

2014 Ryan Lawn and Tree Overseeding Evaluation

University of Nebraska-Lincoln & Kansas State University

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This study was done at the Rocky Ford Turfgrass Research Center in Manhattan, KS, and the John Seaton Anderson Turfgrass Research Center at Mead, NE. Tall fescue was seeded into an existing site of turf that was killed with Roundup+Reward applied two weeks prior to seeding. Plots were established by seeding tall fescue at 10 lbs/1000 sq ft, initial application of herbicides, power raking in two directions and then an application of 11-52-0 at 1 lb P2O5/1000 sq ft. Plots were 5' x 5' and each location had three replications. Applications were made with a CO2 backpack sprayer using a three nozzle boom with 8002vs nozzles at 30 psi in 2 gal/1000ft, or spread with a shaker can. Sites were irrigated to promote germination and prevent seedling stress with irrigation frequency decreased as plots matured. Areas were mowed at 2.5" once seedlings reached approximately 3" and weekly thereafter. Cover ratings of tall fescue, large crabgrass, and yellow foxtail were taken on 2week intervals. This experiment was designed as a 2 X 2 X 6 factorial with two active ingredients, two formulations each, and six application strategies. The data have not been fully analyzed yet since the studies will likely be repeated again next year, but following are our preliminary results.

Formulations used:

Dithiopyr granular= Andersons 0.25% Dimension DG PRO SGN 150

Dithiopyr sprayed= Dimension 2EW

Prodiamine granular= Andersons 0.48 Barricade DG PRO SGN 150

Prodiamine sprayed= Barricade 65WDG

KSU Applications (the first study was overrun by bermudagrass so re-initiated later in the summer)

6-6-2014 Seeding and first applications

7-6-2014 Second application plus starter fert same as above

UNL Applications

4-18-2014 Seeding and first applications

5-16-2014 Second application plus starter fert same as above

Overall results

Full results are provided in Table 1 and 2, and later tables include only that data pertinent to the specific questions. With less crabgrass pressure, the untreated check in Kansas had 93% cover of tall fescue at 84 days after initial treatment (DAIT) in spite of the later seeding date. The untreated check had 31% more tall fescue than the next best treatment. This indicates that our herbicide treatments do have an inhibitory effect on tall fescue in the absence of crabgrass pressure and/or with later summer seedings. With earlier seeding in Nebraska, tall fescue reached 64% cover in the untreated check by 84 DAIT (Table 1) while crabgrass cover was 25% (Table 2). However, a number of treatments reached >90% tall fescue cover with reduced crabgrass competition in the treated plots showing the benefit of preemergence herbicide use in new spring seedings.

Specific questions

Determine if dithiopyr or prodiamine is safest on TTF seedlings while still affording adequate crabgrass control.

In Nebraska, dithiopyr applied at 0.25 lbs ai/A once or twice produced tall fescue cover of >76% by 84 DAIT (Table 3), which was in the highest performing statistical group and slightly better than similar applications of prodiamine. Additionally, dithiopyr treatments produced lower crabgrass cover than prodiamine (Table 4). There was little difference in tall fescue or crabgrass cover between the similar applications of dithiopyr and prodiamine in Kansas (Tables 3 and 4).

Determine if initial application of PRE is essential during seeding.

At-seeding applications of dithiopyr or prodiamine, regardless of formulation, limited establishment compared to the same application made 4 weeks after seeding in both Kansas and Nebraska (Table 5). Tall fescue in many of the at-seeding treatments recovered to a similar level as the 4 week treatments by 84 DAIT with the weed pressure in Nebraska, but not in Kansas. In Nebraska, the at-seeding application of dithiopyr did not reduce crabgrass cover compared to the 4 week applications during the study (table 6). Conversely, the at-seeding application of dithiopyr liquid at 0.25 lbs ai/A in Nebraska produced higher crabgrass cover than the 4 week application of the same treatment (Table 6). With prodiamine, the at-seeding application often reduced crabgrass cover compared to the 4 week application in Nebraska (Table 6).

Determine if various application timings and/or rates will improve seedling safety and/or crabgrass control.

Single applications at seeding of dithiopyr or prodiamine produced the lowest cover of tall fescue, regardless of location or formulation (Table 1). Some of the best performing treatments for tall fescue cover in Kansas include most of the single applications made at 4 weeks after seeding (with no initial application) and almost regardless of active ingredient and formulation (Table 1). As mentioned earlier, this was likely due almost entirely to limiting damage to the more mature tall fescue seedlings since there was virtually no crabgrass pressure. The 4-week applications of dithiopyr also produced the highest tall fescue cover in Nebraska by 84 DAIT (Table 1), though some at-seeding applications at 0.25 lbs ai/A and

or sequentials at 0.25 + 0.25 lbs ai/A also produced adequate cover of tall fescue by 84 DAIT. Prodiamine treatments produced less tall fescue cover at 84 DAIT than dithiopyr treatments in NE (Table 1), probably due to poorer crabgrass control by prodiamine versus dithiopyr (Table 2)

Determine if formulation in the first or second app makes a difference in overseeding success/crabgrass control.

