Bulletin 403

Influence of Herbicides on the Spring Transition of Bermudagrass Greens Overseeded with Perennial Ryegrass

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Bermudagrass (Cynodon spp.) golf greens are usually overseeded in the fall with cool-season grasses throughout the southern United States to maintain a dense, green turf while bermudagrass is dormant. However, the overseeded grass can delay transition back to the bermudagrass monostand the following spring and early summer.

Spring management practices of reducing mowing height, delaying fertilization, and reducing soil moisture (Bruneau et al. 1985; Meyers and Horn 1970; Palmertree 1975) influence the transition of cool-season grass to bermudagrass. However, the response from vertical mowing and coring has not been consistent (Bruneau et al. 1985; Mazur and Wagner 1987). The success of management programs often depends on weather conditions and timing of cultivation treatments.

Because results from the management practices vary, a herbicide that would gradually reduce the cool-season grass and permit normal bermudagrass growth during the transition period would be desirable. A uniform turfgrass cover must be maintained during the transition from overseeded ryegrass to bermudagrass in spring and early summer. When ryegrass dies faster than bermudagrass can fill in, the transition is poor. Ideally, the cover of bermudagrass should increase at the same rate that the cover of ryegrass decreases. For a herbicide to be effective, it must gradually remove ryegrass from the bermudagrass without reducing overall turf quality below an acceptable level. Research in Mississippi (Coats et al. 1973) and Georgia (Johnson 1977, 1982) has shown various degrees of injury to overseeded perennial ryegrass (Lolium perenne L.) from the use of pre-emergence herbicides.

Ryegrass response to pronamide has varied with rates and timing of application (Burt and Gerhold 1970; Coats 1975; Johnson 1976; Mazur 1984). Injury from pronamide application in March or April varied from moderate (but acceptable) levels when turfgrass was maintained at a clipping height of 1.0-inch (Johnson 1976) to unacceptable levels when turfgrass was maintained as a putting green (Coats 1975; Mazur 1984). Even though cover quality on the putting green was not acceptable for several weeks after application, of most of the pronamide treatments, treated bermudagrass grew faster during the transition period than did nontreated bermudagrass.

Transition of a bermudagrass green overseeded with perennial ryegrass continues to be a major problem during the spring and early summer, and the injury to overseeded ryegrass from herbicides varies. The present study assessed the effect of herbicides applied in the spring on the quality of overseeded grass and measured their influence on transition to bermudagrass.

Materials and Methods

Herbicides were evaluated in three experiments from 1986 through 1989 at Griffin, Georgia, on a Tifway bermudagrass putting green overseeded with perennial ryegrass. The perennial ryegrass was a mixture of 32.9% 'Palmer', 32.8% 'Prelude', and 32.8% 'Yorktown' (II).

General information. The soil was an Appling sandy loam with pH 6.2, 1.9% organic matter, 77% sand, 13% silt, and 10% clay content. About six weeks before overseeding, the bermudagrass turf was cored and vertically mowed to remove excess thatch. Perennial ryegrass was seeded at 30 lb/1000 ft^2 around October 10. Immediately after seeding, a 0.125-inch layer of sand was applied to the site. The turfgrass was mowed at a height of 3/8-inch for three weeks; then the cutting height was reduced to 9/32-inch until February.

After February, the grass was maintained at a height of 1/4-inch until it was overseeded the following October. The grass was mowed and clippings were removed twice a week during December, January, and February and three times a week during the rest of the year.

The turfgrass was fertilized with 10 lb/1000 ft^2 of 10-10-10 before overseeding in October, and fertilization was repeated the following April and June. Ammonium nitrate at 3.3 lb/1000 ft^2 was applied in November and repeated at monthly intervals except when 10-10-10 was applied. This fertilization schedule was followed every year. Rainfall was supplemented with irrigation as needed.

Turf injury ratings were as follows: 0 = no injury, 1-15 = minor leaf discoloration, 16-30 = moderate leaf discoloration with some plant desiccation, >30 = moderate to severe leaf discoloration and plant desiccation, and 100 = complete kill. The >30% rate of injury to overseeded ryegrass greens is not acceptable.

Turf injury was visually estimated at biweekly intervals from time of treatment in the spring until about mid-July. Transition ratings, based on the percentage of ground cover of ryegrass and bermudagrass, were made at biweekly intervals from mid-May until about mid-July.

