in Crowley, Louisiana, on a Crowley silt loam (fine, montmorillonitic, thermic, Typic Albaqualf). The test area was laser levelled in August of the preceding year for each study. No other soil-disturbing activities occurred until the studies were planted the following spring.

Herbicides and rates of application for both studies are listed in Tables 1 and 2. In 1991, glyphosate and paraquat were applied alone and in combination with either oxyfluorfen or quinclorac at 6

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or 3 weeks prior to seeding. In 1992, glyphosate, diquat, and glufosinate were applied alone and in combination with either quinclorac or thiobencarb either 3 weeks or 1 week prior to seeding. The experiments were designed as randomized complete blocks with herbicide by application time treatment combinations. Rice (cv. Lemont in 1991 and Mayhelle in 1992) was drill-seeded at the rate of 110 lb/acre in 7-inch rows on 24 April 1991 and 19 April 1992. The test areas were flush irrigated as needed to establish stand and facilitate seedling growth. Fertilizer applications of 90-0-0 and 150-40-40 (N-P-K) were applied preflood in 1991 and 1992, respectively. A shallow, permanent flood was established after fertilizer application. An additional midseason application of 58-0-0 was applied in 1991.

An application of molinate and bensulfuron was required after permanent flood establishment in 1991 due to severe weed pressure. In 1992, the test area was treated with bentazon before permanently flooding to control aquatic broadleaf weeds.

Weed control, days to 50% heading, plant height, and grain yield were determined each year. In 1992, stand density was also determined.

RESULTS AND DISCUSSION

Time of burndown application in relation to planting significantly influenced weed control. Control was increased when herbicides were applied 3 weeks preplant in 1991 (Table 1). The 6-week applications did not provide adequate weed control prior to planting. Weed control improved when residual herbicides were applied in combination with either glyphosate or paraquat. No difference in weed control was observed between oxyfluorfen and quinclorac when tank-mixed with either burndown herbicide.

Grain yields were also influenced by time of burndown application and herbicide. Yields were significantly reduced when the burndown herbicides were applied 6 weeks preplant. Regrowth of weeds not controlled by the burndown applications or additional weed reinfestation prior to planting limited their effectiveness. Reduced grain yields appeared to be related to weed competition and possible stand reduction. The 3-week preplant applications were more effective in extending control or suppression of weeds beyond seeding. Yields were also higher when residual herbicides were applied in combination with either glyphosate or paraquat, especially with the 3-week preplant application. Highest grain yields resulted from quinclorac tank-mix combinations.

Stand density was not affected by either time of application or herbicide treatment in 1992 (Table 2). Annual grass control at 30 days after planting (DAP) was increased as time of burndown was decreased to 1-week preplant and residual herbicides were applied in tank-mix combinations. Separate ratings were taken for barnyardgrass *(Echinochloa* spp.) and sprangletop *(Leptochloa* spp.) at 60 DAP. Weed control was also increased with a 1-week preplant application and when residual tank-mix Combinations were applied. Quinclorac and thiobencarb were equally effective in offering residual grass control.

Grain yields in 1992 were influenced by time of burndown application. Yields were significantly higher with a 1-week preplant timing. Yields were also higher when residual herbicides were applied in combination with the burndown herbicides. Yields were similar for quinclorac and thiobencarh when applied as tank-mix combinations.

Results of these studies indicate that preplant weed control is more effective when the time elapsed between herbicide application and planting is minimized. Even when no residual herbicides are included with a burndown application, weed control before and after planting is increased when shorter delays between herbicide application and planting occur. More effective weed control resulted in higher grain yields in each study.

Timely application of burndown-residual herbicide tank-mixes allows the opportunity to reduce application costs in no-till rice. The performance of all of the non-registered herbicides evaluated in these two studies indicates potential for their use in no-till rice establishment. Additional herbicides registered for burndown use in rice would greatly increase the potential for widespread adaptation of conservation tillage practices in southern rice production.

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Table 1. Preplant burndown evaluation in no-till, drill-seeded Lemont rice. Rice Research Station, South Unit. Crowley, LA. 1991.

Eerbicide	Time of application	Rate	1 Control	Days to 501 heading	Plant height	Grain yield at 121 moisture
	(weeks preplant)	(lb ai/A)			(cm)	(lb/A)
Glyphosate	6	1.0	64	81	65	2822
Paraquate	6	.63	33	81	65	3155
Glyphosate + Oryfluorfen	6	1.0 + .25	79	81	67	3363
Paraquat + Oryfluorfen	6	.63 + .25	70	81	70	4257
Glyphosate + Quinclorac	6	1.0 + .5	83	81	71	5012
Paraquat + Quinclorac	6	.63 + .5	65	82	73	5374
Glyphosate	3	1.0	98	82	71	4726
Paraquat	3	.63	95	82	70	4831
Glyphosate + Oryfluorfen	3	1.0 + .63	98	83	72	5271
Paraquat + Oryfluorfen	3	.63 + .25	95	82	73	5336
Glyphosate + Quinclorac	3	1.0 + .5	99	83	79	6408
Paraquat + Quinclorac	3	.63 + .5	97	83	74	6159
C.V.%			12.38	0.77	5.70	13.5
			Main effects			
Time of application:						
6 week preplant			65	81	69	4020
3 week preplant			97	83	73	5455
LSD (0.05)			6	1	2	376
Herbicide:						
Glyphosate			81	82	68	3841
Paraquat			64	82	68	3993
Glyphosate + Oryfluorfen			88	82	70	4317
Paraquat + Oxyfluorfen			82	82	72	4797
Glyphosate + Quinclorac			91	82	75	5710
Paraquat + Quinclorac			81	82	J4	5766
LSD (0.05)			10	ns	4	651
Contrasts:						
Burndown			72	82	68	3883
Burndown tankmix			86	82	72	5147
			•	ns	*	*
Oxyfluorfen			85	82	70	4557
Quinclorac			86	83	74	5738
			us	ns	*	*