When dithiopyr or prodiamine was sprayed in the first application, it produced slightly lower tall fescue cover up to 71 DAIT than the granular formulation in Nebraska (Table 7). However, tall fescue recovered by 84 DAIT and formulation had no effect on cover. However, the opposite trend occurred in Kansas. Since overall tall fescue cover was lower in Kansas, trends were harder to detect. Formulation had no effect on crabgrass cover in either location (Table 8).

Conclusions

1. These treatments do have an inhibitory effect on tall fescue, so applications should be used with caution only on properties with known crabgrass pressure. Furthermore, outside stresses like drought or high temperatures may exaggerate the damage.
2. Dithiopyr appears to be slightly safer than prodiamine for this use and applications 4 weeks after seeding appear to be safer on tall fescue and as effective for crabgrass control as at-seeding applications.
3. Granular (on fertilizer) formulations appear to be safer on tall fescue than sprayable formulations

Future: This study is being repeated in 2015 to help clarify some of the questions created between two markedly different seeding dates.

Application Description	KSU		UNL	
	A	B	A	B
Application Date:	6/6/2014	7/6/2014	4/18/2014	5/16/2014
Time of Day:	12:00pm	12:00pm	10am	9am
Application Method:	SPRAY	SPRAY	SPRAY	SPRAY
Application Placement:	BROADC	BROADC	BROADC	BROADC
Air Temperature, Unit:	86.3 F	92.1 F	52 F	50 F
% Relative Humidity:	43.2	68.2	57	56
Wind Velocity, Unit:	3 MPH	7.2 MPH	7 MPH	4 MPH
Dew Presence (Y/N):	N no	N no	N no	N no
Soil Temperature, Unit:	81 F	84 F	46 F	52 F
Soil Moisture:	NORMAL	NORMAL	NORMAL	NORMAL

Table 1. Percent cover of tall fescue following various single or sequential pre-emergence applications during establishment at KSU or UNL (all treatments)

		KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center								
Crop Name		Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue			
Rating Date		6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014			
Rating Type		Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground			
Rating Unit		%	%	%	%	%	%	%	%	%	%	%	%			
Days After First/Last Applic.		17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56			
Trt No.	Treatment Name	Rate	Unit	Appl Cod	1	3	5	7	9	11	1	2	3	4	5	6
1	Dithiopyr Granular	0.25	lb ai/a	A	1 e	4 d	9 e	9 f	11 e	12 fgh	20 fg	42 fg	67 cde	85 abc	88 ab	93 a
2	Dithiopyr Granular	0.25	lb ai/a	AB	7 cde	6 d	7 e	9 f	9 e	12 fgh	23 def	48 def	65 de	80 b-e	82 a-e	85 a-d
3	Dithiopyr Granular	0.25	lb ai/a	A	3 e	4 d	5 e	6 f	7 e	8 gh	27 bcd	50 cde	63 def	80 b-e	83 a-d	88 abc
	Dithiopyr Liquid	0.25	lb ai/a	B												
4	Dithiopyr Liquid	0.25	lb ai/a	A	1 e	2 d	3 e	3 f	4 e	12 gh	4 ij	12 j	37 hi	62 h-k	68 gh	77 a-f
5	Dithiopyr Liquid	0.25	lb ai/a	A	10 b-e	18 cd	28 cde	18 ef	16 de	18 e-h	4 ij	12 j	23 j	53 kl	57 ijk	62 e-h
	Dithiopyr Granular	0.25	lb ai/a	B												
6	Dithiopyr Liquid	0.25	lb ai/a	AB	1 e	2 d	4 e	3 f	4 e	5 gh	7 i	20 i	38 hi	60 ijk	67 ghi	78 a-e
7	Dithiopyr Granular	0.25	lb ai/a	B	20 a-d	42 ab	57 abc	50 abc	52 abc	62 b	30 ab	60 ab	83 ab	88 ab	88 ab	90 abc
8	Dithiopyr Liquid	0.25	lb ai/a	B	24 ab	36 abc	43 bcd	45 b-e	50 abc	48 b-e	30 ab	60 ab	85 a	92 a	92 a	92 ab
9	Dithiopyr Granular	0.5	lb ai/a	A	0 e	1 d	1 e	4 f	4 e	4 gh	4 ij	8 jk	23 j	48 l	53 jk	60 fgh
10	Dithiopyr Liquid	0.5	lb ai/a	A	0 e	0 d	1 e	1 f	2 e	3 h	1 j	2 k	8 k	17 m	20 l	27 j
11	Dithiopyr Granular	0.5	lb ai/a	B	22 a-d	53 a	57 abc	53 abc	52 abc	50 bcd	28 abc	60 ab	83 ab	77 c-f	72 e-h	58 gh
12	Dithiopyr Liquid	0.5	lb ai/a	B	6 de	17 cd	30 b-e	25 c-f	28 cde	32 b-h	28 abc	60 ab	78 ab	83 a-d	87 abc	90 abc
13	Prodiamine Granular	0.38	lb ai/a	A	1 e	5 d	7 e	12 f	18 de	22 d-h	22 efg	50 cde	77 abc	82 a-e	80 b-f	76 b-f
14	Prodiamine Granular	0.38	lb ai/a	AB	1 e	2 d	4 e	6 f	9 e	13 fgh	27 bcd	53 b-e	82 ab	80 b-e	77 c-g	73 c-g
15	Prodiamine Granular	0.38	lb ai/a	A	0 e	3 d	6 e	4 f	8 e	15 fgh	20 fg	47 efg	73 bcd	78 b-f	75 d-g	70 d-g
	Prodiamine Liquid	0.38	lb ai/a	B												
16	Prodiamine Liquid	0.38	lb ai/a	A	1 e	2 d	7 e	11 f	16 de	29 c-h	13 h	28 h	52 g	68 f-i	68 gh	65 e-h
17	Prodiamine Liquid	0.38	lb ai/a	A	11 b-e	19 bcd	21 de	20 def	26 cde	34 b-g	13 h	30 h	47 gh	65 g-j	62 hij	52 hi
	Prodiamine Granular	0.38	lb ai/a	B												
18	Prodiamine Liquid	0.38	lb ai/a	AB	1 e	3 d	8 e	12 f	15 de	22 d-h	12 h	30 h	53 fg	75 c-g	72 e-h	62 e-h
19	Prodiamine Granular	0.38	lb ai/a	B	29 a	39 abc	48 a-d	53 abc	55 abc	55 bc	28 abc	57 abc	80 ab	75 c-g	73 d-g	67 e-h
20	Prodiamine Liquid	0.38	lb ai/a	B	16 a-e	42 ab	58 ab	57 ab	60 ab	60 bc	28 abc	60 ab	82 ab	83 a-d	80 b-f	73 c-g
21	Prodiamine Granular	0.75	lb ai/a	A	0 e	2 d	2 e	2 f	2 e	3 h	18 g	40 g	57 efg	72 e-h	72 e-h	70 d-g
22	Prodiamine Liquid	0.75	lb ai/a	A	0 e	0 d	2 e	2 f	3 e	6 gh	5 ij	15 ij	32 ij	55 jkl	50 k	38 ij
23	Prodiamine Granular	0.75	lb ai/a	B	22 a-d	38 abc	48 a-d	48 bcd	50 abc	58 bc	32 a	62 a	82 ab	82 a-e	82 a-e	77 a-f
24	Prodiamine Liquid	0.75	lb ai/a	B	23 abc	42 ab	50 a-d	48 bcd	44 bcd	43 b-f	25 cde	55 a-d	78 ab	72 e-h	70 fgh	63 e-h
25	Untreated Check				25 ab	50 a	75 a	77 a	80 a	93 a	27 bcd	60 ab	80 ab	73 d-g	72 e-h	68 d-h
LSD (P=.05)					16.5	23.1	29.8	28.7	30.6	30.9	4.8	6.9	10.5	11.2	11.4	17.0
Standard Deviation					10.0	14.0	18.1	17.4	18.5	18.8	2.9	4.2	6.3	6.8	6.9	10.3
CV					111.3	81.3	77.7	75.4	74.2	65.3	15.4	10.3	10.4	9.5	9.6	14.6
Treatment F					3.076	5.449	5.177	5.166	4.622	4.906	35.893	65.57	39.151	16.462	14.602	7.401
Treatment Prob(F)					0.0005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 2. Percent cover of large crabgrass following various single or sequential pre-emergence applications during establishment at KSU or UNL (all treatments)

		KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center								
Pest Name		Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass		
Rating Date		6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014			
Rating Type		Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground			
Rating Unit		%	%	%	%	%	%	%	%	%	%	%	%			
Days After First/Last Applic.		17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56			
Trt No.	Treatment Name	Rate	Unit	Appl Cod	2	4	6	8	10	12	7	8	9	10	11	12
1	Dithiopyr Granular	0.25	lb ai/a	A	0 a	2 a	5 a	6 a	16 a	22 a	0 a	0 f	2 hi	1 hi	1 hi	2 hi
2	Dithiopyr Granular	0.25	lb ai/a	AB	1 a	3 a	4 a	4 a	4 a	2 a	0 a	0 f	1 hi	1 hi	1 hi	3 ghi
3	Dithiopyr Granular	0.25	lb ai/a	A	0 a	1 a	3 a	4 a	4 a	4 a	0 a	0 f	1 hi	1 hi	1 hi	2 hi
	Dithiopyr Liquid	0.25	lb ai/a	B												
4	Dithiopyr Liquid	0.25	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	3 ghi	9 def	11 c-f	15 c-f
5	Dithiopyr Liquid	0.25	lb ai/a	A	2 a	8 a	5 a	15 a	17 a	15 a	0 a	0 f	1 hi	0 i	1 i	1 hi
	Dithiopyr Granular	0.25	lb ai/a	B												
6	Dithiopyr Liquid	0.25	lb ai/a	AB	0 a	1 a	2 a	2 a	2 a	2 a	0 a	0 f	1 hi	0 i	1 hi	1 i
7	Dithiopyr Granular	0.25	lb ai/a	B	1 a	4 a	7 a	7 a	7 a	7 a	0 a	2 bcd	12 cde	2 ghi	3 ghi	5 ghi
8	Dithiopyr Liquid	0.25	lb ai/a	B	0 a	1 a	3 a	2 a	2 a	4 a	0 a	0 f	4 f-i	1 hi	1 hi	1 hi
9	Dithiopyr Granular	0.5	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 f	1 hi	0 i	0 i	0 i
10	Dithiopyr Liquid	0.5	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 f	0 i	2 ghi	3 ghi	5 ghi
11	Dithiopyr Granular	0.5	lb ai/a	B	1 a	5 a	7 a	6 a	6 a	5 a	0 a	1 c-f	6 fgh	1 hi	1 hi	1 i
12	Dithiopyr Liquid	0.5	lb ai/a	B	0 a	2 a	3 a	2 a	2 a	2 a	0 a	0 ef	3 ghi	1 hi	1 hi	1 i
13	Prodiamine Granular	0.38	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	1 cde	13 cd	15 bc	15 bc	17 b-e
14	Prodiamine Granular	0.38	lb ai/a	AB	0 a	1 a	0 a	0 a	0 a	0 a	0 a	1 cde	13 cd	10 cde	11 c-f	12 d-g
15	Prodiamine Granular	0.38	lb ai/a	A	1 a	0 a	3 a	4 a	5 a	4 a	0 a	3 ab	13 cd	8 d-g	8 d-g	12 d-g
	Prodiamine Liquid	0.38	lb ai/a	B												
16	Prodiamine Liquid	0.38	lb ai/a	A	0 a	0 a	2 a	2 a	2 a	1 a	0 a	1 cde	8 def	9 c-f	7 e-h	7 f-i
17	Prodiamine Liquid	0.38	lb ai/a	A	1 a	4 a	6 a	6 a	6 a	3 a	0 a	1 def	8 def	3 f-i	4 ghi	6 ghi
	Prodiamine Granular	0.38	lb ai/a	B												
18	Prodiamine Liquid	0.38	lb ai/a	AB	1 a	0 a	1 a	1 a	1 a	0 a	0 a	1 c-f	8 efg	4 e-i	5 f-i	7 f-i
19	Prodiamine Granular	0.38	lb ai/a	B	1 a	1 a	5 a	9 a	8 a	6 a	0 a	2 abc	20 ab	20 ab	20 ab	23 abc
20	Prodiamine Liquid	0.38	lb ai/a	B	1 a	2 a	6 a	6 a	7 a	3 a	0 a	2 bcd	15 bc	13 cd	14 bcd	20 a-d
21	Prodiamine Granular	0.75	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	4 f-i	7 e-h	6 e-i	5 ghi
22	Prodiamine Liquid	0.75	lb ai/a	A	1 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	3 f-i	7 e-h	9 d-g	10 e-h
23	Prodiamine Granular	0.75	lb ai/a	B	1 a	1 a	3 a	4 a	4 a	4 a	0 a	2 abc	17 abc	13 cd	12 cde	12 d-g
24	Prodiamine Liquid	0.75	lb ai/a	B	1 a	2 a	7 a	6 a	8 a	5 a	0 a	3 a	22 a	23 a	23 a	28 a
25	Untreated Check				4 a	3 a	8 a	8 a	6 a	4 a	0 a	2 abc	20 ab	22 a	22 a	25 ab
LSD (P=.05)					2.3	6.0	7.4	11.0	13.8	15.0	0.0	1.2	5.1	6.2	6.1	9.1
Standard Deviation					1.4	3.7	4.5	6.7	8.3	9.1	0.0	0.7	3.1	3.7	3.7	5.5
CV					213.3	207.1	137.5	181.0	194.9	240.7	0.0	76.6	39.0	53.3	51.1	62.2
Treatment F					0.938	0.837	1.007	0.884	0.883	0.912	0	5.223	15.092	11.002	10.976	6.844
Treatment Prob(F)					0.5552	0.6751	0.4759	0.62	0.6206	0.586	1	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 3. Percent cover of tall fescue following commercially common single or sequential applications of dithiopyr or proflaminate during establishment at KSU or UNL.

				KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center					
Crop Name				Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue
Rating Date				6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014
Rating Type				Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
Rating Unit				%	%	%	%	%	%	%	%	%	%	%	
Days After First/Last Applic.				17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56
Trt No.	Treatment Name	Rate	Appl Unit	1		3		5		7		9		11	
1	Dithiopyr Granular	0.25 lb ai/a	A	1 e	4 d	9 e	9 f	11 e	12 fgh	20 fg	42 fg	67 cde	85 abc	88 ab	93 a
2	Dithiopyr Granular	0.25 lb ai/a	AB	7 cde	6 d	7 e	9 f	9 e	12 fgh	23 def	48 def	65 de	80 b-e	82 a-e	85 a-d
4	Dithiopyr Liquid	0.25 lb ai/a	A	1 e	2 d	3 e	3 f	4 e	12 gh	4 ij	12 j	37 hi	62 h-k	68 gh	77 a-f
6	Dithiopyr Liquid	0.25 lb ai/a	AB	1 e	2 d	4 e	3 f	4 e	5 gh	7 i	20 i	38 hi	60 ijk	67 ghi	78 a-e
9	Dithiopyr Granular	0.5 lb ai/a	A	0 e	1 d	1 e	4 f	4 e	4 gh	4 ij	8 jk	23 j	48 l	53 jk	60 fgh
10	Dithiopyr Liquid	0.5 lb ai/a	A	0 e	0 d	1 e	1 f	2 e	3 h	1 j	2 k	8 k	17 m	20 l	27 j
13	Proflaminate Granular	0.38 lb ai/a	A	1 e	5 d	7 e	12 f	18 de	22 d-h	22 efg	50 cde	77 abc	82 a-e	80 b-f	76 b-f
14	Proflaminate Granular	0.38 lb ai/a	AB	1 e	2 d	4 e	6 f	9 e	13 fgh	27 bcd	53 b-e	82 ab	80 b-e	77 c-g	73 c-g
16	Proflaminate Liquid	0.38 lb ai/a	A	1 e	2 d	7 e	11 f	16 de	29 c-h	13 h	28 h	52 g	68 f-i	68 gh	65 e-h
18	Proflaminate Liquid	0.38 lb ai/a	AB	1 e	3 d	8 e	12 f	15 de	22 d-h	12 h	30 h	53 fg	75 c-g	72 e-h	62 e-h
21	Proflaminate Granular	0.75 lb ai/a	A	0 e	2 d	2 e	2 f	2 e	3 h	18 g	40 g	57 efg	72 e-h	72 e-h	70 d-g
22	Proflaminate Liquid	0.75 lb ai/a	A	0 e	0 d	2 e	2 f	3 e	6 gh	5 ij	15 ij	32 ij	55 jkl	50 k	38 ij
25	Untreated Check			25 ab	50 a	75 a	77 a	80 a	93 a	27 bcd	60 ab	80 ab	73 d-g	72 e-h	68 d-h
LSD (P=.05)				16.5	23.1	29.8	28.7	30.6	30.9	4.8	6.9	10.5	11.2	11.4	17.0
Standard Deviation				10.0	14.0	18.1	17.4	18.5	18.8	2.9	4.2	6.3	6.8	6.9	10.3
CV				111.3	81.3	77.7	75.4	74.2	65.3	15.4	10.3	10.4	9.5	9.6	14.6
Treatment F				3.076	5.449	5.177	5.166	4.622	4.906	35.893	65.57	39.151	16.462	14.602	7.401
Treatment Prob(F)				0.0005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL

Table 4. Percent cover of large crabgrass following commercially common single or sequential applications of dithiopyr or prodiamine during establishment at KSU or UNL.

		KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center																
Pest Name	Crabgrass						Crabgrass																	
Rating Date	6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014												
Rating Type	Ground						Ground																	
Rating Unit	%						%																	
Days After First/Last Applic.	17	17	31	1	42	12	55	25	70	40	84	54	14	14	27	27	42	14	60	32	71	43	84	56
Trt No.	Treatment Name	Rate	Unit	Appl Cod	2	4	6	8	10	12	7	8	9	10	11	12								
1	Dithiopyr Granular	0.25	lb ai/a	A	0 a	2 a	5 a	6 a	16 a	22 a	0 a	0 f	2 hi	1 hi	1 hi	2 hi								
2	Dithiopyr Granular	0.25	lb ai/a	AB	1 a	3 a	4 a	4 a	4 a	2 a	0 a	0 f	1 hi	1 hi	1 hi	3 ghi								
4	Dithiopyr Liquid	0.25	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	3 ghi	9 def	11 c-f	15 c-f								
6	Dithiopyr Liquid	0.25	lb ai/a	AB	0 a	1 a	2 a	2 a	2 a	2 a	0 a	0 f	1 hi	0 i	1 hi	1 i								
9	Dithiopyr Granular	0.5	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 f	1 hi	0 i	0 i	0 i								
10	Dithiopyr Liquid	0.5	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 f	0 i	2 ghi	3 ghi	5 ghi								
13	Prodiamine Granular	0.38	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	1 cde	13 cd	15 bc	15 bc	17 b-e								
14	Prodiamine Granular	0.38	lb ai/a	AB	0 a	1 a	0 a	0 a	0 a	0 a	0 a	1 cde	13 cd	10 cde	11 c-f	12 d-g								
16	Prodiamine Liquid	0.38	lb ai/a	A	0 a	0 a	2 a	2 a	2 a	1 a	0 a	1 cde	8 def	9 c-f	7 e-h	7 f-i								
18	Prodiamine Liquid	0.38	lb ai/a	AB	1 a	0 a	1 a	1 a	1 a	0 a	0 a	1 c-f	8 efg	4 e-i	5 f-i	7 f-i								
21	Prodiamine Granular	0.75	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	4 f-i	7 e-h	6 e-i	5 ghi								
22	Prodiamine Liquid	0.75	lb ai/a	A	1 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	3 f-i	7 e-h	9 d-g	10 e-h								
25	Untreated Check				4 a	3 a	8 a	8 a	6 a	4 a	0 a	2 abc	20 ab	22 a	22 a	25 ab								
LSD (P=.05)					2.3	6.0	7.4	11.0	13.8	15.0	0.0	1.2	5.1	6.2	6.1	9.1								
Standard Deviation					1.4	3.7	4.5	6.7	8.3	9.1	0.0	0.7	3.1	3.7	3.7	5.5								
CV					213.3	207.1	137.5	181.0	194.9	240.7	0.0	76.6	39.0	53.3	51.1	62.2								
Treatment F					0.938	0.837	1.007	0.884	0.883	0.912	0	5.223	15.092	11.002	10.976	6.844								
Treatment Prob(F)					0.5552	0.6751	0.4759	0.62	0.6206	0.586	1	0.0001	0.0001	0.0001	0.0001	0.0001								

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 5. Percent cover of tall fescue following various single pre-emergence applications made at seeding or 4 weeks later.

		KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center								
Crop Name		Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue			
Rating Date		6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014			
Rating Type		Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground			
Rating Unit		%	%	%	%	%	%	%	%	%	%	%	%			
Days After First/Last Applic.		17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56			
Trt No.	Treatment Name	Rate	Unit	Appl Cod	1	3	5	7	9	11	1	2	3	4	5	6
1	Dithiopyr Granular	0.25	lb ai/a	A	1 e	4 d	9 e	9 f	11 e	12 fgh	20 fg	42 fg	67 cde	85 abc	88 ab	93 a
7	Dithiopyr Granular	0.25	lb ai/a	B	20 a-d	42 ab	57 abc	50 abc	52 abc	62 b	30 ab	60 ab	83 ab	88 ab	88 ab	90 abc
4	Dithiopyr Liquid	0.25	lb ai/a	A	1 e	2 d	3 e	3 f	4 e	12 gh	4 ij	12 j	37 hi	62 h-k	68 gh	77 a-f
8	Dithiopyr Liquid	0.25	lb ai/a	B	24 ab	36 abc	43 bcd	45 b-e	50 abc	48 b-e	30 ab	60 ab	85 a	92 a	92 a	92 ab
9	Dithiopyr Granular	0.5	lb ai/a	A	0 e	1 d	1 e	4 f	4 e	4 gh	4 ij	8 jk	23 j	48 l	53 jk	60 fgh
11	Dithiopyr Granular	0.5	lb ai/a	B	22 a-d	53 a	57 abc	53 abc	52 abc	50 bcd	28 abc	60 ab	83 ab	77 c-f	72 e-h	58 gh
10	Dithiopyr Liquid	0.5	lb ai/a	A	0 e	0 d	1 e	1 f	2 e	3 h	1 j	2 k	8 k	17 m	20 l	27 j
12	Dithiopyr Liquid	0.5	lb ai/a	B	6 de	17 cd	30 b-e	25 c-f	28 cde	32 b-h	28 abc	60 ab	78 ab	83 a-d	87 abc	90 abc
13	Prodiamine Granular	0.38	lb ai/a	A	1 e	5 d	7 e	12 f	18 de	22 d-h	22 efg	50 cde	77 abc	82 a-e	80 b-f	76 b-f
19	Prodiamine Granular	0.38	lb ai/a	B	29 a	39 abc	48 a-d	53 abc	55 abc	55 bc	28 abc	57 abc	80 ab	75 c-g	73 d-g	67 e-h
16	Prodiamine Liquid	0.38	lb ai/a	A	1 e	2 d	7 e	11 f	16 de	29 c-h	13 h	28 h	52 g	68 f-i	68 gh	65 e-h
20	Prodiamine Liquid	0.38	lb ai/a	B	16 a-e	42 ab	58 ab	57 ab	60 ab	60 bc	28 abc	60 ab	82 ab	83 a-d	80 b-f	73 c-g
21	Prodiamine Granular	0.75	lb ai/a	A	0 e	2 d	2 e	2 f	2 e	3 h	18 g	40 g	57 efg	72 e-h	72 e-h	70 d-g
23	Prodiamine Granular	0.75	lb ai/a	B	22 a-d	38 abc	48 a-d	48 bcd	50 abc	58 bc	32 a	62 a	82 ab	82 a-e	82 a-e	77 a-f
22	Prodiamine Liquid	0.75	lb ai/a	A	0 e	0 d	2 e	2 f	3 e	6 gh	5 ij	15 ij	32 ij	55 jkl	50 k	38 ij
24	Prodiamine Liquid	0.75	lb ai/a	B	23 abc	42 ab	50 a-d	48 bcd	44 bcd	43 b-f	25 cde	55 a-d	78 ab	72 e-h	70 fgh	63 e-h
25	Untreated Check				25 ab	50 a	75 a	77 a	80 a	93 a	27 bcd	60 ab	80 ab	73 d-g	72 e-h	68 d-h
LSD (P=.05)					16.5	23.1	29.8	28.7	30.6	30.9	4.8	6.9	10.5	11.2	11.4	17.0
Standard Deviation					10.0	14.0	18.1	17.4	18.5	18.8	2.9	4.2	6.3	6.8	6.9	10.3
CV					111.3	81.3	77.7	75.4	74.2	65.3	15.4	10.3	10.4	9.5	9.6	14.6
Treatment F					3.076	5.449	5.177	5.166	4.622	4.906	35.893	65.57	39.151	16.462	14.602	7.401
Treatment Prob(F)					0.0005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 6. Percent cover of large crabgrass following various single pre-emergence applications made at seeding or 4 weeks later.