Herbicide treatments were arranged in a randomized complete block design with four replications. Plot size was 5 ft by 10 ft. All data were analyzed statistically by year and across years with means separated by LSD at the 0.05 level. Herbicide x year interactions occurred and means are presented separately; herbicide x year interactions are not uncommon. Although moisture was not limited, the difference, in results was probably due to other environmental factors. Nomenclature of herbicides used in all experiments is noted in table 1, while treatment and ratings dates are cited in table 2. None of the herbicides included in these experiments was applied for weed control. Rather, they were used to aid in the transition from overseeded ryegrass to bermudagrass turf.

Table 1. Nomenclature of Herbicides Used on Transition From Overseeded-Perennial Ryegrass to Bermudagrass Experiments in Griffin

Common Name	Trade	Chemical Name	Company
Benefin + oryzalin	XL	oryzalin = 4-(dipropyl-amino) -3,5-dinitroben-zenesulfonamide benefin = N-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl) benzenamine	Dow Elanco
Benefin + oxadiazon	Regal Star	benefin = *given above* oxadiazon = 3-[2,4-dichloro-5- (1-methylethoxy)phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2-(3H)-one	Regal Chemical
Glyphosate	Roundup	N-(phosphonomethyl)glycine	Monsanto
Metribuzin	Sencor	4-amino-6-(1,1-dimethylethyl)-3- (methylthio)-1,2,4-triazin-5(4H)-one	Mobay
MSMA	Daconate 6	Monosodium salt of MAA	Fermenta ASC
Oxadiazon	Ronstar G, WP	*Given above*	Rhone-Poulenc
Paraquat	Gramoxone	1,1'-dimethyl-4,4'-bipyridinium ion	ICI Americas
Pronamide	Kerb	3,5-dichloro(N-1,1-dimethyl-2- propynyl)benzamide	Rohm & Haas

a. Trade and company names are included for the benefit of the reader and do not imply any endorsement or preferential treatment. A given herbicide may have more than one trade name, and the one used is from the company

Table 2. Dates of Treatment and Rating of Herbicides on Transition From Over-seeded Perennial Ryegrass to Bermudagrass Experiments in Griffin

			Date	
Experiment			**Treated**	**Rated**
I	Preemergence herbicides	1986:	March 5	March 21
			April 29	April 3,29
				May 15,29
				June 12,17,30
				July 17
		1987:	March 3	March 23
			April 28	April 6,27
				May 12,27
				June 8,18
				July 7
II	Postemergence herbicides	1986:	April 18	May 1,7,15,29
				June 12,17,30
				July 17
		1987:	April 20	May 5,12
				May 18, 25
				June 8,18
				July 7
III	Pronamide timing	1988:	March 30	April 22,28
				May 12,19,26
			April 14,29	June 2,8,22
			May 12	July 1,13
		1989:	March 29	April 19,24
				May 8,22
			April 12,27	June 1,9,23
			May 15	July 6,17

Preemergence Herbicide Experiment. Herbicides and formulations applied to overseeded perennial ryegrass were: pendimethalin (60DG), oryzalin (4AS), oryzalin + benefin (1 + 1G), oxadiazon (2G and 50WP), and oxadiazon + benefin (1.0 + 0.5G). The oxadiazon + benefin was formulated on urea nitrogen.

However, this slow-acting formulation released very little N before the first ratings were made three weeks later. Oryzalin + benefin, oxadiazon G, and oxadiazon + benefin were applied as granules with a drop spreader, while pendimethalin, oryzalin, and oxadiazon WP were applied as a broadcast spray in 40 gal water/acre.

The herbicides were applied in one or two applications that totaled the amounts indicated in tables 3 and 4. When a single application was used, the full amount was applied March 5, 1986 and March 3, 1987. When two applications were used, one-half of the amount was applied on these dates and one-half on April 29, 1986, and April 28, 1987. Treatments were applied to the same plots each year.

Table 3. Influence of Preemergence Herbicide Treatments on Injury of Bermudagrass Overseeded With Perennial Ryegrass

Treatments			Turf Injury[a] (-% -)							
Herbicide[b]	Rate lb ai/A	Application No.	1986				1987			
			Mar 21	Apr 29	May 29	June 12	Mar 23	Apr 27	May 27	June 18
Untreated	-	-	0	0	0	0	0	0	0	0
Pendimethalin	3.0	1	5	29	0	0	9	7	2	0
	1.5	2	5	13	4	6	1	4	17	0
Oryzalin	2.0	1	14	82	19	3	8	0	0	0
	1.0	2	11	73	20	16	8	1	0	0
Oryzalin + benefin	1.0 + 1.0	1	16	82	19	0	16	5	0	0
	0.5 + 0.5	2	11	75	14	0	13	7	0	0
Oxadiazon G	3.0	1	2	4	0	6	5	0	0	12
	1.5	2	5	5	0	19	3	4	24	41
Oxadiazon WP	3.0	1	52	25	1	0	23	7	0	8
	1.5	2	42	4	38	13	7	4	47	26
Oxadiazon + benefin	2.0 + 1.0	1	4	12	5	0	0	0	0	0
	1.0 + 0.5	2	2	4	18	24	0	0	0	11
LSD 0.05			6	6	15	NS	5	8	15	20