* = significant at P = 0.05.
ns = nonsignificant

Table 2. Preplant burndown evaluation in no-till, drill-seeded Maybelle rice. Rice Research Station. South Unit, Crowley, LA. 1992.

Herbicide	Time Of application	Rate	Stand density	2 Grass control' 30 DAP	60 DAF'		Days to 502 heading	Plant height	Grain yield at 122 moisture
				AG	BYG	ST			
	(weeks preplant)	(lb ai/A)	(plants/ft²)					(cm)	(lb/A)
Diquat	3	.5	19	85	80	70	77	101	7113
Diquat + Quinclorac	3	.5 + .375	17	80	77	72	77	100	7743
Diquat + Thiobencarb	3	.5 + 3.0	20	87	82	77	77	101	7436
Glyphosate	3	.75	18	72	72	82	77	101	7722
Glyphosate + Quinclorac	3	.75 + .375	22	85	87	75	77	97	7283
Glyphosate + Thiobencarb	3	.75 + 3.0	21	85	90	82	77	101	7913
Glufosinate	3	.75	21	60	67	57	77	100	7230
Glufosinate + Quinclorac	3	.75 + .375	21	92	87	75	77	103	7944
Glufosinate + Thiobencarb	3	.75 + 3.0	20	85	85	80	77	102	7873
Quinclorac	3	.375	20	95	85	82	78	99	7675
Thiobencarb	3	3.0	19	95	82	87	79	96	7242
Diquat	1	.5	22	90	82	85	77	99	7519
Diquat + Quinclorac	1	.5 + .375	20	97	90	90	77	103	7916
Diquat + Thiobencarb	1	.5 + 3.0	21	100	90	90	77	102	7869
Glyphosate	1	.75	23	95	87	87	77	100	7971
Glyphosate + Quinclorac	1	.75 + .375	21	100	90	85	77	99	8110
Glyphosate + Thiobencarb	1	.75 + 3.0	22	100	90	90	77	99	8098
Glufosinate	1	.75	21	90	80	77	77	100	7600
Glufosinate + Quinclorac	1	.75 + .375	22	97	90	87	76	100	7653
Glufosinate + Ibiobencarb	1	.75 + 3.0	23	97	87	90	76	97	7948
Quinclorac	1	.375	18	97	90	87	79	98	7706
Thiobencarb	1	3.0	18	97	90	90	78	97	7936
c.v.2			16.31	12.41	6.49	11.86	0.64	3.41	5.92
Time of application:									
3-week preplant			20	84	82	77	77	100	7561
1-week preplant			21	97	88	87	77	99	7848
LSD (0.05)			ns	5	2	4	ns	ns	194

Continued.

Table 2. Continued

Eerbicide	Time of application	Rate	Stand density	% Grass control[1] 30 DAP	60 DAP		Days to 502 heading	Plant height	Grain yield at 122 moisture
				AG	BYG	ST			
	(weeks preplant)	(lb ai/A)	(plants/ft²)					(cm)	(lb/A)
Herbicide:									
Diquat			21	87	81	77	77	100	7316
Diquat + Quinclorac			19	89	84	81	77	101	7829
Diquat + Tbiobencarb			21	94	86	a4	77	102	7652
Glyphosate			20	84	80	a5	77	101	7846
Glyphosate + Quinclorac			21	92	89	80	77	98	7697
Glyphosate + Thiobencarb			21	92	90	86	77	100	8005
Glufosinate			21	75	74	67	77	100	7415
Glufosinate + Quinclorac			21	95	89	81	77	101	7799
Glufosinate + Thiobencarb			22	91	86	a5	77	100	7910
Quinclorac			19	96	a7	a5	78	99	7691
Thiobencarb			19	96	86	89	79	96	7589
LSD *(0.05)*			ns	11	05	1	1	ns	ns
Contrasts:									
Burndown			21	82	78	76	77	100	7526
Burndown tankmix			21	92	a7	83	77	100	7815
			ns	*	*	*	ns	ns	•
Quinclorac			21	92	87	81	77	100	7775
Thiobencarb			21	92	87	85	77	101	7856
			ns	ns	ns	ns	ns	ns	ns

[1] DAP = days after planting. Rating for 30 DAP is overall grass rating. Separate ratings were assigned for barnyardgrass and sprangletop 60 DAP.

• = significant at P = 0.05.

ns = nonsignificant