		KSU Rocky Ford Turfgrass Research Center										UNL John Seaton Anderson Turfgrass Research Center									
Pest Name		Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass		
Rating Date		6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014								
Rating Type		Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground								
Rating Unit		%	%	%	%	%	%	%	%	%	%	%	%								
Days After First/Last Applic.		17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56								
Trt No.	Treatment Name	Rate	Unit	Appl Cod	2	4	6	8	10	12	7	8	9	10	11	12					
1	Dithiopyr Granular	0.25	lb ai/a	A	0 a	2 a	5 a	6 a	16 a	22 a	0 a	0 f	2 hi	1 hi	1 hi	2 hi					
7	Dithiopyr Granular	0.25	lb ai/a	B	1 a	4 a	7 a	7 a	7 a	7 a	0 a	2 bcd	12 cde	2 ghi	3 ghi	5 ghi					
4	Dithiopyr Liquid	0.25	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	3 ghi	9 def	11 c-f	15 c-f					
8	Dithiopyr Liquid	0.25	lb ai/a	B	0 a	1 a	3 a	2 a	2 a	4 a	0 a	0 f	4 f-i	1 hi	1 hi	1 hi					
9	Dithiopyr Granular	0.5	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 f	1 hi	0 i	0 i	0 i					
11	Dithiopyr Granular	0.5	lb ai/a	B	1 a	5 a	7 a	6 a	6 a	5 a	0 a	1 c-f	6 fgh	1 hi	1 hi	1 i					
10	Dithiopyr Liquid	0.5	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 f	0 i	2 ghi	3 ghi	5 ghi					
12	Dithiopyr Liquid	0.5	lb ai/a	B	0 a	2 a	3 a	2 a	2 a	2 a	0 a	0 ef	3 ghi	1 hi	1 hi	1 i					
13	Prodiamine Granular	0.38	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	1 cde	13 cd	15 bc	15 bc	17 b-e					
19	Prodiamine Granular	0.38	lb ai/a	B	1 a	1 a	5 a	9 a	8 a	6 a	0 a	2 abc	20 ab	20 ab	20 ab	23 abc					
16	Prodiamine Liquid	0.38	lb ai/a	A	0 a	0 a	2 a	2 a	2 a	1 a	0 a	1 cde	8 def	9 c-f	7 e-h	7 f-i					
20	Prodiamine Liquid	0.38	lb ai/a	B	1 a	2 a	6 a	6 a	7 a	3 a	0 a	2 bcd	15 bc	13 cd	14 bcd	20 a-d					
21	Prodiamine Granular	0.75	lb ai/a	A	0 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	4 f-i	7 e-h	6 e-i	5 ghi					
23	Prodiamine Granular	0.75	lb ai/a	B	1 a	1 a	3 a	4 a	4 a	4 a	0 a	2 abc	17 abc	13 cd	12 cde	12 d-g					
22	Prodiamine Liquid	0.75	lb ai/a	A	1 a	0 a	0 a	0 a	0 a	0 a	0 a	0 ef	3 f-i	7 e-h	9 d-g	10 e-h					
24	Prodiamine Liquid	0.75	lb ai/a	B	1 a	2 a	7 a	6 a	8 a	5 a	0 a	3 a	22 a	23 a	23 a	28 a					
25	Untreated Check				4 a	3 a	8 a	8 a	6 a	4 a	0 a	2 abc	20 ab	22 a	22 a	25 ab					
LSD (P=.05)					2.3	6.0	7.4	11.0	13.8	15.0	0.0	1.2	5.1	6.2	6.1	9.1					
Standard Deviation					1.4	3.7	4.5	6.7	8.3	9.1	0.0	0.7	3.1	3.7	3.7	5.5					
CV					213.3	207.1	137.5	181.0	194.9	240.7	0.0	76.6	39.0	53.3	51.1	62.2					
Treatment F					0.938	0.837	1.007	0.884	0.883	0.912	0	5.223	15.092	11.002	10.976	6.844					
Treatment Prob(F)					0.5552	0.6751	0.4759	0.62	0.6206	0.586	1	0.0001	0.0001	0.0001	0.0001	0.0001					

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 7. Percent cover of tall fescue when comparing granular versus liquid formulations of dithiopyr or prodiamine.

				KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center						
Crop Name				Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	Tall Fescue	
Rating Date				6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014	
Rating Type				Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	
Rating Unit				%	%	%	%	%	%	%	%	%	%	%		
Days After First/Last Applic.				17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56	
Trt	Treatment	Rate	Appl													
No.	Name	Rate	Unit	Cod	1	3	5	7	9	11	1	2	3	4	5	6
2	Dithiopyr Granular	0.25	lb ai/a	AB	7 cde	6 d	7 e	9 f	9 e	12 fgh	23 def	48 def	65 de	80 b-e	82 a-e	85 a-d
6	Dithiopyr Liquid	0.25	lb ai/a	AB	1 e	2 d	4 e	3 f	4 e	5 gh	7 i	20 i	38 hi	60 ijk	67 ghi	78 a-e
3	Dithiopyr Granular	0.25	lb ai/a	A	3 e	4 d	5 e	6 f	7 e	8 gh	27 bcd	50 cde	63 def	80 b-e	83 a-d	88 abc
	Dithiopyr Liquid	0.25	lb ai/a	B												
5	Dithiopyr Liquid	0.25	lb ai/a	A	10 b-e	18 cd	28 cde	18 ef	16 de	18 e-h	4 ij	12 j	23 j	53 kl	57 ijk	62 e-h
	Dithiopyr Granular	0.25	lb ai/a	B												
14	Prodiamine Granular	0.38	lb ai/a	AB	1 e	2 d	4 e	6 f	9 e	13 fgh	27 bcd	53 b-e	82 ab	80 b-e	77 c-g	73 c-g
18	Prodiamine Liquid	0.38	lb ai/a	AB	1 e	3 d	8 e	12 f	15 de	22 d-h	12 h	30 h	53 fg	75 c-g	72 e-h	62 e-h
15	Prodiamine Granular	0.38	lb ai/a	A	0 e	3 d	6 e	4 f	8 e	15 fgh	20 fg	47 efg	73 bcd	78 b-f	75 d-g	70 d-g
	Prodiamine Liquid	0.38	lb ai/a	B												
17	Prodiamine Liquid	0.38	lb ai/a	A	11 b-e	19 bcd	21 de	20 def	26 cde	34 b-g	13 h	30 h	47 gh	65 g-j	62 hij	52 hi
	Prodiamine Granular	0.38	lb ai/a	B												
25	Untreated Check				25 ab	50 a	75 a	77 a	80 a	93 a	27 bcd	60 ab	80 ab	73 d-g	72 e-h	68 d-h
LSD (P=.05)					16.5	23.1	29.8	28.7	30.6	30.9	4.8	6.9	10.5	11.2	11.4	17.0
Standard Deviation					10.0	14.0	18.1	17.4	18.5	18.8	2.9	4.2	6.3	6.8	6.9	10.3
CV					111.3	81.3	77.7	75.4	74.2	65.3	15.4	10.3	10.4	9.5	9.6	14.6
Treatment F					3.076	5.449	5.177	5.166	4.622	4.906	35.893	65.57	39.151	16.462	14.602	7.401
Treatment Prob(F)					0.0005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.

Table 8. Percent cover of crabgrass when comparing granular versus liquid formulations of dithiopyr or prodiamine.

		KSU Rocky Ford Turfgrass Research Center						UNL John Seaton Anderson Turfgrass Research Center								
Pest Name		Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass	Crabgrass			
Rating Date		6/23/2014	7/7/2014	7/18/2014	7/31/2014	8/15/2014	8/29/2014	5/2/2014	5/15/2014	5/30/2014	6/17/2014	6/28/2014	7/11/2014			
Rating Type		Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground			
Rating Unit		%	%	%	%	%	%	%	%	%	%	%	%			
Days After First/Last Applic.		17 17	31 1	42 12	55 25	70 40	84 54	14 14	27 27	42 14	60 32	71 43	84 56			
Trt No.	Treatment Name	Rate	Rate Unit	Appl Cod	2	4	6	8	10	12	7	8	9	10	11	12
2	Dithiopyr Granular	0.25	lb ai/a	AB	1 a	3 a	4 a	4 a	4 a	2 a	0 a	0 f	1 hi	1 hi	1 hi	3 ghi
6	Dithiopyr Liquid	0.25	lb ai/a	AB	0 a	1 a	2 a	2 a	2 a	2 a	0 a	0 f	1 hi	0 i	1 hi	1 i
3	Dithiopyr Granular	0.25	lb ai/a	A	0 a	1 a	3 a	4 a	4 a	4 a	0 a	0 f	1 hi	1 hi	1 hi	2 hi
	Dithiopyr Liquid	0.25	lb ai/a	B												
5	Dithiopyr Liquid	0.25	lb ai/a	A	2 a	8 a	5 a	15 a	17 a	15 a	0 a	0 f	1 hi	0 i	1 i	1 hi
	Dithiopyr Granular	0.25	lb ai/a	B												
14	Prodiamine Granular	0.38	lb ai/a	AB	0 a	1 a	0 a	0 a	0 a	0 a	0 a	1 cde	13 cd	10 cde	11 c-f	12 d-g
18	Prodiamine Liquid	0.38	lb ai/a	AB	1 a	0 a	1 a	1 a	1 a	0 a	0 a	1 c-f	8 efg	4 e-i	5 f-i	7 f-i
15	Prodiamine Granular	0.38	lb ai/a	A	1 a	0 a	3 a	4 a	5 a	4 a	0 a	3 ab	13 cd	8 d-g	8 d-g	12 d-g
	Prodiamine Liquid	0.38	lb ai/a	B												
17	Prodiamine Liquid	0.38	lb ai/a	A	1 a	4 a	6 a	6 a	6 a	3 a	0 a	1 def	8 def	3 f-i	4 ghi	6 ghi
	Prodiamine Granular	0.38	lb ai/a	B												
25	Untreated Check				4 a	3 a	8 a	8 a	6 a	4 a	0 a	2 abc	20 ab	22 a	22 a	25 ab
LSD (P=.05)					2.3	6.0	7.4	11.0	13.8	15.0	0.0	1.2	5.1	6.2	6.1	9.1
Standard Deviation					1.4	3.7	4.5	6.7	8.3	9.1	0.0	0.7	3.1	3.7	3.7	5.5
CV					213.3	207.1	137.5	181.0	194.9	240.7	0.0	76.6	39.0	53.3	51.1	62.2
Treatment F					0.938	0.837	1.007	0.884	0.883	0.912	0	5.223	15.092	11.002	10.976	6.844
Treatment Prob(F)					0.5552	0.6751	0.4759	0.62	0.6206	0.586	1	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter do not significantly differ (P=.05, LSD)

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.