a. Turf injury ratings were based on 0 = no injury, ≥30 = unacceptable, and 100% = complete kill.
b. Herbicides were applied March 5 and April 29, 1986, and March 3 and April 28, 1987.

Table 4. Influence of Preemergence Herbicide Treatments on Transition From Overseeded Perennial Ryegrass to Bermudagrass

Treatments			Ryegrass to bermudagrass transition[a] % cover											
			1986						1987					
			May 15		June 17		July 17		May 12		June 8		July 7	
Herbicide[b]	Rate lb ai/A	Application No.	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye

Untreated	-	-	50	50	56	44	56	39	47	53	53	45	61	38
Pendimethalin	3.0	1	56	40	59	41	61	39	53	41	64	31	80	19
	1.5	2	58	39	60	40	56	44	53	46	55	39	66	31
Oryzalin	2.0	1	58	24	74	25	75	24	81	12	93	4	96	0
	1.0	2	59	24	74	24	76	18	79	12	93	4	95	0
Oryzalin + benefin	1.0 + 1.0	1	56	24	75	23	85	12	80	10	89	3	95	0
	0.5 + 0.5	2	55	38	61	39	63	35	77	16	86	8	94	0
Oxadiazon G	3.0	1	45	55	54	41	56	36	45	55	53	40	53	33
	1.5	2	49	51	57	38	59	36	45	55	55	29	54	26
Oxadiazon WP	3.0	1	46	49	58	42	63	36	54	46	56	41	63	33
	1.5	2	40	60	51	42	51	42	41	40	51	36	58	31
Oxadiazon + benefin	2.0 + 1.0	1	41	59	51	49	60	39	50	40	53	35	59	34
	1.0+ 0.5	2	44	56	51	44	56	39	50	50	54	41	62	37
LSD 0.05			10	11	9	7	9	11	7	7	11	13	10	7

a. Transition ratings are based on turfgrass cover. The cover of bermudagrass and perennial ryegrass must be maintained at ≥90% to be acceptable during the transition period.
b. Herbicides were applied March 5 and April 29, 1986, and March 3 and April 28, 1987.

Postemergence Herbicide Experiment. Herbicides and formulations, applied as a single application at various amounts to overseeded perennial ryegrass on April 18, 1986 and April 20, 1987, were pronamide (50WP), paraquat (2L), glyphosate (4L), metribuzin (75DF), and MSMA (6L). Herbicide rates are noted in tables 5 and 6. All postemergence herbicides were applied as broadcast spray in 40 gal water/acre. A nonionic surfactant (alkylarylpolyoxyethylene glycols free fatty acid isopropanol) was applied with paraquat at 0.5% (v/v). Treatments were applied to different plots each year.

Table 5. Influence of Postemergence Herbicide Treatments on Injury of Bermudagrass Overseeded With Perennial Ryegrass

Treatments		**Turf injury[a]**							
		1986				**1987**			
Herbicide[b]	**Rate**	**May 1**	**May 15**	**June 12**	**July 17**	**May 4**	**May 18**	**June 8**	**July 7**
	lb ai/Acre	**----------% ----------**							
Untreated	-	0	0	0	0	0	0	0	0
Pronamide	0.25	-	-	-	-	3	0	0	0
	0.5	-	-	-	-	7	32	14	0
	0.75	32	48	24	0	8	42	17	0
Paraquat	0.05	-	-	-	-	75	42	3	0
	0.10	83	67	16	0	77	56	3	2
	0.15	83	63	0	0	-	-	-	-
Glyphosate	0.10	28	3	0	2	33	4	1	6
	0.15	39	3	0	0	41	31	0	0

Metribuzin	0.10	24	7	0	0	3	10	1	0
	0.15	43	39	5	0	3	4	11	6
MSMA	0.25	2	5	0	0	-	-	-	-
	0.5	0	0	3	3	-	-	-	-
	1.0	2	0	3	2	3	0	7	7
	2.0	13	3	6	2	8	7	13	0
LSD 0.05		7	12	17	NS	5	11	13	NS

a. Turf injury ratings were based on 0 = no injury, ≥30 = unacceptable, and 100% = complete kill.
b. Herbicides were applied April 18, 1986, and April 20, 1987.

Table 6. Influence of Postemergence Herbicide Treatments on Transition from Overseeded Perennial Ryegrass to Bermudagrass

Treatments		**Ryegrass to bermudagrass transition[a] - % cover -**											
		1986						**1987**					
		May 15		**June 12**		**July 17**		**May 18**		**June 8**		**July 7**	
Herbicide[b]	**Rate lb ai/A**	**Ber**	**Rye**	**Ber**	**Rye**	**Ber**	**Rye**	**Ber**	**Rye**	**Ber**	**Rye**	**Ber**	**Rye**
Untreated	-	50	50	56	44	54	45	50	50	60	38	68	30
Pronamide	0.25	-	-	-	-	-	-	53	47	60	40	88	11
	0.5	-	-	-	-	-	-	59	21	74	14	93	3
	0.75	50	14	70	3	98	0	63	28	79	8	91	3
Paraquat	0.05	-	-	-	-	-	-	66	8	85	9	94	1
	0.10	43	10	59	14	91	0	56	0	85	0	94	0
	0.15	55	8	86	5	97	1	-	-	-	-	-	-
Glyphosate	0.10	49	51	54	46	46	52	50	48	61	38	67	27
	0.15	54	44	51	49	46	54	53	41	65	31	77	21
Metribuzin	0.10	60	40	54	46	53	47	52	48	59	40	76	23
	0.15	45	44	55	38	54	44	54	43	61	29	69	26
MSMA	0.25	48	52	56	44	48	52	-	-	-	-	-	-
	0.5	43	57	51	49	35	61	-	-	-	-	-	-
	1.0	51	49	55	45	53	47	53	47	65	34	74	21
	2.0	45	55	54	46	43	57	55	45	61	33	79	20
LSD 0.05		10	9	13	7	9	9	8	10	12	9	11	12

a. Transition ratings are based on turfgrass cover. The cover of bermudagrass and perennial ryegrass must be maintained at ≥90% to be acceptable during the transition period.
b. Herbicides were applied April 18, 1986, and April 20, 1987.

Pronamide Timing Experiment. Pronamide at 0.25, 0.5, and 0.75 lb/acre was applied ± two days as a single application to different plots March 30, April 13, and 28, and May 14, 1988 and 1989. In addition, pronamide at 0.25 lb/acre was applied in two or three applications to the same plots on March 30 plus April

13, March 30 plus April 28, March 30 plus April 13 plus April 28, and April 13 plus April 28. Treatments are given in tables 7 and 8. Pronamide was applied as a broadcast spray in 40 gal water/acre.

Table 7. Influence of Timing of Pronamide Treatments on Injury of Bermudagrass Overseeded With Perennial Ryegrass

Treatments		Turf Injury[a] (-% -)									
		1988					1989				
Rates	Date Applied	Apr 28	May 12	May 19	June 2	June 22	April 24	May 8	May 22	June 1	June 23
Untreated	-	0	0	0	0	0	0	0	0	0	0
0.25	Mar 30	12	32	6	0	0	1	16	10	0	0
0.25	Apr 13	6	23	12	2	0	0	24	20	21	0
0.25	Apr 28	-	26	16	33	0	-	13	23	25	1
0.25	May 14	-	-	0	26	42	-	-	10	51	27
0.5	Mar 30	49	46	14	0	0	11	30	30	5	0
0.5	Apr 13	10	32	27	0	0	0	34	38	31	25
0.5	Apr 28	-	21	21	26	0	-	15	38	62	36
0.5	May 14	-	-	11	33	37	-	-	9	42	46
0.75	Mar 30	61	54	26	0	0	19	50	27	0	0
0.75	Apr 13	39	58	53	15	0	0	50	63	56	0
0.75	Apr 28	-	31	29	20	0	-	16	46	65	38
0.75	May 14	-	-	4	26	28	-	-	13	52	62
0.25 +0.25	Mar 30 +Apr 13	60	65	41	0	0	1	45	32	6	0
0.25 +0.25	Apr 13 +Apr 28	6	49	35	15	0	0	28	49	7	0
0.25 +0.25	Mar 30 +Apr 28	32	41	27	1	0	1	38	39	16	0
0.25 +0.25 +0.25	Mar 30 +Apr 13 +Apr 28	27	45	27	18	0	2	42	43	11	0
LSD 0.05		12	15	13	15	15	6	15	21	29	16

a. Turf injury ratings were based on 0 = no injury, ≥30 = unacceptable, and 100% = complete kill.

Table 8. Influence of Timing of Pronamide Treatments on Transition From Overseeded Perennial Ryegrass to Bermudagrass

Treatments	Ryegrass to Bermudagrass Transition[a]	
	1988	1989

		May 19		June 2		June 22		July 13		May 22		June 1		June 23		July 17	
Rate lb ai/Acre	Applied Date	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye	Ber	Rye
		----------% cover----------															
Untreated	-	53	47	53	47	60	40	58	42	53	47	58	42	57	42	68	25
0.25	Mar 30	67	33	61	39	70	30	70	30	58	41	63	37	63	33	67	27
0.25	Apr 13	60	38	58	42	72	28	68	30	56	44	58	41	63	35	71	27
0.25	Apr 28	70	30	63	27	73	18	93	0	57	42	57	42	65	27	75	20
0.25	May 14	57	43	57	43	60	17	88	8	55	47	54	46	58	28	82	10
0.5	Mar 30	73	15	97	3	100	0	96	2	63	32	78	22	85	12	88	5
0.5	Apr 13	62	25	78	22	89	11	88	7	61	36	70	25	78	17	92	6
0.5	Apr 28	77	13	82	5	92	0	97	0	61	39	57	38	68	17	87	8
0.5	May 14	59	41	62	38	65	0	98	0	55	45	59	41	63	15	89	5
0.75	Mar 30	72	4	98	2	100	0	92	0	72	20	95	5	95	3	95	0
0.75	Apr 13	63	2	89	5	99	0	95	0	66	10	68	7	87	10	97	0
0.75	Apr 28	73	3	81	7	86	0	99	0	68	28	67	20	63	12	93	0
0.75	May 14	60	40	62	38	67	0	99	0	57	43	57	40	59	7	85	0
0.25+0.25	Mar 30+Apr 13	66	6	92	7	100	0	98	0	68	25	77	23	83	13	87	3
0.25+0.25	Apr 13+Apr 28	65	18	77	17	92	0	99	0	68	30	70	25	78	13	93	5
0.25+0.25	Mar 30+Apr 28	70	3	91	7	98	0	90	0	65	28	77	23	87	12	93	0
0.25+0.25+0.25	Mar 30+Apr 13+Apr 28	72	10	88	8	98	0	98	0	68	23	79	19	87	13	96	0
LSD 0.05		11	8	11	9	12	8	10	7	7	7	11	14	12	15	13	13

a. Transition ratings are based on turfgrass cover. The cover of bermudagrass and perennial ryegrass must be maintained at ≥90% to be acceptable during the transition period.

Results and Discussion

Preemergence Herbicide

Turf injury. The injury to overseeded ryegrass in 1986 was higher when treated with oryzalin or oryzalin + benefin in 1986 than in 1987 (table 3). Only slight-to-moderate injury occurred within three weeks after treatment. However, by late April 1986, injury from oryzalin was severe whether it was applied alone or with benefin, regardless of rate. The turf treated with oryzalin or oryzalin + benefin did not fully recover until mid-June. Recovery resulted when bermudagrass grew in areas where ryegrass was severely injured or killed. There was no ryegrass injury from either oryzalin or oryzalin + benefin at eight weeks after treatment in 1987. Because turfgrass fully recovered by late April, it maintained a high quality turf throughout May and June. The variation in ryegrass injury from oryzalin and oryzalin + benefin during 1986 and 1987 was not due to soil type, as the herbicides were applied to the same plots both years. However, air temperature may have caused the difference in response. During the first week in April, the mean temperature was 68°F in 1986; in 1987 it was only 44°F. The warmer temperature in 1986 may have increased the activity of the herbicide on ryegrass. In only one year did oryzalin applied alone or with benefin injure overseeded ryegrass. However, neither herbicide should be applied to ryegrass seeded the previous fall.

Ryegrass treated in 1986 with oxadiazon WP at 3.0 lb/acre was severely injured in March three weeks after treatment but had fully recovered by May 29 (table 3). The initial injury to ryegrass from oxadiazon WP was mostly leaf discoloration, with little or no stand loss. When ryegrass was treated at 1.5 lb/acre on March 3, recovery was faster. Ryegrass was treated with oxadiazon WP at 1.5 lb/acre on March 3 and treatment was repeated on April 29. An injury rating of 38% was recorded in late May, but the ryegrass was fully recovered by mid-June. Thus, a split application of oxadiazon WP did not reduce ryegrass injury, as compared to a single application. Oxadiazon G caused only slight discoloration in 1986.

In 1987, oxadiazon WP at 3.0 lb/acre moderately injured (23%) ryegrass in March 23 at three weeks after treatment (table 3). When application was reduced to 1.5 lb/acre, ryegrass was injured only slightly (7%) in March and April, but injury was severe (47%) in May following the second application. The turf did not recover from two applications by June 18. Oxadiazon G applied at 3.0 lb/acre did not injure overseeded ryegrass throughout the spring or early summer. However, treating the grass with 1.5 lb/acre on March 3 and April 28 caused some discoloration (24%) in May and severe injury (41%) in June. The higher injury rate from multiple oxadiazon WP applications in 1987 than from similar applications in 1986 was not due to temperature. The mean air temperature for one month after the second application was 69°F in 1986, compared to 70°F in 1987.

Therefore, split application of oxadiazon G injured the overseeded ryegrass too severely to be acceptable in one of the two years. A 1982 Georgia study reported that oxadiazon G injured overseeded ryegrass when applied at 2.0 lb/acre or higher (Johnson). However, a later study found no damage from a similar treatment (Johnson 1987). In the present study, oxadiazon G did not injure overseeded ryegrass when applied as a single application at 3.0 lb/acre in early March. However, ryegrass was severely injured in late May and June when treated twice with 1.5 lb/acre once in early March and again in late April.

The injury to overseeded ryegrass treated with pendimethalin was higher in 1986 than in 1987 (table 3). Maximum injury in 1986 was 29% in April at eight weeks after treatment with 3.0 lb/acre, compared with 17% May 27, 1987, in plots treated twice with 1.5 lb/acre (March 3 and April 28).

Oxadiazon + benefin caused slight injury to overseeded ryegrass in April and May in one of two years (table 3). In most instances, the amount of injury was commercially acceptable.

Transition. Oryzalin at 2.0 lb/acre applied as a single application or 1.0 lb/acre applied at each of two applications and oryzalin + benefin applied at 1.0 + 1.0 lb/acre as a single application injured overseeded ryegrass too severely to be acceptable in 1986 (table 3) and resulted in a poor transition (table 4). Ryegrass cover was reduced to 24% in these treated plots by mid-May, compared to a 50% cover found in nontreated plots. Since the amount of cover of bermudagrass in treated plots (56% to 59%) was no higher than in nontreated (50%) plots, the total turfgrass cover ranged from 80% to 83%. However, oryzalin and oryzalin + benefin did not affect bermudagrass growth, so that there was almost complete cover by the grasses in June. When oryzalin + benefin was applied at 0.5 + 0.5 lb/acre in two applications in 1986, ryegrass cover

in May was 12% lower than in nontreated plots, but the total cover [bermudagrass (55%) plus ryegrass (38%)] was acceptable at 93%. In 1987, the transition from ryegrass to bermudagrass with oryzalin and oryzalin + benefin treatments was acceptable and faster than the previous year. Total turfgrass cover was at least 90% in mid-May, while ryegrass cover ranged from 10% to 16% and bermudagrass cover ranged from 77% to 81%. During June, ryegrass cover in untreated plots was higher and bermudagrass cover was lower than in plots treated with oryzalin or oryzalin + benefin at 1.0 + 1.0 lb/acre.

Neither oxadiazon formulation nor pendimethalin influenced the transition of overseeded ryegrass to bermudagrass in 1986, compared with the untreated (table 4). Combinations of oxadiazon + benefin did not influence the transition in either year. In 1987, pendimethalin at 3.0 lb/acre applied as a single application in early March had reduced ryegrass cover by 12% in May, 14% in June, and 19% in July, but an acceptable turf cover of 94% to 99% was maintained during this period. Pendimethalin applied at 1.5 lb/acre on March 4 and April 29 did not influence turfgrass transition.

Oxadiazon formulations applied at 3.0 lb/acre March 4 and April 29 during 1987 did not affect the transition of overseeded ryegrass to bermudagrass (table 4). However, when 1.5 lb/acre was applied on March 4 and repeated on April 29, the ryegrass cover was reduced faster than bermudagrass could increase in May from WP formulation and in June and July from G formulation. Since total turfgrass cover was <90%, results from these oxadiazon treatments would not be commercially acceptable. These results show that the effectiveness of preemergence herbicides applied to overseeded perennial ryegrass for summer weed control will vary during the spring transition period.

Oryzalin + benefin at 0.5 + 0.5 lb/acre applied in early March and repeated in late April hastened the transition period. Pendimethalin applied at 3.0 lb/acre as a single application in early March did not influence transition in 1986, but hastened transition in 1987. Pendimethalin did not influence the transition from overseeded ryegrass to bermudagrass as much as did oryzalin + benefin, but the transition in the pendimethalin-treated plots was faster than the transition of turfgrass growing in nontreated plots. It should be emphasized that when herbicides hasten transition, some degree of ryegrass injury may result. The discoloration from herbicides possibly can be tolerated more in some turf areas, such as golf course fairways (>30%), than in other areas, such as golf course tees and greens (<30%).

Postemergence Herbicide

Turf injury. Paraquat severely injured overseeded ryegrass, regardless of application rate (table 5). Glyphosate caused moderate- to-severe injury early in 1986 and 1987, while metribuzin caused similar injury only in 1986. Turf treated with either glyphosate or metribuzin fully recovered without any sod cover loss. MSMA at 2.0 lb/acre caused only slight discoloration and the turf fully recovered without any sod loss.

The injury to overseeded ryegrass from pronamide at 0.75 lb/acre was severe in 1986 and 1987 (table 5). In 1986, ryegrass injury from pronamide at 0.75 lb/acre increased rapidly and remained high until after mid-May, when bermudagrass began to recover. The rapid reduction in ryegrass cover with no initial increase in bermudagrass cover (table 6) resulted in a poor quality turf . In contrast, it is not known why the ryegrass was injured for a shorter period in May 1987 from pronamide at the same rate.

In 1987, the injury to overseeded ryegrass was similar whether pronamide was applied at 0.5 or 0.75 lb/acre (table 5). However, the grass was not injured when pronamide was applied at 0.25 lb/acre.

Transition. Overseeded ryegrass treated with paraquat was injured too severely to be acceptable; also, transition from ryegrass to bermudagrass was poor (table 6). Ryegrass was killed faster than bermudagrass could grow. Although glyphosate and metribuzin caused moderate-to-severe injury to ryegrass, the herbicides did not hasten the transition to bermudagrass. MSMA also did not influence the transition from ryegrass to bermudagrass.

Pronamide applied at 0.75 lb/acre in 1986 resulted in a poor transition from overseeded ryegrass to bermudagrass (table 6). Because the injury to the overseeded ryegrass from pronamide at the same rate in 1987 was gradual, the quality of turf during the transition period was improved. The total turfgrass cover in May 1986 was 64%, compared with 91% cover during the same period the following year. The mean air temperature for four weeks after treatment in 1986 was 65°F, slightly cooler than the mean air temperature recorded during the same period in 1987 (69°F). Apparently, warm temperatures favor bermudagrass growth more than do cooler temperatures.

In 1987, the transition from overseeded ryegrass to bermudagrass from pronamide at 0.5 and 0.75 lb/acre was similar, and injury levels were not acceptable in May or June (table 6). Total turf cover ranged from 80% (May 18) in plots treated at 0.5 lb/acre on May 18 to 87% in plots treated at 0.75 lb/acre on June 8. However, the transition was acceptable when the herbicide was applied at 0.25 lb/acre. Mazur (1984) reported that 0.25 lb/acre of pronamide resulted in a rapid increase in bermudagrass, but the discoloration of ryegrass and increase in open space resulted in an unacceptable reduction in turfgrass quality. In the present study, pronamide at 0.25 lb/acre did not affect the transition from overseeded ryegrass to bermudagrass in May or June, but ryegrass cover was lower and bermudagrass cover was higher in July with a total turf cover of 99%. Pronamide at 0.25 lb/acre did not discolor the overseeded ryegrass, and the transition to bermudagrass was slower than in plots treated at 0.5 or 0.75 lb/acre. The slower transition did not occur until late spring and early summer; i.e., at the time that favored optimum bermudagrass growth. Pronamide was the only herbicide that showed any potential for hastening the transition of overseeded ryegrass to bermudagrass during the spring and early summer. For turfgrass growers using overseeded mixtures that include species other than perennial ryegrass, the herbicides discussed may not provide the same results.

Timing of Pronamide

Turf injury. The initial pronamide injury to overseeded perennial ryegrass increased as the rate increased from 0.25 to 0.75 lb/acre (table 7). However, the degree and duration of injury occurring for each rate varied with application dates. The maximum injury was lower when pronamide was applied at 0.25 lb/acre on April 13 (24%) than when it was applied on March 30 (32%), April 28 (33%) and May 14 (51%). When a rate of 0.25 lb/acre was applied in two or more applications, unacceptable turf injury occurred over a longer period than when ryegrass was treated once on March 30 or April 13 at the same rate.

When the pronamide rate was increased to 0.5 lb/acre, maximum injury to overseeded ryegrass was not always higher, compared to a pronamide rate of 0.25 lb/acre (table 7). Perennial ryegrass injury with pronamide at 0.5 lb/acre applied on March 30 was 49% in 1988 when rated on April 28 at four weeks after treatment, but injury was reduced to 14% by May 19 at seven weeks after treatment. In 1989, the injury was 30% at five weeks after treatment from a similar date when rated on May 8, but had decreased to 5% by June 1. When the application of pronamide at 0.5 lb/acre was delayed until April 13, 1988, the maximum injury was 32% at four weeks after treatment, compared with maximum injury of 49% at four weeks after treatment. In 1989, the maximum injury from treatment on April 13 was slightly higher (38%) and the injury (>30%) occurred over a longer period than when treatment was applied on March 30. The injury to overseeded ryegrass from the April 13 treatment in 1989 also lasted over a longer period than the injury incurred during the same time in 1988.

In 1989, when pronamide at 0.5 lb/acre was delayed until April 28 or May 14, ryegrass injury was severe (62% to 65%). Also, the maximum injury was higher than when a similar rate of treatment was applied on March 30 (30%) or April 13 (38%) (table 7). Differences were not as great between dates of treatment at 0.5 lb/acre in 1988.

A single pronamide application at 0.75 lb/acre severely injured perennial ryegrass in 1988 and 1989, regardless of the application date (table 7).

All pronamide treatments caused some degree of unacceptable injury (>30%) to perennial ryegrass following application. However, ryegrass injury from pronamide can be regulated in part by selected dates and rates of application.

Pronamide at 0.25 lb/acre applied either on March 30 or April 13 hastened the transition of overseeded perennial ryegrass back to bermudagrass only slightly in 1988 but not at all in 1989 (table 8). In 1988, when the application date was delayed until April 28, the spring transition was faster through June, and was nearly completed (93% bermudagrass - 0% ryegrass) by July 13. The spring transition following the May 14 application date was less effective than following the April 28 date.

Pronamide applied at 0.25 lb/acre in two or three applications did not provide a good smooth transition in 1988 (table 8). Therefore, pronamide applied more than once injured ryegrass faster than bermudagrass could initiate spring growth. Total cover of bermudagrass and ryegrass was 73% to 83% when ratings were made on May 19. In 1989, total turf cover was > 90% during the same period.

Differences in the number of herbicide applications (two or three) and in the application dates did not affect the transition in July in either year.

Pronamide applied at 0.5 lb/acre March 30 or April 13 resulted in excellent transition from overseeded perennial ryegrass to bermudagrass (table 8). When the application date was delayed until April 28 or later, turf cover was <90% at some time during June and July. A similar response also occurred with 0.75 lb/acre, except that the transition on June 1, 1989, was poor when ryegrass was treated on April 13.

Pronamide hastened the spring transition of bermudagrass overseeded with perennial ryegrass. Although pronamide caused some injury to overseeded perennial ryegrass, the optimum results were obtained when pronamide at 0.5 lb/acre was applied on April 13. Bermudagrass overseeded with perennial ryegrass exhibited moderate injury for most of May but maintained a smooth transition with ≥95% total cover during June and July. Using a single application at 0.5 lb/acre on April 13 resulted in less turf injury than was caused by two applications at 0.25 lb/acre. For turfgrass growers using overseeded mixtures that include species other than perennial ryegrass, the results of this study may not be applicable.

Summary and Conclusions

Three experiments were conducted to determine the effects of herbicides on injury and spring transition of overseeded perennial ryegrass back to bermudagrass green. Major conclusions are as follows:

1. Pendimethalin applied at 3.0 lb/acre in early March hastened the transition from overseeded ryegrass to bermudagrass in one of two years, but 1.5 lb/acre applied in each of two applications did not.

2. Oryzalin, oryzalin + benefin, or paraquat severely injured ryegrass, while oxadiazon at 3.0 lb/acre, oryzalin + benefin, glyphosate, metribuzin, or MSMA did not affect transition from overseeded ryegrass to bermudagrass.

3. Pronamide applied as a single application at 0.75 lb/acre or multiple applications at 0.25 lb/acre severely injured overseeded ryegrass.

4. All pronamide treatments injured overseeded ryegrass. However, the injury from 0.5 lb/acre applied once at mid-April was within the acceptance level except from one to three weeks during May or early June and resulted in a good transition with ≥95% total cover during the spring and summer. Pronamide applied once at 0.25 lb/acre did not consistently affect transition.

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